SGMA Signals

MANAGING GROUNDWATER FOR NATURE

Contents

Acknowledgments

The Nature Conservancy is grateful to The Water Foundation for its generous support of our review of Groundwater Sustainability Plans and the work of our Water Program.

Introduction to SGMA Signals

Groundwater is a critical component of California's water supply and is increasingly under threat from pumping that has, for decades in many places, exceeded natural replenishment. California is taking on this challenge with the Sustainable Groundwater Management Act (SGMA), which seeks to reliably manage groundwater to meet current and future water needs for the economy, communities and environment. SGMA was signed into law in 2014 and amended the Water Code (Part 2.74 of Division 6 of the Water Code, Sections 10720–10737.8). The Act requires that local agencies plan for, and achieve, sustainable groundwater management by 2042.

The Nature Conservancy (TNC) helped to pass SGMA and has been actively working to ensure that nature is addressed as required under the law. To this end, TNC has developed the Groundwater Resource Hub, providing free science, tools and case studies designed to help Groundwater Sustainability Agencies (GSAs) comply with SGMA.

Over the past thirty years in the San Joaquin Valley alone, groundwater pumping has exceeded natural replenishment by approximately two million acre-feet every year, which is 11% of the region's net water use. In addition to existing groundwater overdraft, California faces increasing water[1] demand due to population growth, climate change impacts that include reductions in snowpack, increased frequency of droughts, and altered surface water availability. Reduced water availability and altered flow regimes are affecting Groundwater Dependent Ecosystems (GDEs), which are plants and animals that depend on groundwater to meet at least a portion of their water needs such as rivers, wetlands, springs and estuaries. Over the past century, 92% of California's GDEs have been lost[2, 3], leaving the state's remaining GDEs as critical refugia that often support threatened and endangered species protected under state and federal law[4].

1 Water and the Future of the San Joaquin Desert, by Public Policy Institute of California.

2 The Critical Species LookBook provides a compendium of California's 84 threatened and endangered species likely to be reliant on groundwater. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_web.pdf

3 Moyle PB, Williams JE. 1990. Biodiversity loss in the temperate zone: Decline of the native fish fauna of California. Conservation Biology 4:275–284.

4 Seavy NE, Gardali T, Golet GH, Griggs FT, Howell CA, Kelsey R, Small SL, Viers JH, Weigand JF. 2009. Why climate change makes riparian restoration more important than ever: Recommendations for practice and research. Ecological Restoration 27:330–338.

GSAs have been tasked with creating Groundwater Sustainability Plans (GSPs or Plans) that set forth actions to achieve sustainable groundwater use within 20 years. SGMA includes specific requirements to identify and consider impacts to GDEs that are present in almost all of California's groundwater basins SGMA requires that *all* beneficial uses and users of groundwater, including wildlife and habitat, be considered in the development and implementation of Plans. The inclusion of natural communities in the management our state's groundwater resources is essential to protect and restore habitat and wildlife, and as such, is an important factor in distinguishing *sustainable* groundwater management from the status quo.

TNC carefully reviewed all 30 GSPs available at the time (highlighted in the map on the next page), submitting comments to GSAs on their draft plans, as well as providing comments to final plans submitted to the Department of Water Resources (DWR) in 2020. TNC's goal in reviewing the plans was to ensure that SGMA's requirements to consider and address nature were fully realized. Of the Plans reviewed, TNC determined that only three sufficiently addressed nature. The remaining 27 were either incomplete or inadequate in their consideration of the environment.

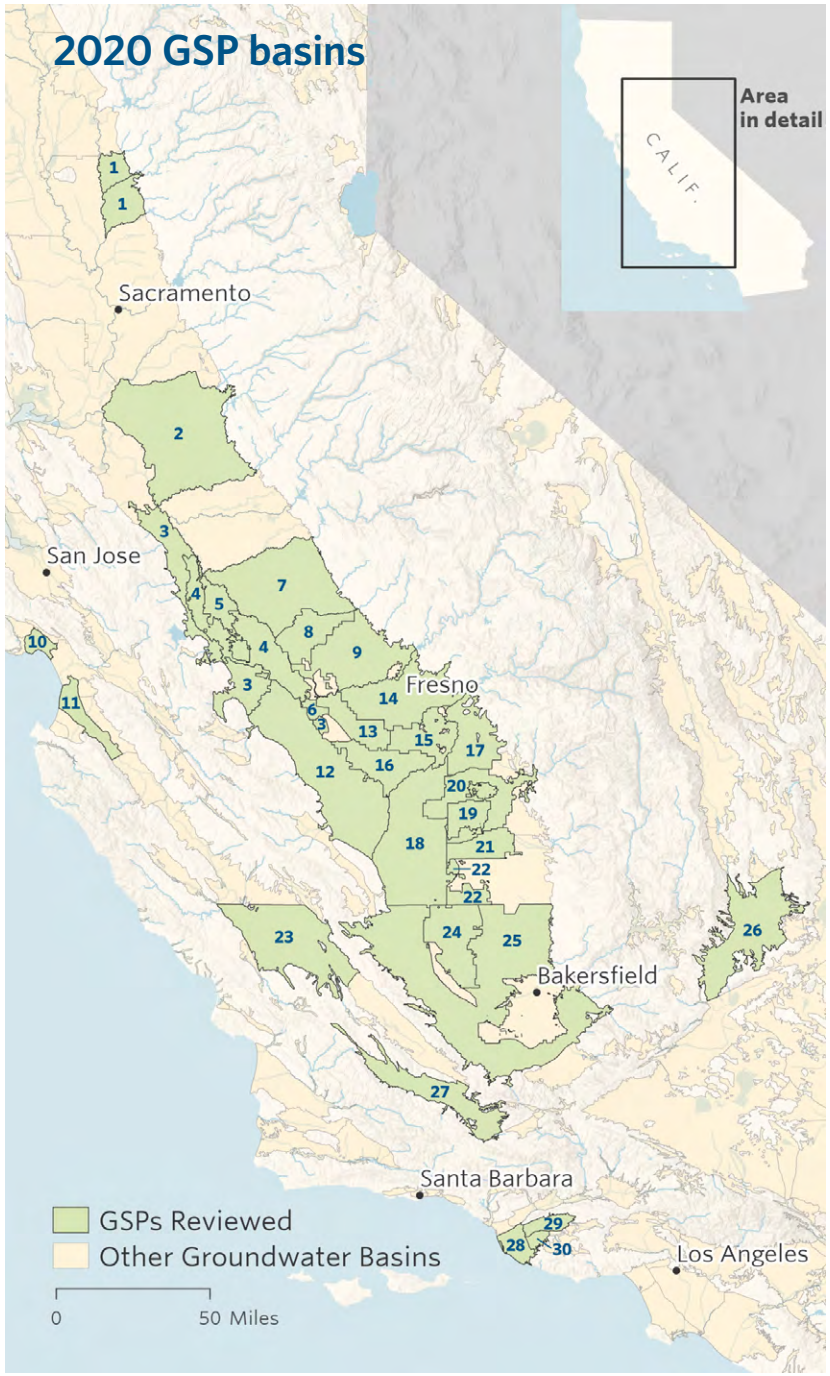
Understanding the complexity of groundwater management, SGMA is designed as an adaptive management process, through which management plans and actions should improve over time as data gaps are filled and uncertainty is reduced. The goal of this report is to help GSAs improve their GSPs as they respond to feedback from the state or in the process updating their plans every five years.

This report summarizes the findings of TNC's review using eight Sustainability Metrics, detailed in the table to the right, to determine how well each GSP accounts for and proposes to manage groundwater for the needs of nature. These Sustainability Metrics are based on elements of SGMA that require nature be considered in GSPs.

Sustainability Metrics		
1		How well are Groundwater Dependent Ecosystems (GDEs) identified and mapped?
2		How well are Interconnected Surface Waters (ISWs) identified and mapped?
3		How well does the water budget account for the water use of nature, including GDEs, ISWs, native vegetation and managed wetlands?
4		How well do the management criteria consider GDEs and avoid undesirable results?
5		How well do the management criteria for ISWs analyze the impact to surface water beneficial users?
6		How well are environmental stakeholders engaged?
7		How well is nature incorporated in projects & management actions?
8		How well is nature identified and addressed within the monitoring network?

TERMS TO KNOW

- **Groundwater Dependent Ecosystem (GDEs):** SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Note, GDEs rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources.
- **Interconnected Surface Water (ISW):** SGMA [23 CCR §351(o)] defines ISW as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". "At any point" has both a spatial and temporal component. Even short durations of interconnected groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.
- **Environmental Beneficial Uses/Users of groundwater:** Beneficial users include Groundwater Dependent Ecosystems, native vegetation, managed wetlands, etc.



1	North and South Yuba
2	Eastern San Joaquin
3	Northern and Central Delta-Mendota Region
4	San Joaquin River Exchange Contractors Water Authority
5	Grasslands
6	Fresno County (Management Areas A & B)
7	Merced
8	Chowchilla Subbasin
9	Madera Subbasin
10	Santa Cruz Mid-County
11	Salinas Valley Basin (180–400)
12	Westlands Water District
13	McMullin
14	North Kings
15	Central Kings
16	North Fork Kings
17	Kings River East
18	Tulare Lake Subbasin
19	Mid-Kaweah Joint Powers Authority
20	Greater Kaweah
21	Lower Tule River Irrigation District
22	Tri-County Water Authority
23	Joint GSA: SLO County, Paso Robles, San Miguel CSD, Shandon–San Juan
24	Semitropic Water Storage District
25	Kern Groundwater Authority
26	Indian Wells
27	Cuyama
28	Fox Canyon–Oxnard
29	Fox Canyon–Los Posas
30	Fox Canyon–Pleasant Valley

Evaluation of Groundwater Sustainability Plans

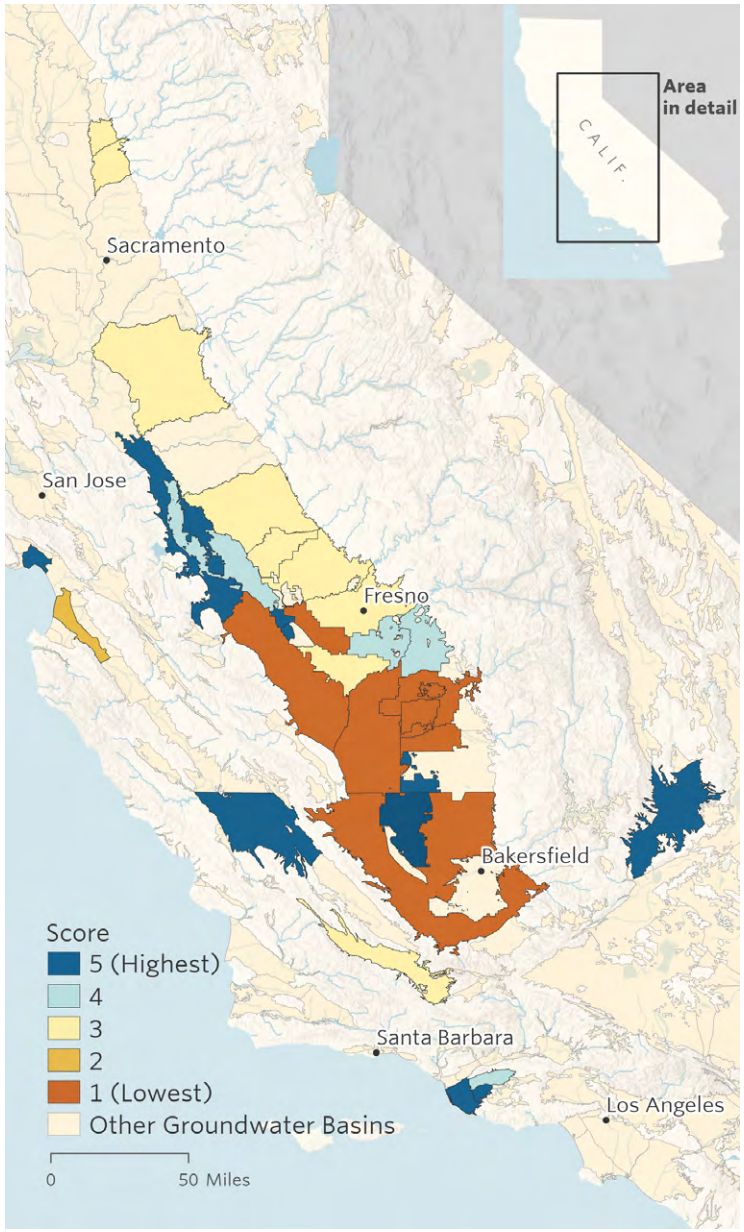
In order to evaluate how well GSPs performed against the eight Sustainability Metrics, TNC developed a rating and evaluation system. GSPs were scored from 1 (lowest) to 5 (highest) for each Sustainability Metric based on the criteria described in the table below. Each GSP was assigned an overall score using the average score across all metrics. Based on this evaluation, TNC provided a recommendation on whether each GSP adequately, incompletely, or inadequately accounted for nature's needs.

Metric Evaluation & Scoring System

Metric			Parameter	Metric Rating and Evaluation: 0 = NA, 1 (lowest) – 5 (highest)					
1		**How well are GDEs identified and mapped?**	How well is the hydrologic connection with GDEs understood, e.g., quality of data/analysis of shallow aquifer and possible connectivity w/ GDEs?	NA	1	2	3	4	5
				None exist	They exist but are not acknowledged OR >90% inappropriately removed	They are acknowledged; 75–90% inappropriately removed	They are acknowledged; 50–75% inappropriately removed	They are acknowledged; 25–50% inappropriately removed	They are acknowledged; <25% inappropriately removed
2		**How well are ISWs identified and mapped?**	Do they have a quality methodology? Does it cover the whole basin? Did they document methods or refer to existing studies?	NA	1	2	3	4	5
				None exist	They exist but are not acknowledged OR inconsistent/ inadequate method(s) applied to interconnected surface waters	They are acknowledged; consistent and appropriate methodology applied to small portion (< 25% stream miles/ surface water bodies or areas)	They are acknowledged; consistent and appropriate methodology applied to a limited portion (25–50% stream miles/surface water bodies or areas)	They are acknowledged; consistent and appropriate methodology applied to a majority (51–75% stream miles/ surface water bodies or areas)	They are acknowledged; consistent and appropriate methodology applied to most (>75% stream miles/surface water bodies or areas)
3		**How well does the water budget account for the water use of nature, including GDEs, ISWs, native vegetation and managed wetlands?**	How well are the inputs and outputs of water from the environment understood using the best available information and science?	NA	1	2	3	4	5
				None exist	Environmental water use exists but are not acknowledged	Environmental water use is acknowledged but not accounted for in budget	Environmental water use water is not clearly defined use aggregated with agricultural water use	Environmental water use is accurately accounted for in budget	Environmental water use and climate projections are accounted for in budget

Metric			Parameter	Metric Rating and Evaluation: 0 = NA, 1 (lowest) – 5 (highest)					
4		How well do the Sustainable management criteria consider GDEs and avoid undesirable results?	How well is the impact of groundwater management on GDE response understood using the best available information and science?	NA	1	2	3	4	5
				None exist	GDEs exist but have been dismissed	Impact(s) considered but there is a negative impact/ possible threat to GDEs	Impact(s) considered and there is no impact/threat to GDEs expected	Impact(s) considered and adverse impact avoided OR Hydrologic conditions stable	Impact(s) considered and adverse impact avoided for GDEs and threatened/ endangered species
5		How well do the management criteria for ISWs analyze the impact to surface water beneficial users?	How well is the hydrologic connection between shallow groundwater and surface water understood (e.g.,data/models available and well developed), and how does it support existing environmental beneficial users?	NA	1	2	3	4	5
				None exist	Environmental beneficial users are omitted from consideration without due diligence	Environmental beneficial users are considered, but large adverse impacts exist	Environmental beneficial users are considered, but moderate adverse impacts exist	Environmental beneficial users are considered, but limited adverse impacts exist	Environmental beneficial users are considered, but no adverse impacts exist
6		How well are Environmental Stakeholders engaged?		NA	1	2	3	4	5
				None exist	Stakeholders exist but are not acknowledged	Stakeholders acknowledged but not engaged	Stakeholders have been engaged at least once	Stakeholders included in technical advisory group or committee	Stakeholders included as a voting member on the GSA board
7		How well is nature incorporated in projects & management actions?	Will any projects and management actions sustain or enhance the condition of environmental beneficial users in the basin?	NA	1	2	3	4	5
				None exist	Potential benefits/threats to the environment exist but are not acknowledged	Environmental benefits acknowledged or threats mitigated	Environmental benefits acknowledged and threats mitigated	Environmental benefits explicitly advanced by project(s) or threats explicitly avoided	Environmental benefits explicitly advanced and quantified by project(s) and threats explicitly avoided
8		How well is nature identified and addressed within the monitoring network?		NA	1	2	3	4	5
				None exist	Environmental monitoring needs exist but not identified	Limited amount of monitoring needs identified	Moderate to large amount of monitoring needs identified OR Limited amount of monitoring needs addressed	Moderate to large amount of monitoring needs addressed	Monitoring needs addressed and explicitly include ecological monitoring OR No monitoring needs exist

Including Nature in Groundwater Sustainability



DATA SOURCES: Groundwater Basins – DWR, Highways – Caltrans, Rivers – NHD, Basemap – Esri

METRIC 1

How well are Groundwater Dependent Ecosystems identified and mapped?

SIGNIFICANCE

Given the historic loss of groundwater dependent ecosystems (GDEs), especially in the Central Valley, the GDEs that remain today are important biological hotspots that often support threatened and endangered species.

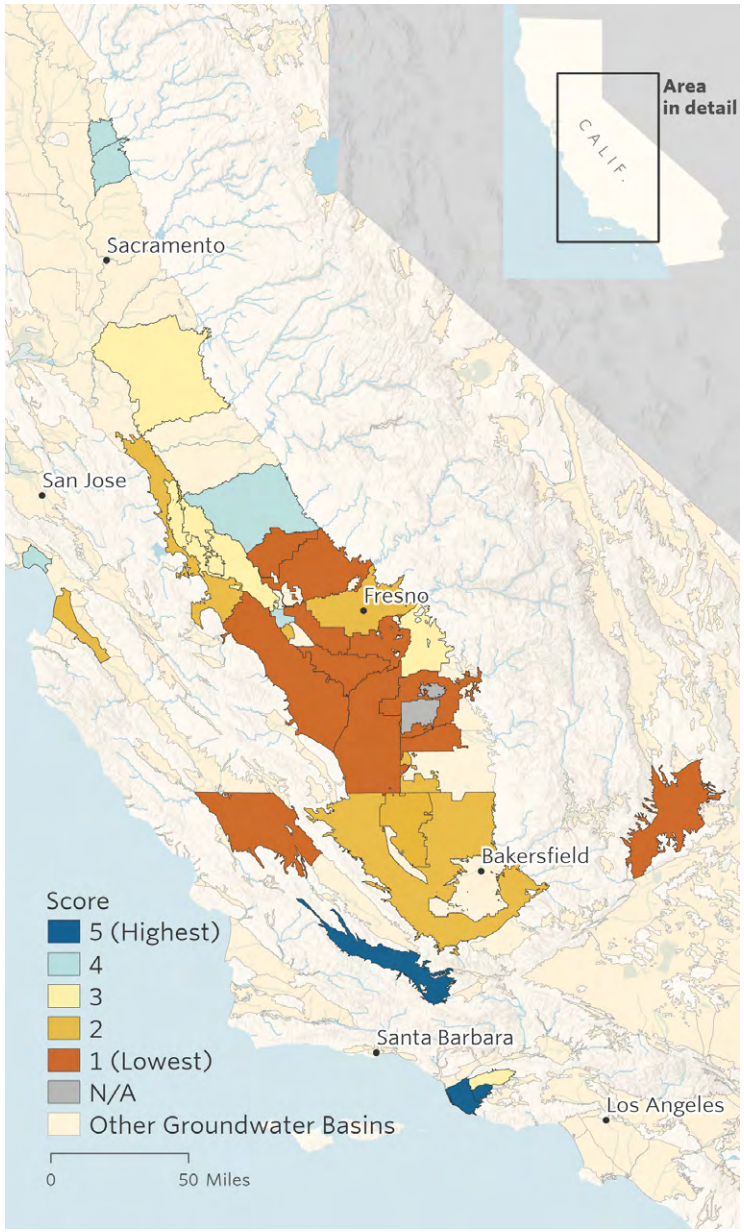
RECOMMENDED BEST PRACTICES

The Natural Communities Commonly Associated with Groundwater (NCCAG) dataset provides a starting point for GSAs to identify GDEs in their basin. The Nature Conservancy provides guidance for how GSAs can map GDEs in their basin using the NCCAG. Recommended best practices for verifying whether mapped features in the NC dataset are connected to a groundwater include:

- Establish whether natural communities are likely connected to groundwater by considering shallow principle aquifers that provide 'significant or economic' quantities of groundwater to streams and wells.
- Use groundwater level data from multiple years that can represent interannual and interseasonal variability.
- Use depth-to-groundwater data to identify whether natural communities are supported by groundwater and should be considered GDEs.
- Select groundwater wells that can measure the true water table position, have screened well depth interval data, and are within 5 km of possible GDEs.
- Contour groundwater elevations at monitoring wells and subtract it from land surface elevation data, such as a Digital Elevation Model (DEM), to derive depth-to-groundwater contours.
- Where data gaps exist, retain natural communities as "potential GDEs" until there is sufficient evidence to warrant their removal.

TOOLS

- Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs
- Identifying GDEs under SGMA: Best Practices for using the NC dataset



DATA SOURCES: Groundwater Basins – DWR, Highways – Caltrans, Rivers – NHD, Basemap – Esri

METRIC 2

How well are Interconnected Surface Waters identified and mapped?

SIGNIFICANCE

Most rivers exchange water with surrounding aquifers. These interconnected surface waters provide critical habitat for aquatic ecosystems, supporting key life processes such as migration, spawning, and seed dispersal.

RECOMMENDED BEST PRACTICES

Reconcile data gaps

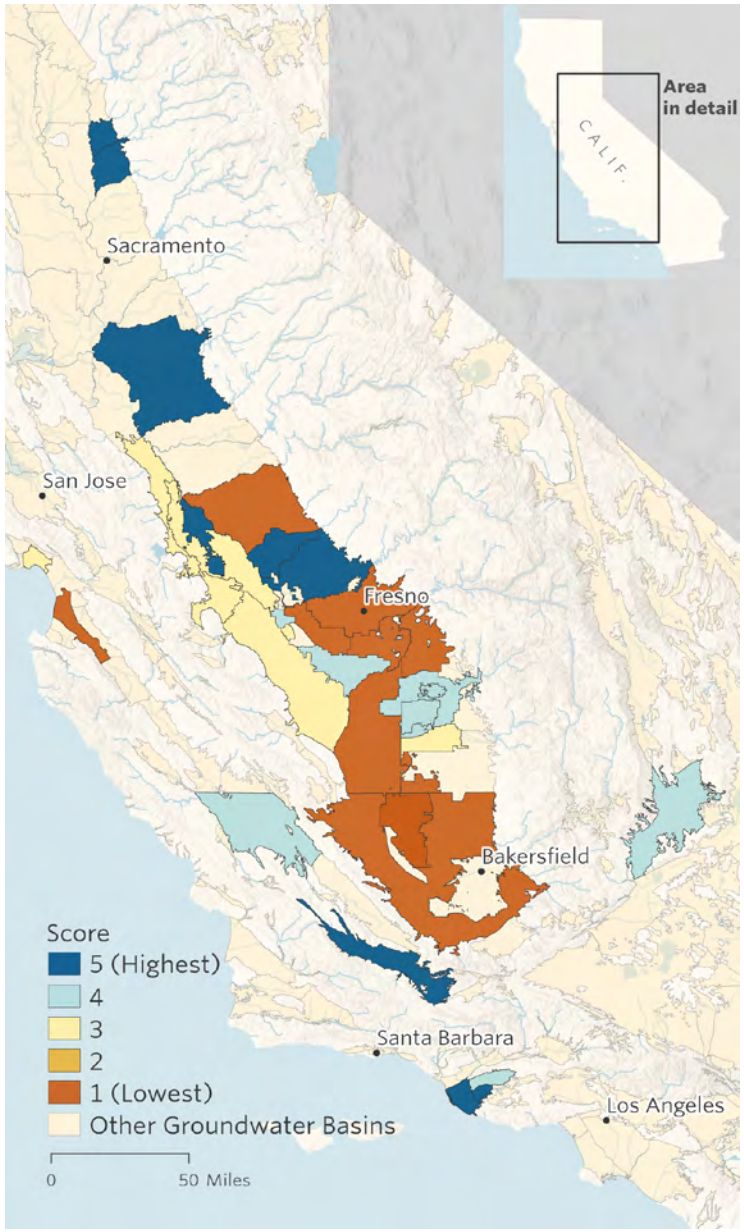
- Until a disconnection can be proven, include all potential and confirmed ISWs in the GSP. The absence of evidence is not the evidence of absence.
- Where data gaps exist, describe concrete actions, with a timeline and budget, to increase the number of monitoring wells in proximity to streams to fill data gaps and properly identify the dynamics between groundwater and surface water.
- Prioritize the installation of 1) nested or multi-completion wells that can monitor impacts on shallow aquifers from pumping in deeper aquifers, and 2) shallow wells at locations near high value or sensitive resources that are vulnerable to, significant and unreasonable, adverse impacts.

Characterize surface water and groundwater connectivity

- Retain stream segments with intermittent connections to groundwater as ISWs.
- Increase monitoring to fill data gaps (particularly in shallow aquifers) and to utilize current and future shallow groundwater data collected from the monitoring plan to improve the modeled relationship between surface water and groundwater.
- Conduct a thorough review of existing information on surface water-groundwater interconnectivity (including the estimation of the quantity and timing of streamflow depletions) in the subbasin[5].

TOOLS

- The ICONS dataset provides information on the depth to groundwater and the likely presence of interconnected surface water (ISW) in the Central Valley. Available at: https://icons.codefornature.org/



DATA SOURCES: Groundwater Basins – DWR, Highways – Caltrans, Rivers – NHD, Basemap – Esri

METRIC 3

How well does the water budget account for the water use of nature, including GDEs, ISWs, native vegetation and managed wetlands?

SIGNIFICANCE

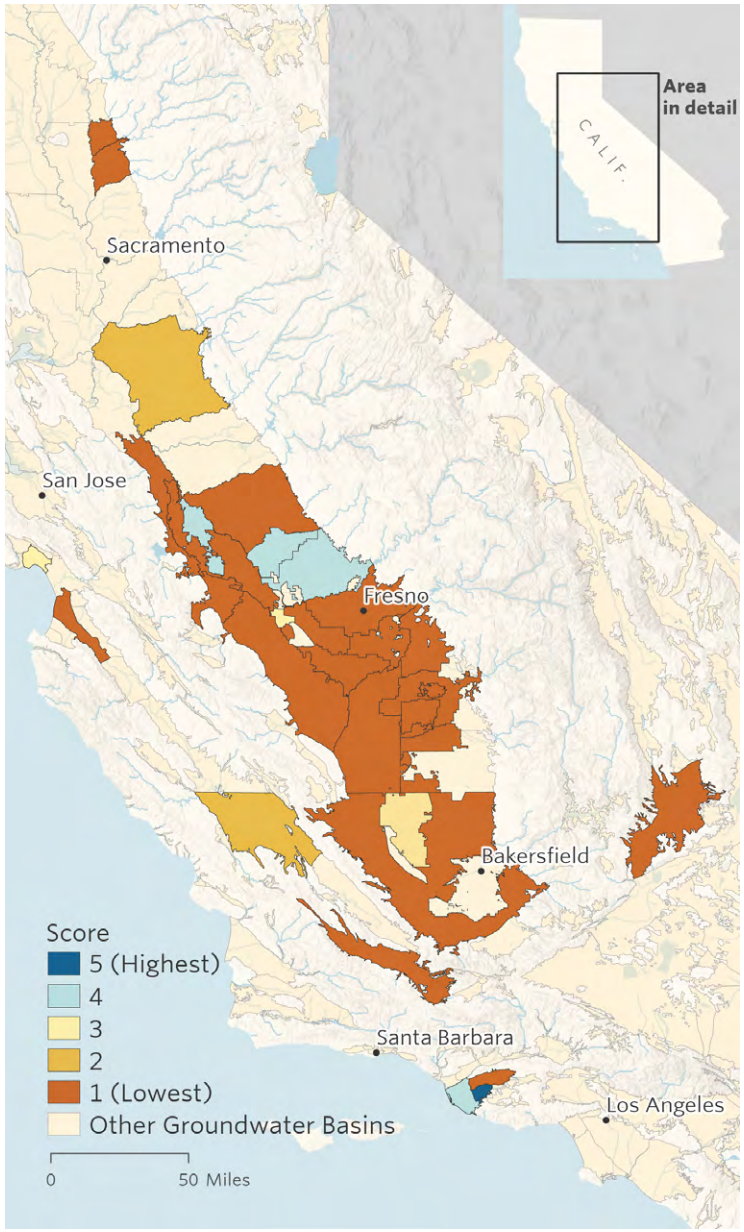
When environmental consumptive water use is not explicitly accounted for in the water budget, the sustainability yield can be overestimated and result in additional groundwater extractions that keep the basin out of balance.

RECOMMENDED BEST PRACTICES

- Explicitly include environmental beneficial users as a water use sector in the water budget.
- Include the current, historical and projected demands of native vegetation and/or managed wetlands.
- Include consumptive water use (evapotranspiration) in the surface water budget as a surface water outflow and identify groundwater outflow to evapotranspiration as a groundwater budget component.
- Use appropriate crop coefficients for native vegetation, managed wetlands, and agricultural crops when estimating evapotranspiration losses from the basin's water budget.

TOOLS

- Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs.



METRIC 4

How well do the Sustainable Management Criteria consider Groundwater Dependent Ecosystems and avoid undesirable results?

SIGNIFICANCE

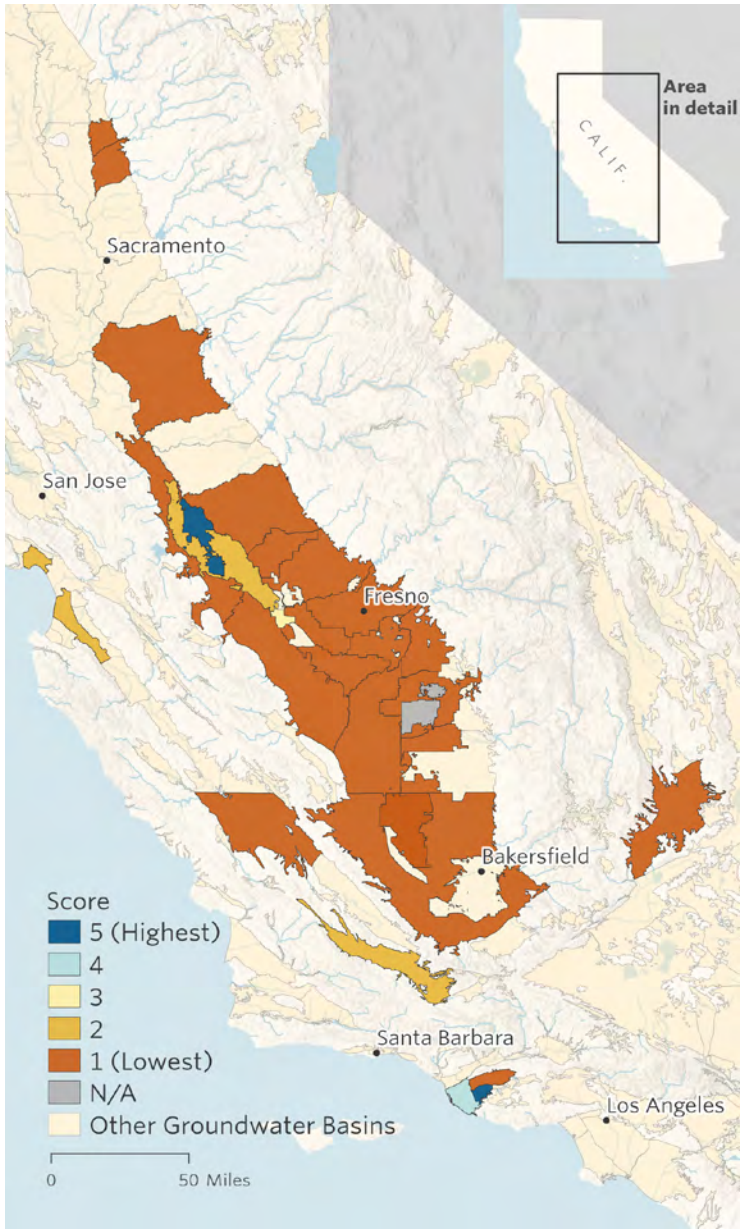
SGMA requires the consideration of all beneficial uses and users of groundwater, including groundwater dependent ecosystems when defining undesirable results, and establishing minimum thresholds. The three most relevant undesirable results to GDEs are: 1) Chronic Lowering of Groundwater Levels, 2) Degraded Water Quality, and 3) Depletions of Interconnected Surface Waters. When defining undesirable results, potential impacts to GDEs need to be identified and described in the context of groundwater conditions in the basin. If potential impacts to GDEs are not adequately described and considered when establishing minimum thresholds in the basin, groundwater conditions in the basin may irreparable destroy ecosystems and critical habitat that support federal and state protected species.

RECOMMENDED BEST PRACTICES

- Groundwater dependent ecosystems need consideration when establishing sustainable management criteria for the groundwater elevations, water quality, and interconnected surface waters sustainability indicators.
- Potential effects on groundwater dependent ecosystems need to be acknowledged when describing undesirable results in the basin.
- Groundwater thresholds for ecosystems and species also need to be addressed when establishing minimum thresholds and measurable objectives in the basin.
- The Nature Conservancy provides the following guidance for considering GDEs when establishing sustainable management criteria:

TOOLS

- Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs.
- GDE Pulse: A tool for assessing changes in GDEs health using satellite, rainfall, and groundwater data.



DATA SOURCES: Groundwater Basins – DWR, Highways – Caltrans, Rivers – NHD, Basemap – Esri

METRIC 5

How well do the management criteria for ISWs analyze the impact to surface water beneficial users?

SIGNIFICANCE

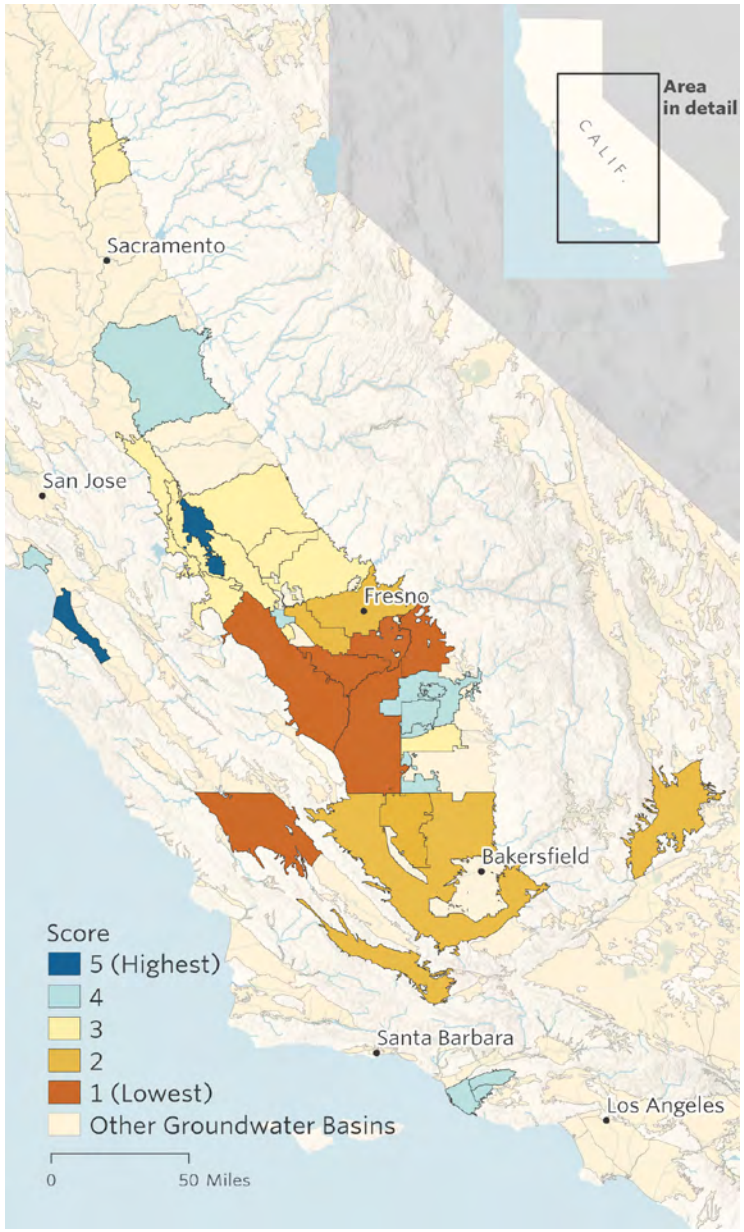
SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water (e.g., instream aquatic habitat, freshwater species) be avoided within interconnected surface waters. Beneficial users of surface water include environmental users such as plants or animals[2], which therefore must be considered when establishing sustainable management criteria for the interconnected surface water sustainability indicator.

RECOMMENDED BEST PRACTICES

- Describe potential effects on environmental beneficial uses and users of surface water when defining sustainable management criteria for interconnected surface waters in the basin, as required under SGMA.
- The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of surface waters (e.g., salmon, steelhead).

TOOLS

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



DATA SOURCES: Groundwater Basins – DWR, Highways – Caltrans, Rivers – NHD, Basemap – Esri

METRIC 6

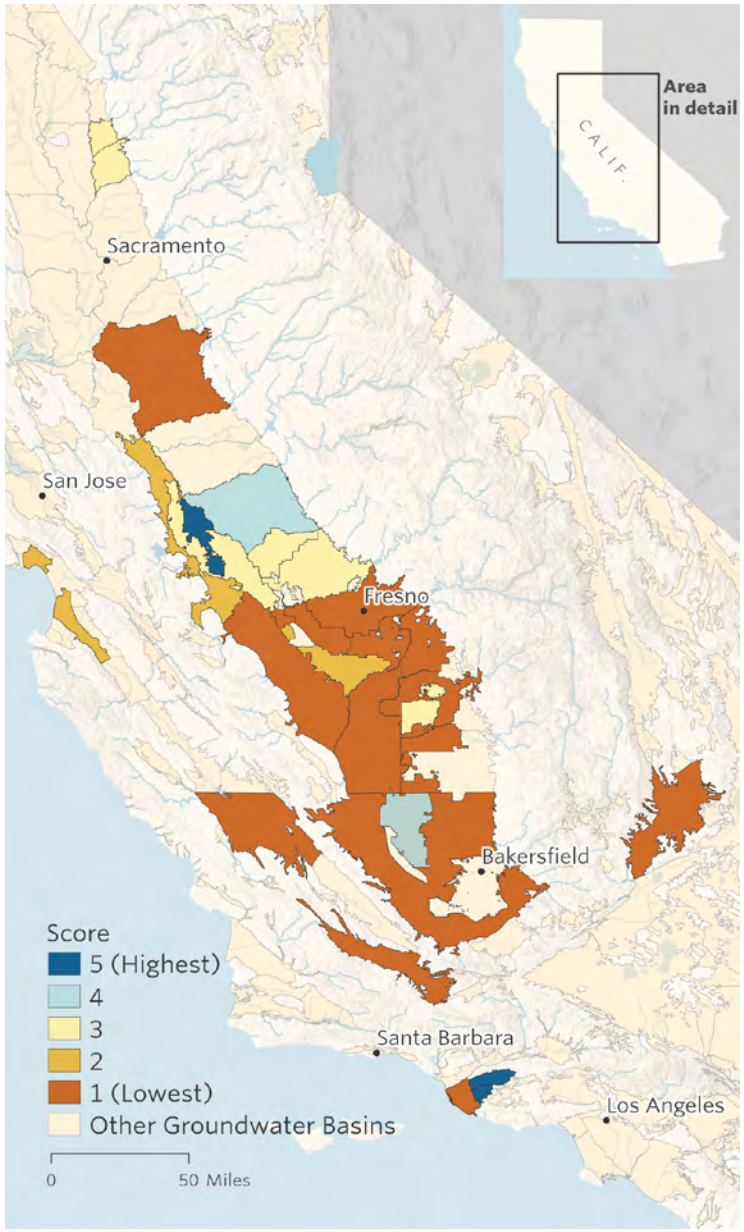
How well are Environmental Stakeholders engaged?

SIGNIFICANCE

Stakeholder engagement is an important tool for building acceptance, trust, and compliance in decision-making. By involving stakeholders and their concerns in GSP development and GSP implementation, the foundations for achieving groundwater sustainability are in place. Stakeholder engagement can best be measured by the degree to which stakeholder input is incorporated into the plan.

RECOMMENDED BEST PRACTICES

- Consult with representatives from Tribes, Disadvantaged Communities, natural resource agencies, and environmental organizations during GSP development and implementation.
- Prioritize stakeholder engagement amongst all beneficial users through improvements to the stakeholder engagement plan, partnerships, more representative governance and funding decisions.
- Solicit feedback from stakeholder constituents early in GSP development via advisory groups, working groups or technical committees.
- Seriously consider stakeholder feedback provided in comment letters on the draft GSP into the final GSP by providing ample time after the public comment period to address concerns in the final GSP.



DATA SOURCES: Groundwater Basins – DWR, Highways – Caltrans, Rivers – NHD, Basemap – Esri

METRIC 7

How well is nature incorporated in projects & management actions?

SIGNIFICANCE

Implementing multi-benefit projects can simultaneously address water quantity issues as well as provide environmental benefits or benefits to disadvantaged communities. Multi-benefit projects may also create opportunities for additional funding sources that would otherwise be difficult for water agencies to access (e.g., conservation-based funds).

RECOMMENDED BEST PRACTICES

For projects and management actions already identified, include and describe additional management actions and projects targeted for managing ISWs and GDEs. For new projects and management actions state how environmental benefits and multiple benefits will accrue and include these benefits as criteria for assessing project priorities.

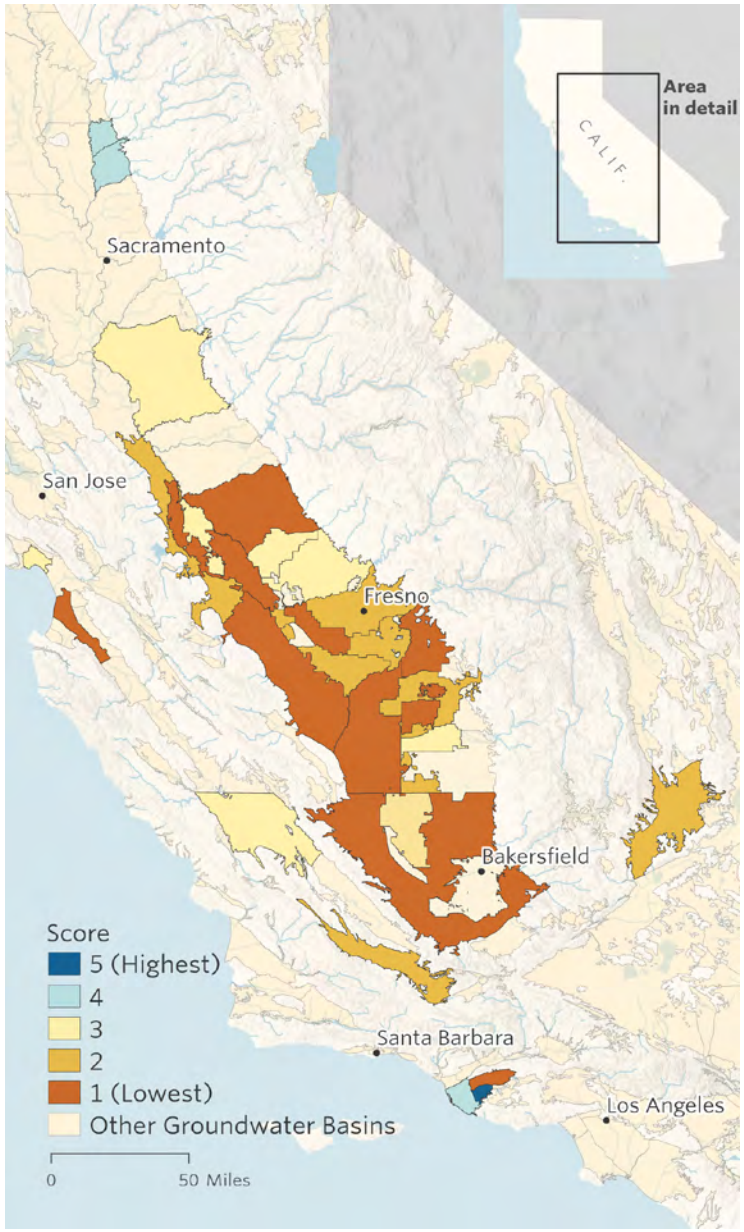
- Engage with environmental organizations to learn about multiple-benefit projects that can be implemented to enhance the water supply while benefiting habitat.
- Conduct education and outreach for protection of GDEs and ISWs as well as specific management of these ecosystems and the species they provide for.
- Identify if there is habitat value incorporated into basin design and how recharge basin(s) can be managed to benefit environmental users.
- State how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.

The Nature Conservancy provides the following guidance for GSAs to use:

- Groundwater Dependent Ecosystems under SGMA: Guidance for Preparing GSPs.

TOOLS

- Multi-Benefit Recharge Project Methodology Guidance for GSPs" Link to https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/.



DATA SOURCES: Groundwater Basins – DWR, Highways – Caltrans, Rivers – NHD, Basemap – Esri

METRIC 8

How well is nature identified and addressed within the monitoring network?

SIGNIFICANCE

A lack of shallow monitoring wells and/or the lack of plans for future monitoring can threaten water availability for surface water users, shallow domestic wells, GDEs, and aquatic habitats.

RECOMMENDED BEST PRACTICES

- Reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs so that surface-shallow groundwater interactions are fully integrated into Plans;
- Characterize groundwater conditions within GDEs and ISWs (e.g., discuss how monitoring data will be used to estimate the quantity and timing of streamflow depletions); and
- Determine what ecological monitoring can be used to assess the potential for, significant and unreasonable, impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

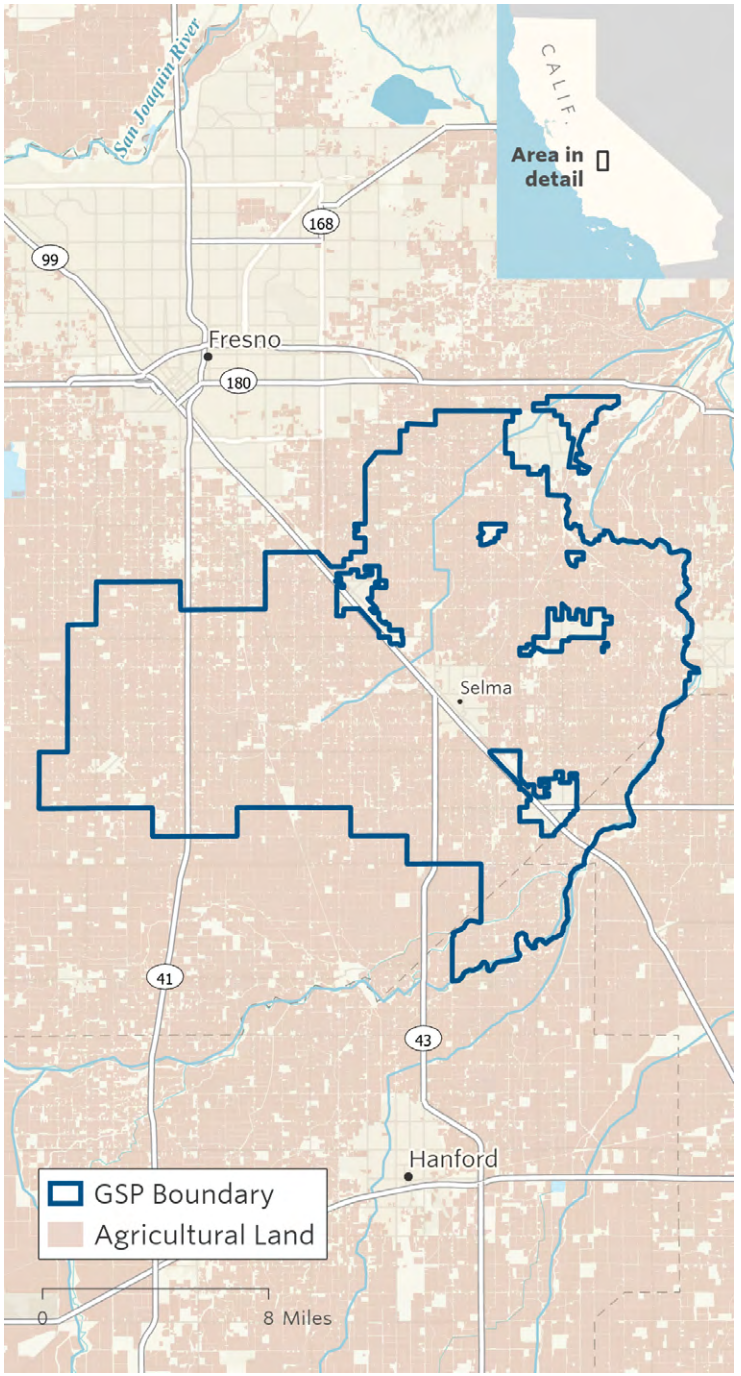
GSP Profiles

This section summarizes our findings for each of the 30 GSPs that we reviewed. The profiles summarize how we ranked the GSPs performance for each of the eight Sustainability Metrics, and provide a brief justification for the ranking and our assessment based on the GSP's score across all Metrics. Want more details about how each GSP managed groundwater for nature? See our detailed comment letters here.

Want to know how well this GSP included Climate Change, Disadvantaged Communities and Clean Drinking Water? See the public comment letters on the individual GSPs by the Groundwater Leadership Forum at the Department of Water Resource's SGMA Portal.

Central Kings

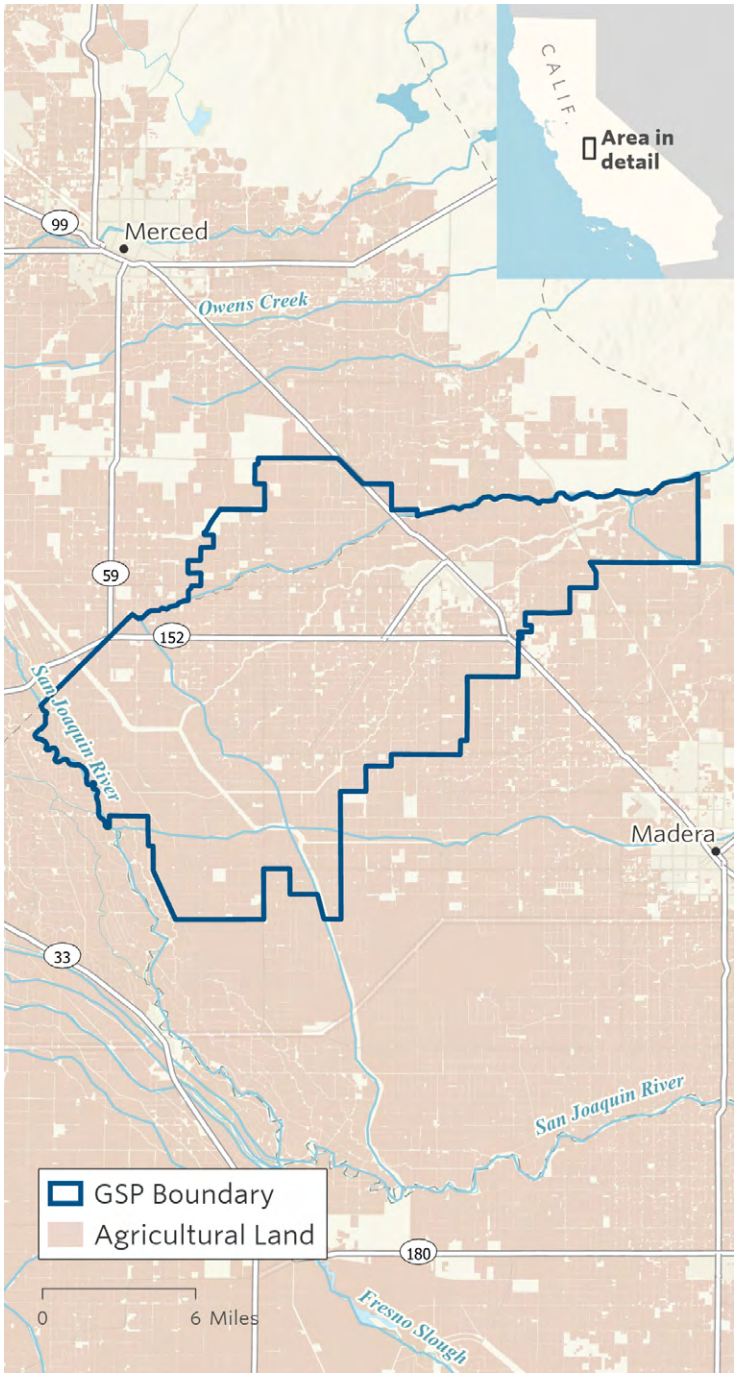
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	4	They were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths.
	Identification & Consideration of ISW	1	ISWs were incorrectly removed based on lack of continuous saturation between surface water and groundwater.
	Environment Specified in Water Budget	1	Water use by EBUs is not acknowledged in GSP water budgets.
	SG/SMCs for GDEs	1	Management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	Management criteria for ISWs were not developed due to the unproven statement that they are not likely to occur.
	Environmental Stakeholders	1	The GSP does not state how environmental stakeholders were engaged.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	2	Data gaps in the monitoring network are acknowledged but not filled by future monitoring plans.
AVERAGE SCORE		1.5	**The GSP is inadequate in addressing environmental needs and in meeting the ecosystem objectives of SGMA.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Chowchilla Subbasin

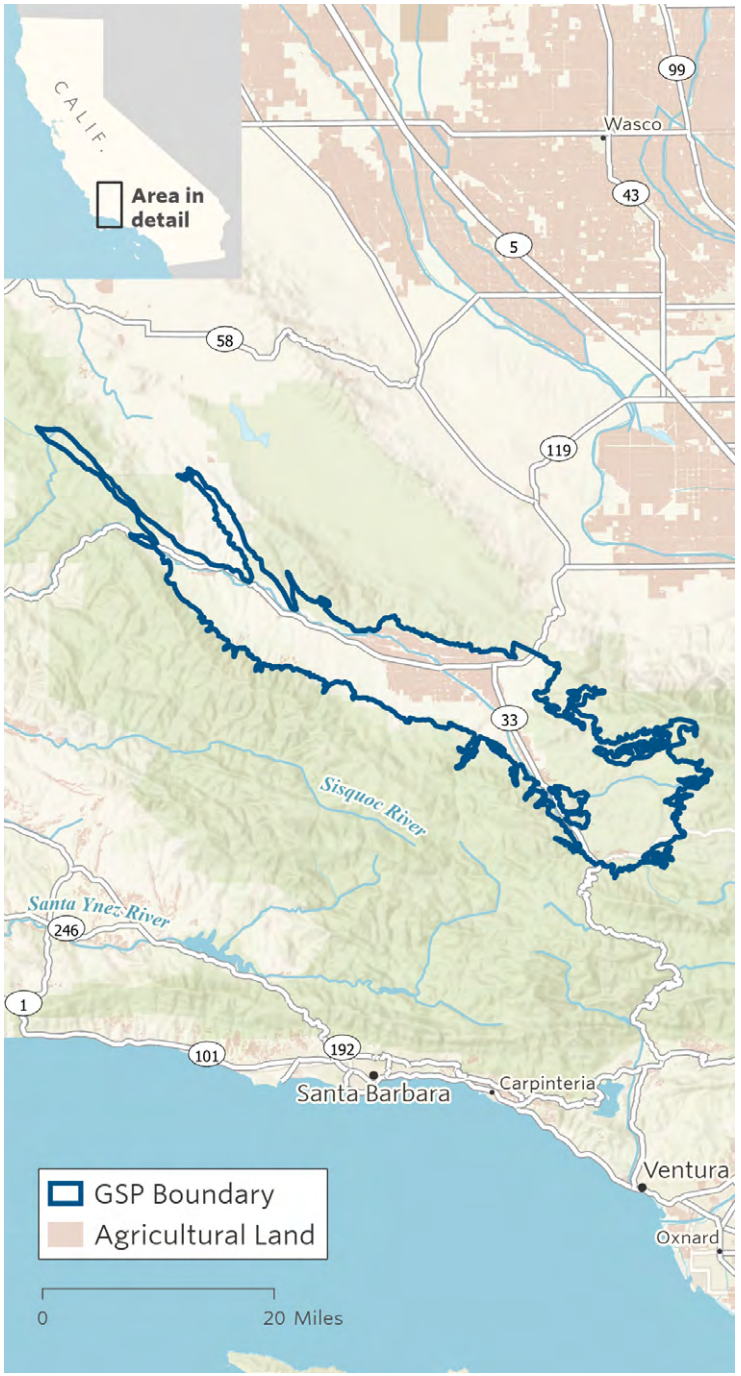
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	3	GDEs were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths. GDEs located next to net-losing streams were erroneously rejected.
	Identification & Consideration of ISW	1	ISWs were incorrectly removed based on characterization of losing streams as disconnected.
	Environment Specified in Water Budget	5	Consumptive use is estimated for native vegetation.
	SG/SMCs for GDEs	4	Measurable objectives for groundwater levels are within the range of maximum vegetation rooting depth and are expected to maintain the spatial extent of the GDE unit.
	SG/SMCs for ISW	1	Management criteria for ISWs were not developed because ISWs are incorrectly dismissed.
	Environmental Stakeholders	3	The GSA has engaged with environmental stakeholders throughout the plan review process.
	Projects & Management Actions	3	Environmental benefits and/or multiple benefits are included as criteria for assessing project priorities.
	Monitoring Network	3	Monitoring for identified GDEs is adequate but further monitoring is needed to properly analyze potential GDEs and ISWs.
AVERAGE SCORE		2.9	**The GSP adequately protects identified GDEs but provides incomplete analysis and monitoring for ISWs.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Cuyama

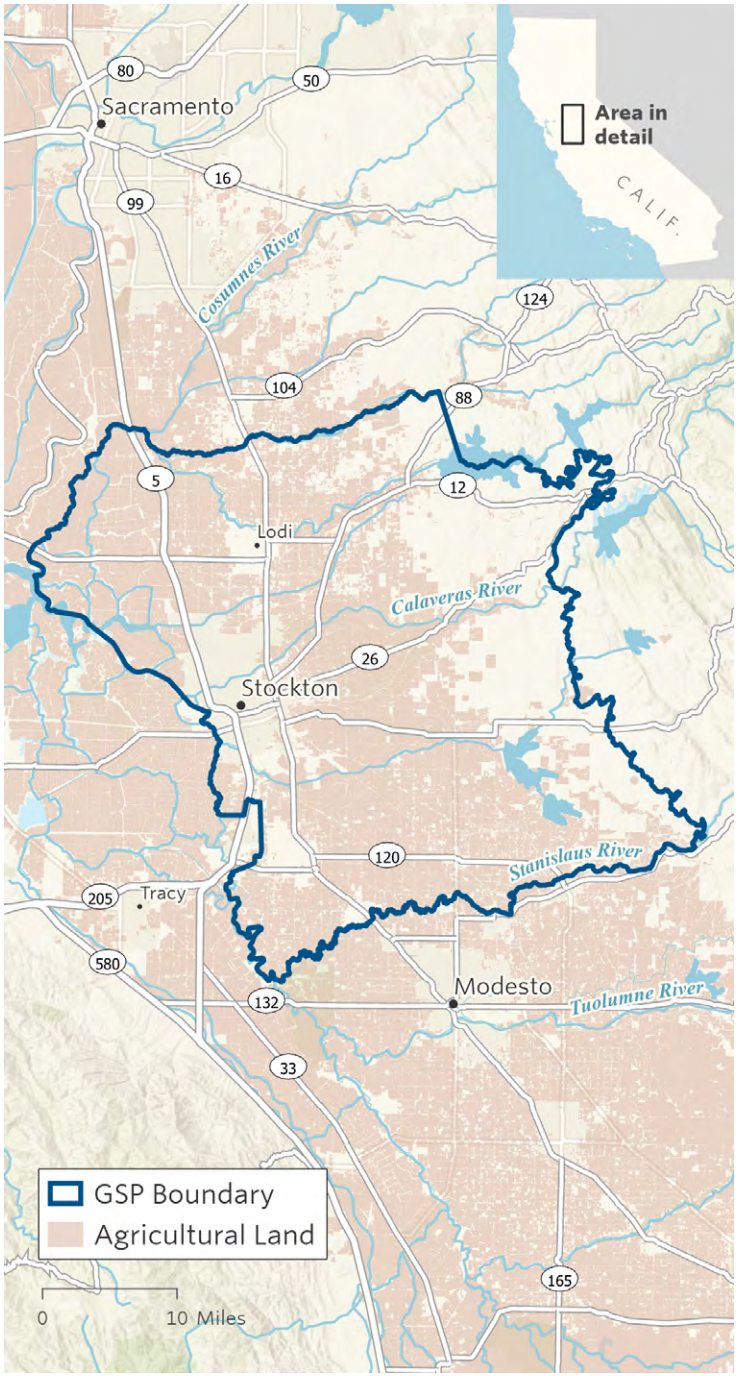
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	3	The GDE identification process did not take groundwater levels into consideration. The GDE identification process utilized aerial imagery in an incorrect manner. The removal of GDE units based on the presence of sandy, dry, and friable soils was not scientifically justified.
	Identification & Consideration of ISW	5	ISWs were mapped and depletions were estimated using model results.
	Environment Specified in Water Budget	5	Consumptive use is estimated for native vegetation.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	2	Groundwater level thresholds used by proxy to protect the Basin from undesirable results related to depletion of interconnected surface water do not protect the environment.
	Environmental Stakeholders	2	The GSP acknowledges environmental stakeholders but does not state how they were engaged.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	2	Data gaps in the monitoring network for GDEs are not acknowledged. Data gaps for ISWs are acknowledged but not filled by future monitoring plans.
AVERAGE SCORE		**2.6**	**The GSP does not adequately protect GDEs or ISWs through Sustainable Management Criteria or future monitoring.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Eastern San Joaquin

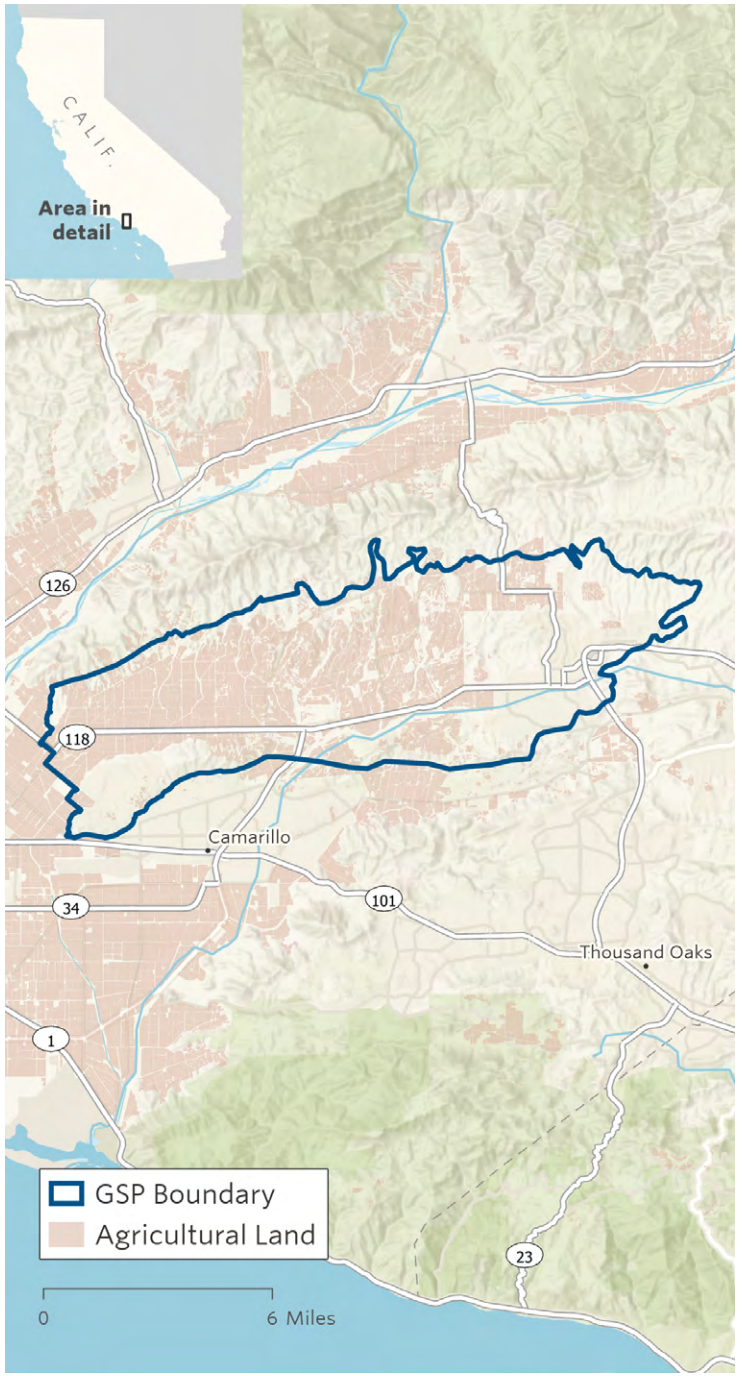
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	3	GDEs were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths.
	Identification & Consideration of ISW	3	ISWs were incorrectly removed based on lack of continuous saturation between surface water and groundwater.
	Environment Specified in Water Budget	5	Consumptive use is estimated for seasonal wetlands and native vegetation.
	SG/SMCs for GDEs	2	The management criteria consider but do not address impacts to GDEs.
	SG/SMCs for ISW	1	The management criteria for ISWs do not consider impacts to surface water areas.
	Environmental Stakeholders	4	Environmental stakeholders are represented in technical advisory group.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	2	Data gaps in the monitoring network are acknowledged but not filled by future monitoring plans.
AVERAGE SCORE		2.8	**The GSP addresses ISWs and GDEs but does not include Sustainable Management Criteria to protect the environment and has data gaps.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Fox Canyon–Los Posas

Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	4	Wetland and vegetative GDEs were identified and mapped using The Nature Conservancy's data. GDEs were rejected along losing stream reaches.
	Identification & Consideration of ISW	3	ISWs were incorrectly removed based on characterization of losing streams as disconnected.
	Environment Specified in Water Budget	4	Consumptive use is estimated for riparian vegetation.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	Management criteria for ISWs were not developed because ISWs are incorrectly dismissed.
	Environmental Stakeholders	4	Environmental stakeholders are represented in a technical advisory group.
	Projects & Management Actions	5	Environmental benefits of projects are quantified.
	Monitoring Network	1	The environment was not identified and addressed by the monitoring network.
AVERAGE SCORE		2.9	**The GSP is inadequate in addressing environmental beneficial uses and users and in meeting the ecosystem objectives of SGMA.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Fox Canyon–Oxnard

Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	5	Wetland and vegetative GDEs were identified and mapped using The Nature Conservancy's data.
	Identification & Consideration of ISW	5	ISWs were identified and mapped along gaining streams.
	Environment Specified in Water Budget	5	Consumptive use is estimated for riparian vegetation.
	SG/SMCs for GDEs	4	The management criteria consider impacts to GDEs but require further analysis.
	SG/SMCs for ISW	4	The management criteria consider impacts to ISWs but require further analysis.
	Environmental Stakeholders	4	Environmental stakeholders are represented in technical advisory group.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	4	Data gaps in the monitoring network are acknowledged and additional shallow monitoring wells are planned.
AVERAGE SCORE		4.0	**The GSP addresses the environment and meets the ecosystem objectives of SGMA.**

DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

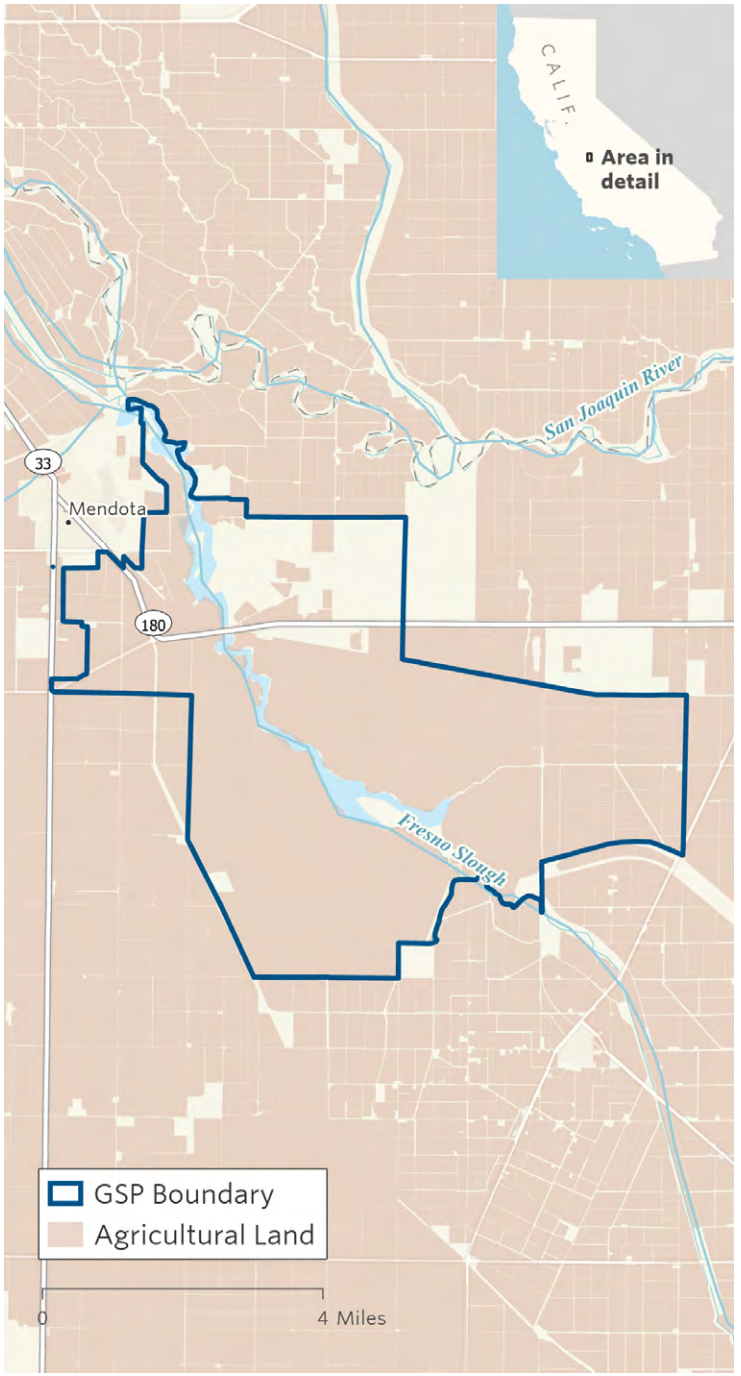
Fox Canyon–Pleasant Valley

Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	5	Wetland and vegetative GDEs were identified and mapped using The Nature Conservancy's data.
	Identification & Consideration of ISW	5	ISWs were identified and mapped but not quantified.
	Environment Specified in Water Budget	5	Consumptive use is estimated for riparian vegetation.
	SG/SMCs for GDEs	5	The management criteria consider impacts to GDEs.
	SG/SMCs for ISW	5	The management criteria for ISWs consider impacts to the environment.
	Environmental Stakeholders	4	Environmental stakeholders are represented in technical advisory group.
	Projects & Management Actions	5	Environmental benefits of projects are quantified.
	Monitoring Network	5	Monitoring of the environment planned using remote sensing methods.
AVERAGE SCORE		4.9	**The GSP is adequate in addressing the environmental beneficial uses and users and in meeting the ecosystem objectives of SGMA.**

DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Fresno County (Management Areas A & B)

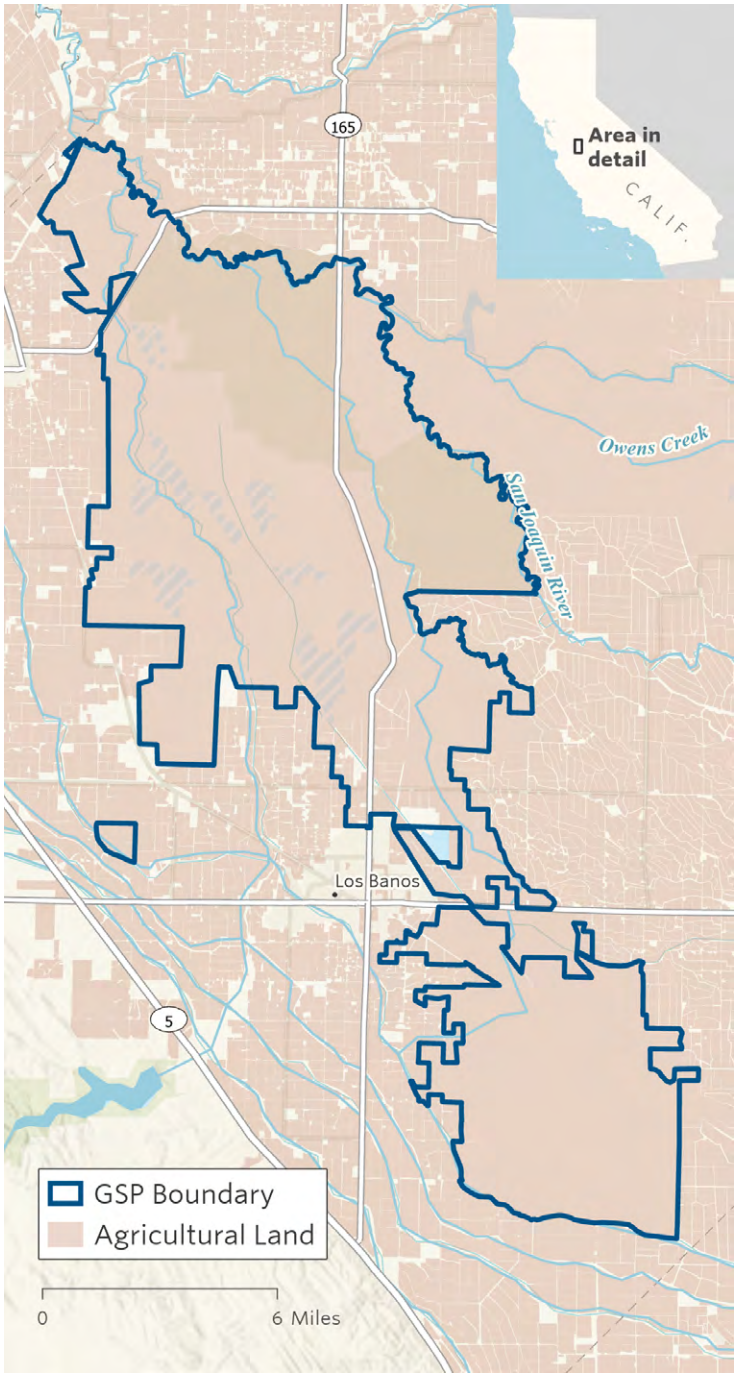
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	5	Wetland and vegetative GDEs were identified and mapped using The Nature Conservancy's data. GDEs were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths.
	Identification & Consideration of ISW	4	ISWs were identified and mapped along gaining streams.
	Environment Specified in Water Budget	4	Consumptive use is estimated for riparian vegetation.
	SG/SMCs for GDEs	3	The management criteria consider impacts to GDEs but requires further analysis.
	SG/SMCs for ISW	3	The management criteria for ISWs consider impacts to surface water areas.
	Environmental Stakeholders	4	Environmental stakeholders are represented in technical advisory group.
	Projects & Management Actions	1	No projects or management actions have been developed.
	Monitoring Network	2	Data gaps in the monitoring network are acknowledged but not filled by future monitoring plans.
AVERAGE SCORE		**3.3**	**The GSP addresses and considers impacts to GDEs and ISWs but does not include Sustainability Management Criteria to protect the environment.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Grasslands

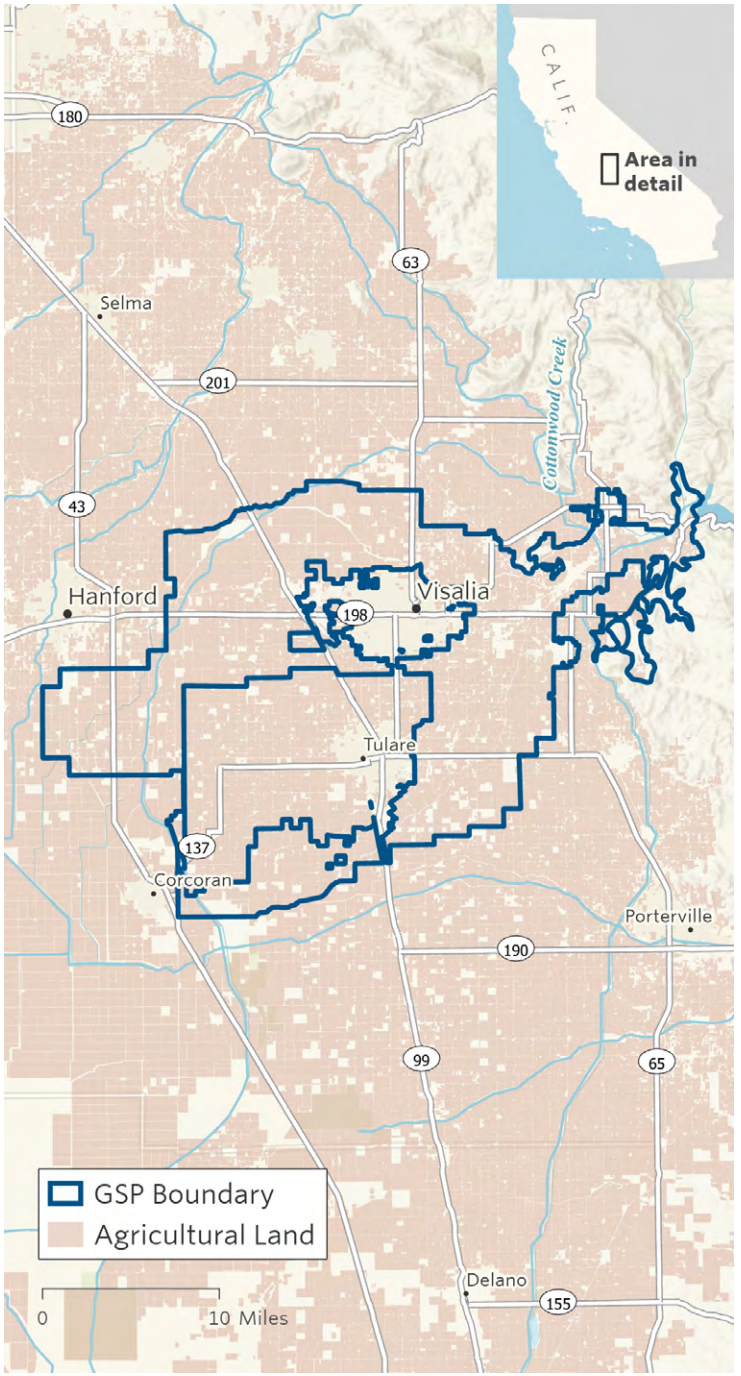
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	5	Wetland and vegetative GDEs were identified and mapped using The Nature Conservancy's data. GDEs included managed wetlands.
	Identification & Consideration of ISW	3	ISWs were identified and mapped along gaining streams but were incorrectly removed where shallow groundwater data was lacking.
	Environment Specified in Water Budget	5	Consumptive use is estimated for seasonal wetlands and native vegetation.
	SG/SMCs for GDEs	4	The management criteria consider impacts to GDEs and reflect a stable hydrologic system.
	SG/SMCs for ISW	5	The management criteria for ISWs use groundwater levels to consider impacts to surface water areas. Impacts to wetland vegetation are not considered.
	Environmental Stakeholders	5	Environmental stakeholders comprise the GSA and advisory committee.
	Projects & Management Actions	5	Environmental benefits of projects are quantified.
	Monitoring Network	3	Data gaps in the monitoring network are acknowledged but not filled by future monitoring plans.
AVERAGE SCORE		4.4	**The GSP successfully addresses, manages and protects the environment. Further investigation of shallow groundwater, identification of ISWs, and ecological monitoring would improve the GSP.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Greater Kaweah

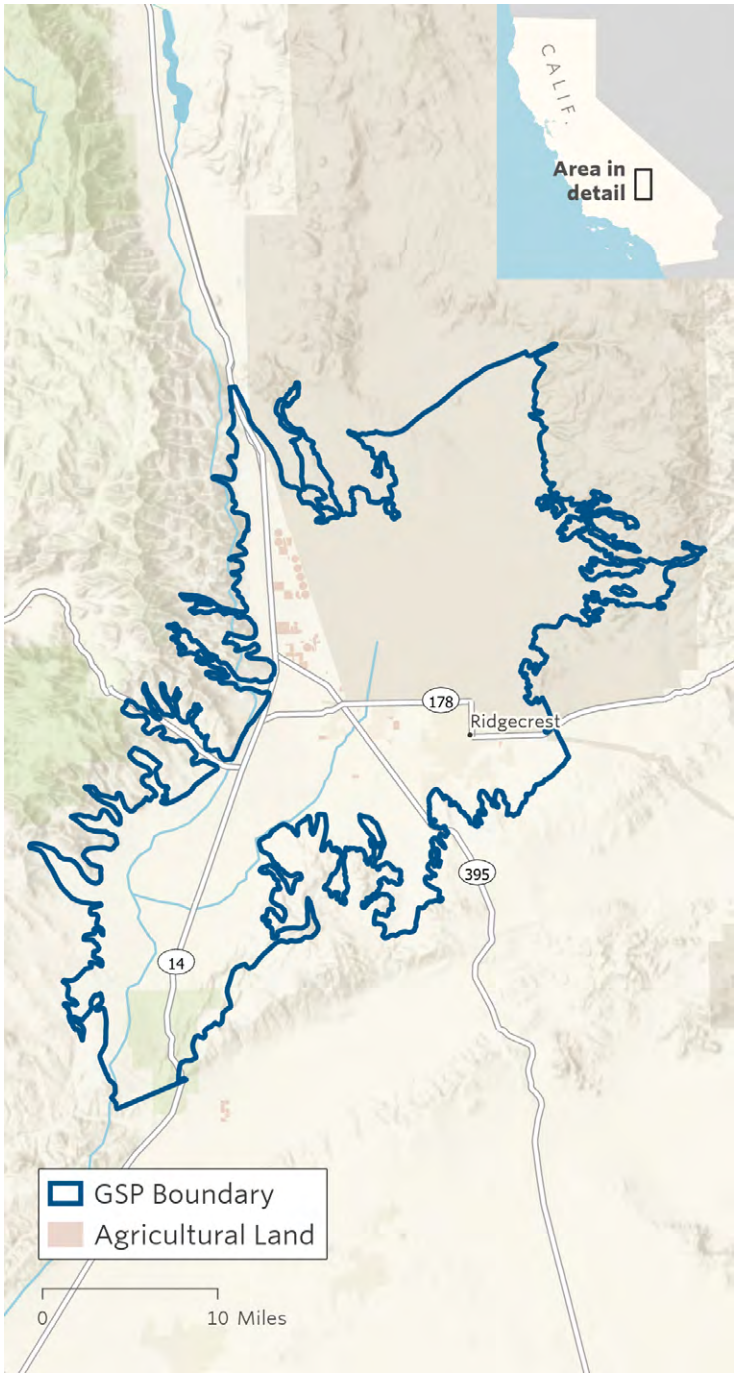
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	1	GDEs were rejected due to being surface water dependent without considering the shifting reliance of GDEs on both surface water and groundwater. GDEs were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths.
	Identification & Consideration of ISW	1	ISWs were incorrectly removed based on lack of continuous saturation between surface water and groundwater.
	Environment Specified in Water Budget	4	Consumptive use is estimated for phreatophytes.
	SG/SMCs for GDEs	1	The management critieria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	Management criteria for ISWs were not developed due to the unproven statement that ISWs are not likely to occur.
	Environmental Stakeholders	4	Environmental stakeholders are represented on the stakeholder committee.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	2	Data gaps in the monitoring network are acknowledged but not filled by future monitoring plans.
AVERAGE SCORE		**1.9**	**The GSP does not adequately protect GDEs or ISWs through Sustainable Management Criteria or future monitoring.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Indian Wells

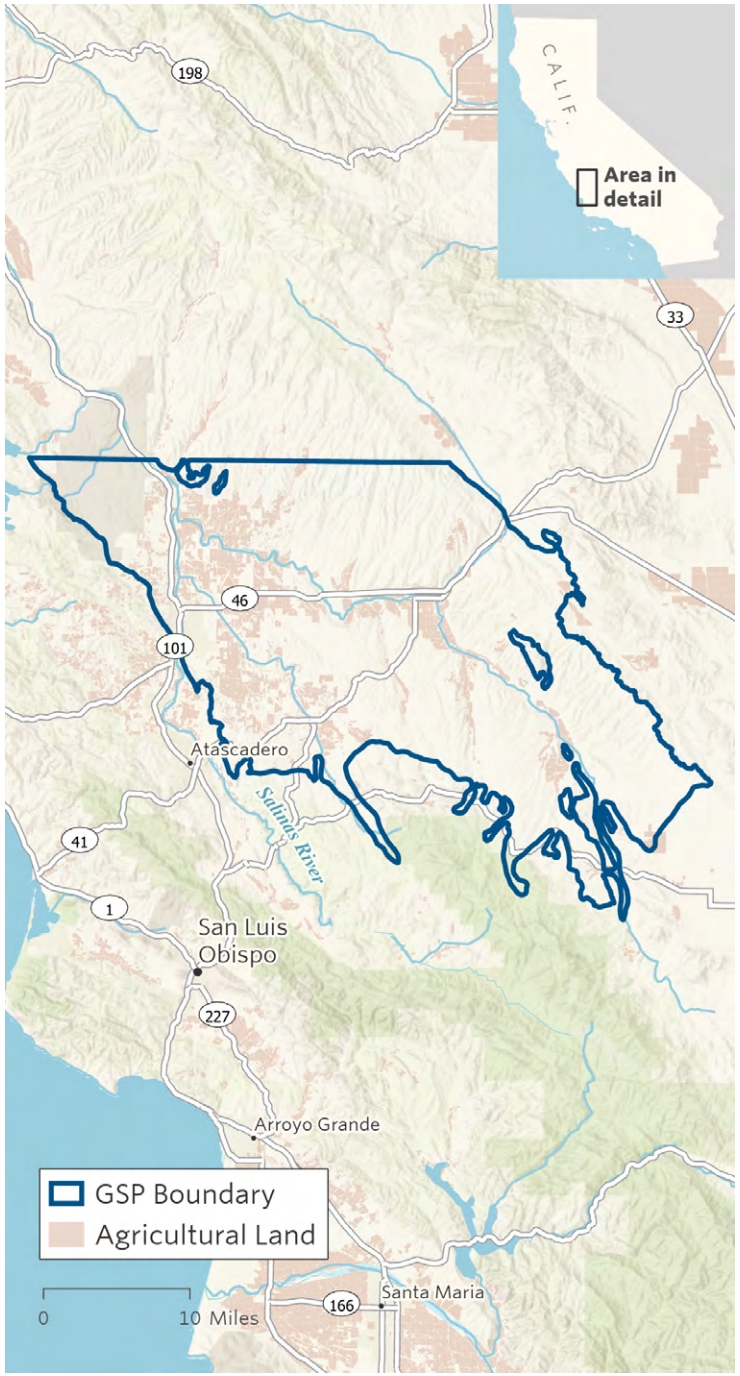
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	5	Most of The Nature Conservancy's dataset was retained in the GSP, however further analysis could help prioritize future monitoring and project resources.
	Identification & Consideration of ISW	1	ISWs were not identified due to a lack of data.
	Environment Specified in Water Budget	4	Consumptive use is estimated for native vegetation.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	Management criteria for ISWs were not developed due to insufficient data.
	Environmental Stakeholders	2	The GSP acknowledges environmental stakeholders but does not state how they were engaged.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	2	Data gaps in the monitoring network are acknowledged but not filled by future monitoring plans.
AVERAGE SCORE		2.1	**The GSP does not adequately protect GDEs and ISWs through Sustainable Management Criteria. Future monitoring needs are recognized but not adequately described.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Joint GSA: SLO County, Paso Robles, San Miguel CSD, Shandon–San Juan

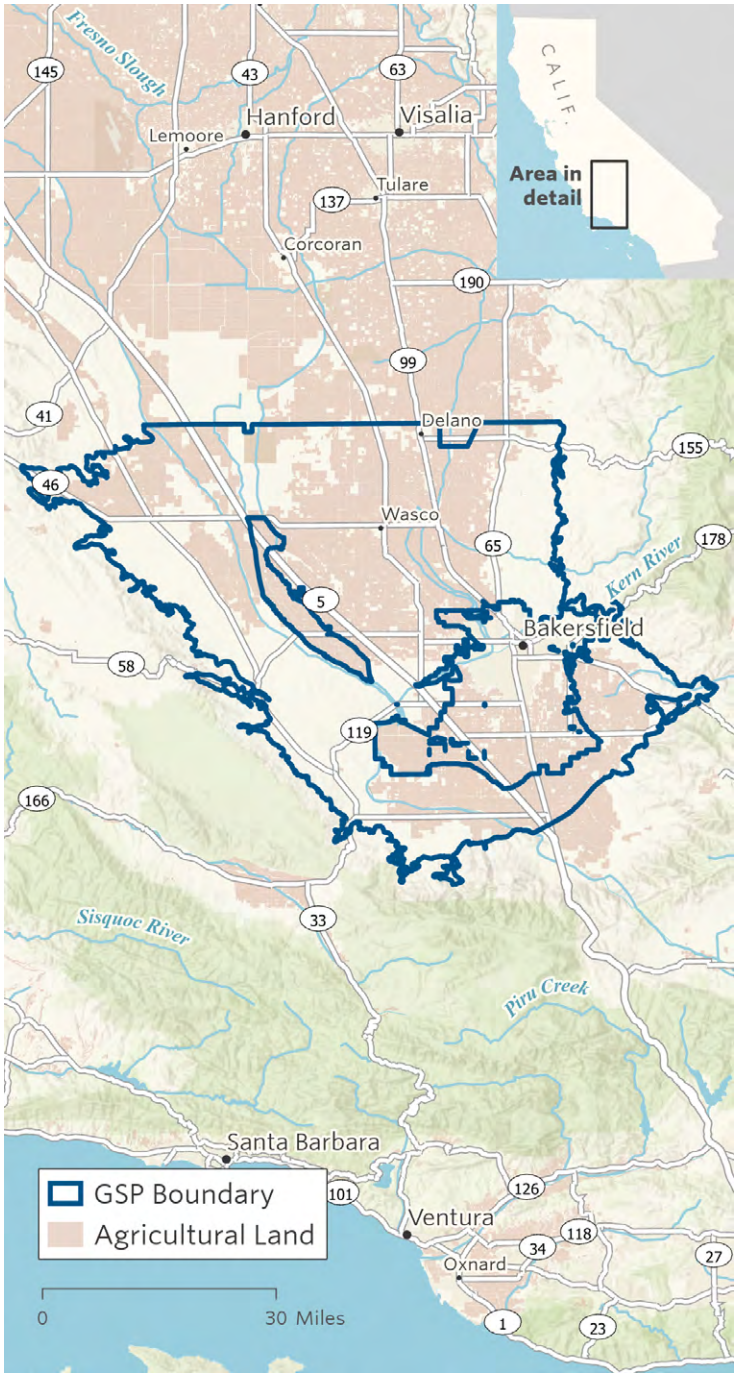
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	5	Wetland and vegetative GDEs were identified and mapped using The Nature Conservancy's data but not quantified.
	Identification & Consideration of ISW	1	ISWs were not identified due to a lack of data.
	Environment Specified in Water Budget	4	Consumptive use is estimated for riparian vegetation.
	SG/SMCs for GDEs	2	The management criteria consider but do not address impacts to GDEs.
	SG/SMCs for ISW	1	Management criteria were not developed for ISWs due to insufficient data.
	Environmental Stakeholders	1	The GSP does not state how environmental stakeholders are engaged.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	3	Data gaps in the monitoring network are acknowledged but not filled by future monitoring plans.
AVERAGE SCORE		2.3	**The GSP is incomplete in the addressing of environmental beneficial uses and users and in meeting the ecosystem objectives of SGMA.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Kern Groundwater Authority

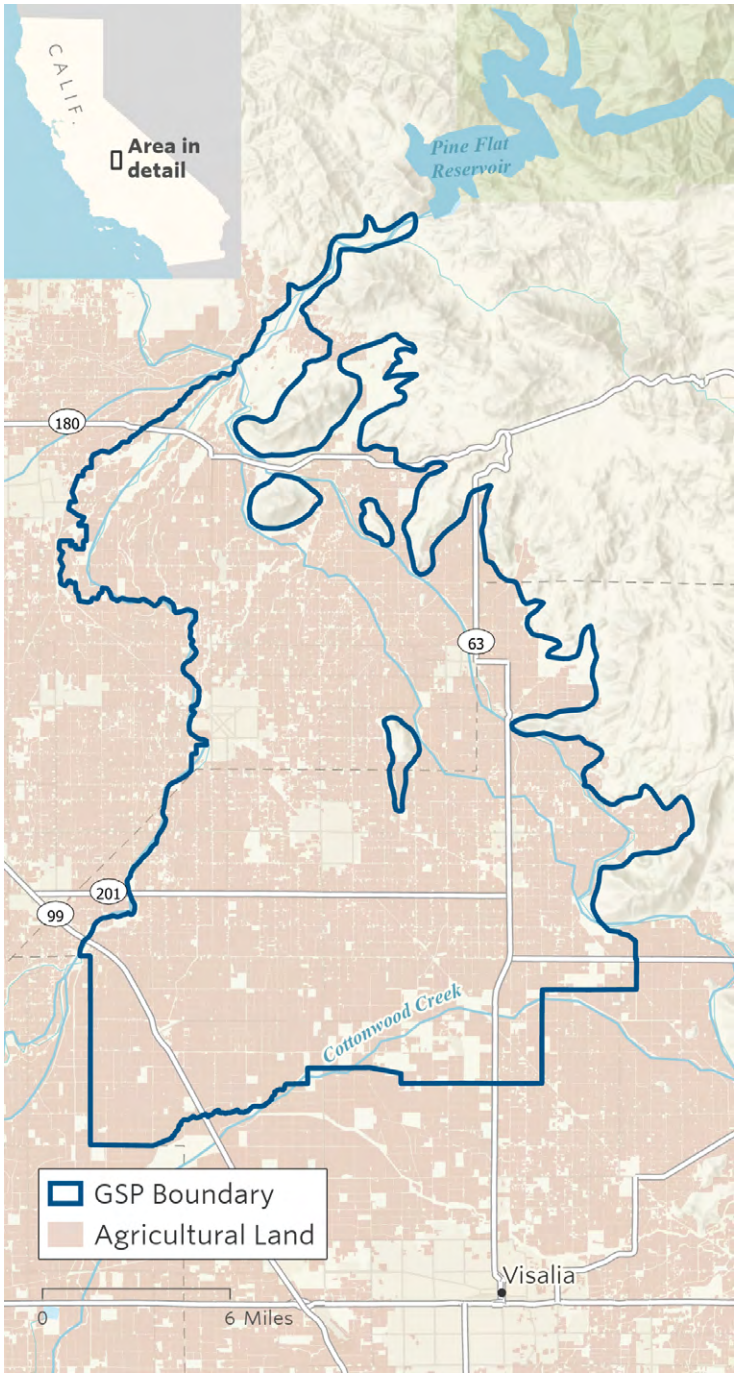
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	1	Wetland and vegetative GDEs were not identified and mapped due to lack of ISWs. Data gaps were not acknowledged.
	Identification & Consideration of ISW	2	ISWs were incorrectly removed based on lack of continuous saturation between surface water and groundwater.
	Environment Specified in Water Budget	1	Water use by the environment is not acknowledged in GSP water budgets.
	SG/SMCs for GDEs	1	The management critieria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	The management critieria for ISWs do not consider impacts to surface water areas.
	Environmental Stakeholders	2	The GSP acknowledges environmental stakeholders but does not state now they were engaged.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	1	The environment was not identified and addressed by the monitoring network.
AVERAGE SCORE		**1.3**	**The GSP does not adequately characterize ISW and GDEs nor consider ISWs and GDEs in the Subbasin's sustainable management criteria. We believe the GSP is insufficient.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Kings River East

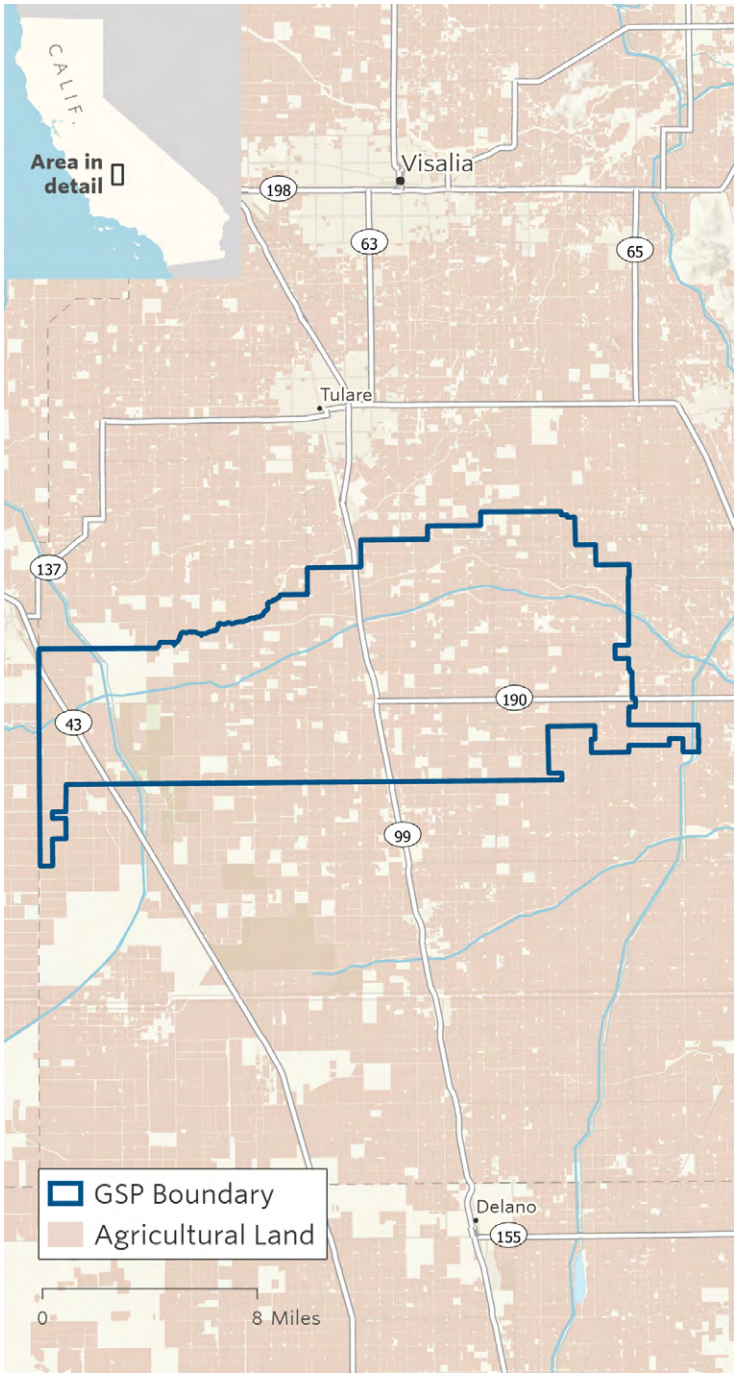
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	4	GDEs were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths.
	Identification & Consideration of ISW	3	An incomplete analysis of ISWs does not address how ISWs were identified or removed.
	Environment Specified in Water Budget	1	Water use by the environment is not acknowledged in GSP water budgets.
	SG/SMCs for GDEs	1	The management critieria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	Management critieria for ISWs were not developed due to the unproven statement that undesirable results are not likely to occur.
	Environmental Stakeholders	1	The GSP does not state how environmental stakeholders were engaged.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	1	Data gaps in the monitoring network are not acknowledged.
AVERAGE SCORE		1.6	**The GSP does not adequately protect GDEs and ISWs through Sustainable Management Criteria or future monitoring.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Lower Tule River Irrigation District

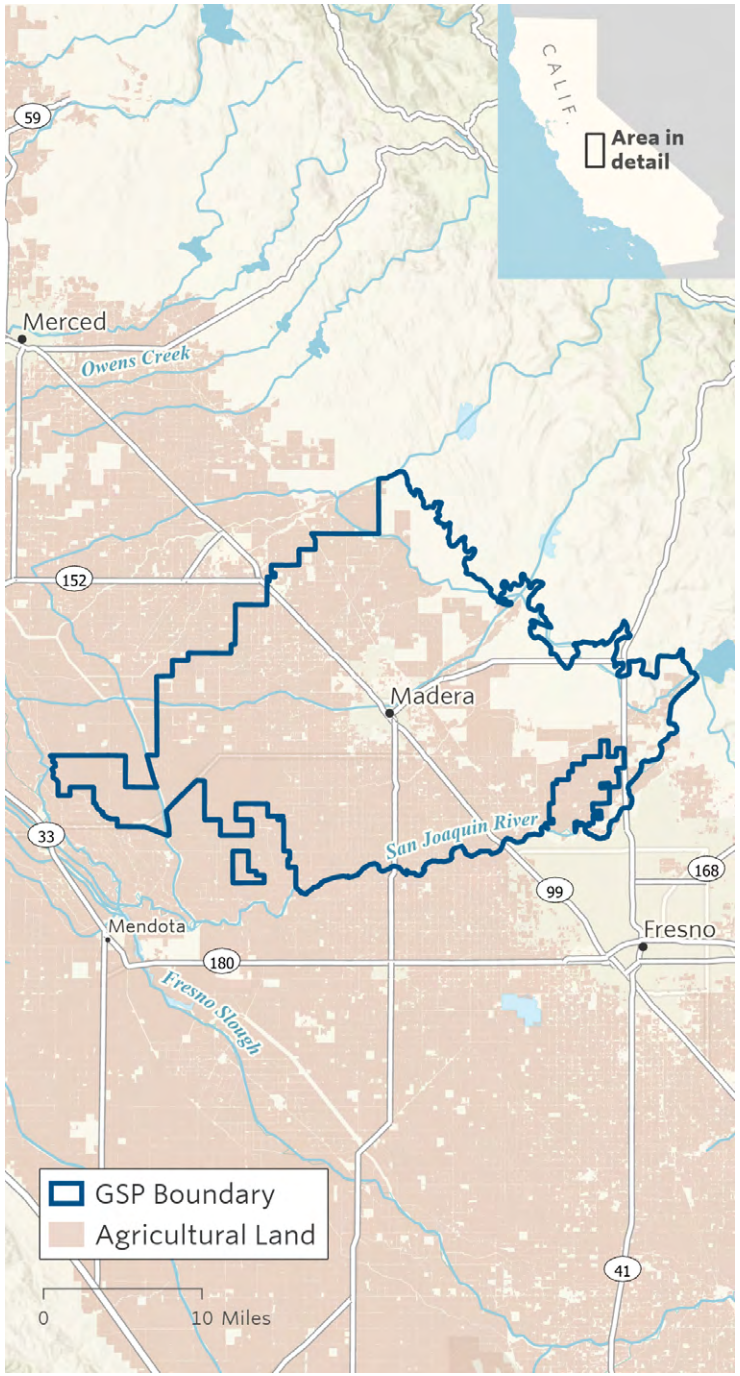
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	1	GDEs were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths.
	Identification & Consideration of ISW	1	ISWs were not identified. No monitoring data or quantitative analysis provided.
	Environment Specified in Water Budget	3	Consumptive use by the environment is combined with agricultural use.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	Management criteria for ISWs were not developed due to the unproven statement that ISWs are not likely to occur.
	Environmental Stakeholders	3	The GSA has engaged with environmental stakeholders throughout the plan review process.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	3	Data gaps in the monitoring network are acknowledged but not filled by future monitoring plans.
AVERAGE SCORE		1.8	**The GSP is incomplete as data gaps exist in regard to environmental uses and users of groundwater throughout the GSP. The plan needs a more thorough identification and evaluation of ISWs and GDEs for each sustainability indicator.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Madera Subbasin

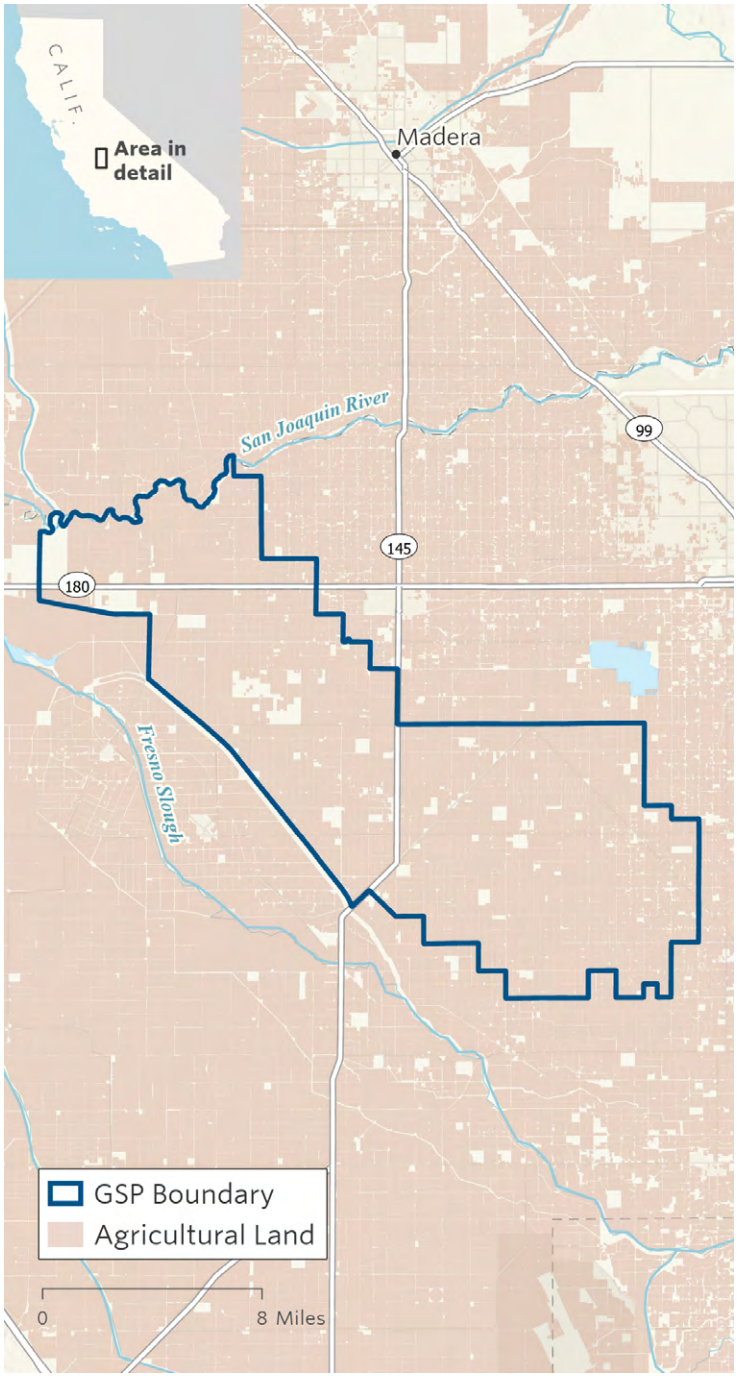
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	3	GDEs were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths. GDEs located next to net-losing streams were erroneously rejected.
	Identification & Consideration of ISW	1	ISWs were incorrectly removed based on lack of continuous saturation between surface water and groundwater.
	Environment Specified in Water Budget	5	Consumptive use is estimated for native vegetation.
	SG/SMCs for GDEs	4	The management criteria protect identified GDEs.
	SG/SMCs for ISW	1	Management criteria for ISWs were not developed because ISWs are incorrectly dismissed.
	Environmental Stakeholders	3	The GSA has engaged with environmental stakeholders throughout the plan review process.
	Projects & Management Actions	3	Environmental benefits and/or multiple benefits are included as criteria for assessing project priorities.
	Monitoring Network	3	Monitoring for identified GDEs is adequate but further monitoring is needed to properly analyze potential GDEs and ISWs.
AVERAGE SCORE		**2.9**	**The GSP adequately protects identified GDEs but provides incomplete analysis and monitoring for ISWs.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

McMullin

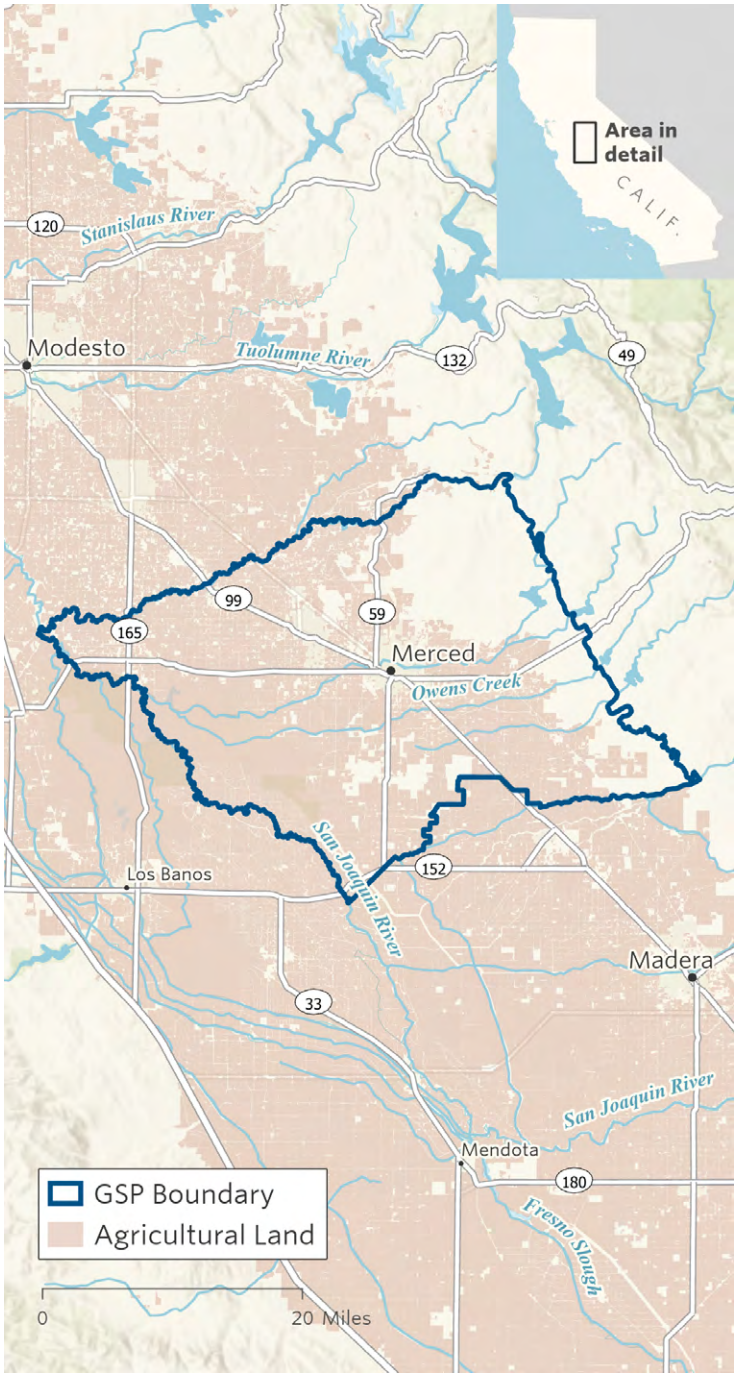
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	1	GDEs were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths.
	Identification & Consideration of ISW	1	ISWs were incorrectly removed based on lack of continuous saturation between surface water and groundwater.
	Environment Specified in Water Budget	1	Water use by the environment is not acknowledged in GSP water budgets.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	Management criteria for ISWs were not developed because ISWs are incorrectly dismissed.
	Environmental Stakeholders	2	The GSP acknowledges environmental stakeholders but does not state how they were engaged.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	1	Data gaps in the monitoring network are not acknowledged.
AVERAGE SCORE		1.1	**The GSP does not adequately protect GDEs and ISWs through Sustainable Management Criteria or future monitoring.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Merced

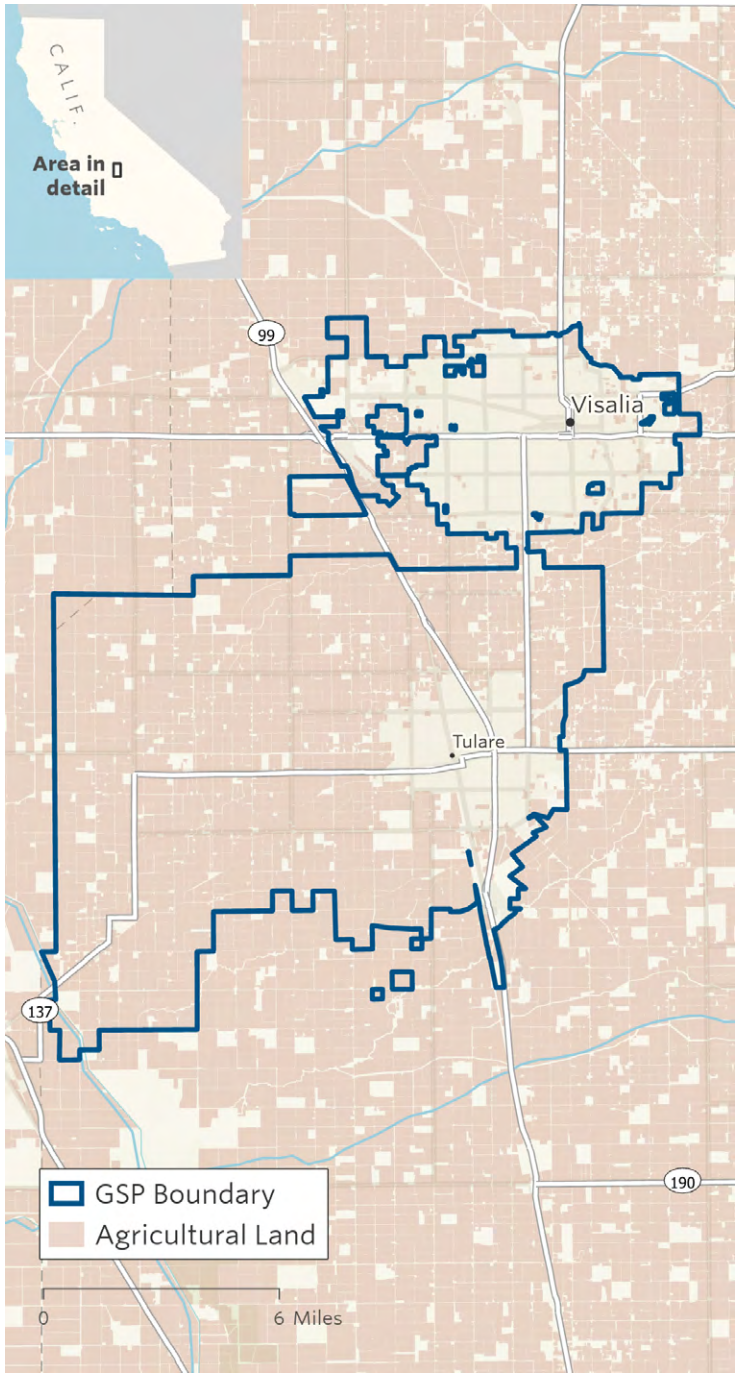
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	3	GDEs were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths. GDEs were rejected due to being surface water dependent without considering the shifting reliance of GDEs on both surface water and groundwater. GDE were removed in areas adjacent to irrigated fields. GDEs located next to net-losing streams were rejected.
	Identification & Consideration of ISW	4	ISWs were defined based on a surface water/ groundwater model of the basin; but there was limited data for calibration.
	Environment Specified in Water Budget	1	Water use by the environment is not acknowledged in GSP water budgets.
	SG/SMCs for GDEs	1	Management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	The management criteria for ISWs do not consider impacts to the environment.
	Environmental Stakeholders	3	The GSP acknowledges environmental stakeholders and has engaged with them in a limited manner.
	Projects & Management Actions	4	Environmental benefits and/or multiple benefits are included as criteria for assessing project priorities.
	Monitoring Network	2	Data gaps in the monitoring network are acknowledged for ISWs and planned to be filled. No similar effort is described for GDEs.
AVERAGE SCORE		2.3	**The GSP does not adequately protect GDEs and ISWs through the management criteria or future monitoring.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Mid-Kaweah Joint Powers Authority

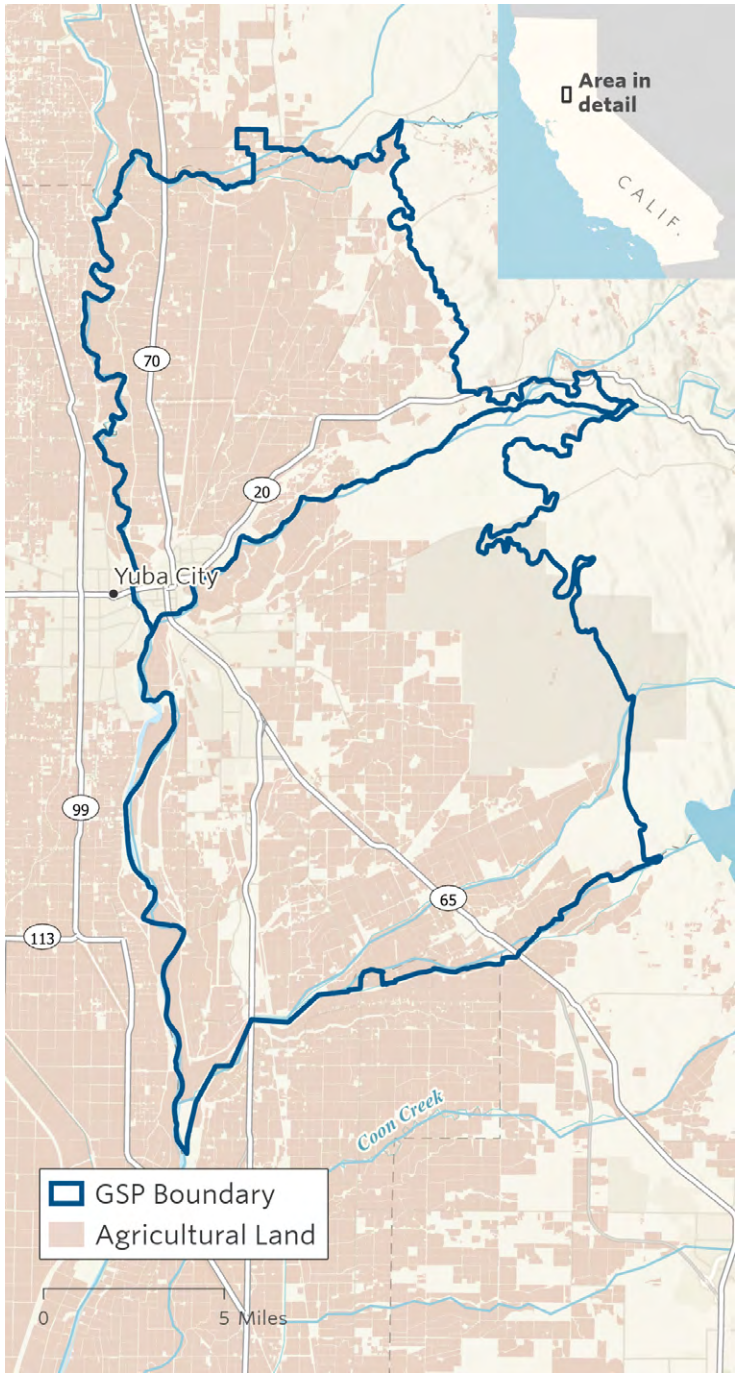
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	1	GDEs were rejected due to being surface water dependent without considering the shifting reliance of GDEs on both surface water and groundwater. GDEs were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths.
	Identification & Consideration of ISW	N/A	ISWs were correctly removed based on deep groundwater.
	Environment Specified in Water Budget	4	Consumptive use is estimated for phreatophytes.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	N/A	Management criteria for ISWs were not developed because there are no ISWs in the GSA.
	Environmental Stakeholders	4	Environmental stakeholders are represented on the advisory committee.
	Projects & Management Actions	3	Environmental benefits of projects are discussed.
	Monitoring Network	1	Data gaps in the monitoring network are not acknowledged.
AVERAGE SCORE		**2.3**	**The GSP does not adequately protect GDEs through Sustainable Management Criteria or future monitoring.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

North and South Yuba

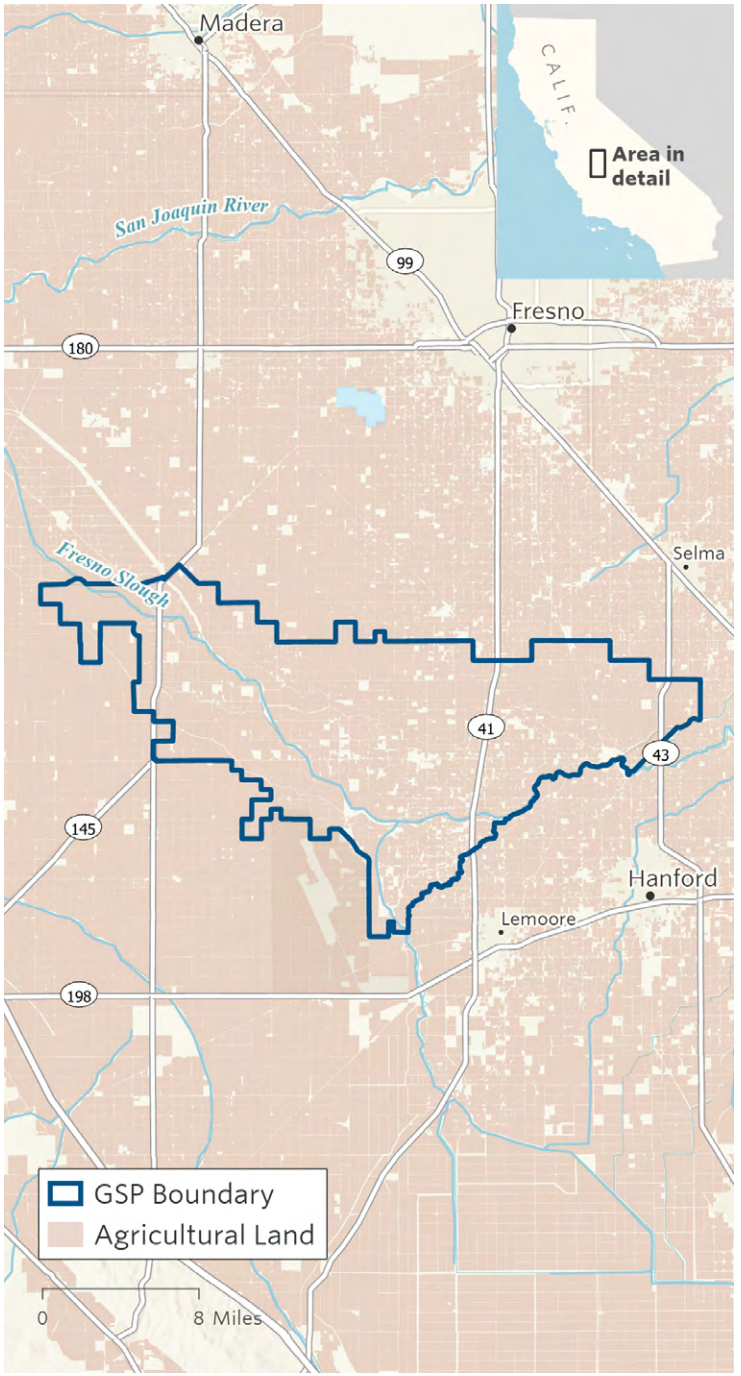
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	3	GDEs were removed on the basis of incorrectly applying a depth criterion to rooting depths of vegetation. GDE were erroneously removed in areas adjacent to irrigated fields. GDEs were rejected due to being surface water dependent without considering the shifting reliance of GDEs on both surface water and groundwater. GDEs located next to net-losing streams were erroneously rejected.
	Identification & Consideration of ISW	4	ISWs were mapped and depletions were estimated using model results.
	Environment Specified in Water Budget	5	Consumptive use is estimated for native vegetation.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	Groundwater level thresholds used by proxy to protect the Basin from undesirable results related to depletion of interconnected surface water does not protect the environment.
	Environmental Stakeholders	3	The GSA has engaged with environmental stakeholders throughout the plan review process.
	Projects & Management Actions	3	Future GDE monitoring is proposed, however environmental benefits of other projects are not fully described.
	Monitoring Network	4	The GSP develops a monitoring network that adequately characterizes GDEs and other environmental beneficial users of surface water and groundwater.
AVERAGE SCORE		**3.0**	**The GSP does not adequately protect GDEs and ISWs through Sustainable Management Criteria. Future monitoring proposes adequate characterization of GDEs.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

North Fork Kings

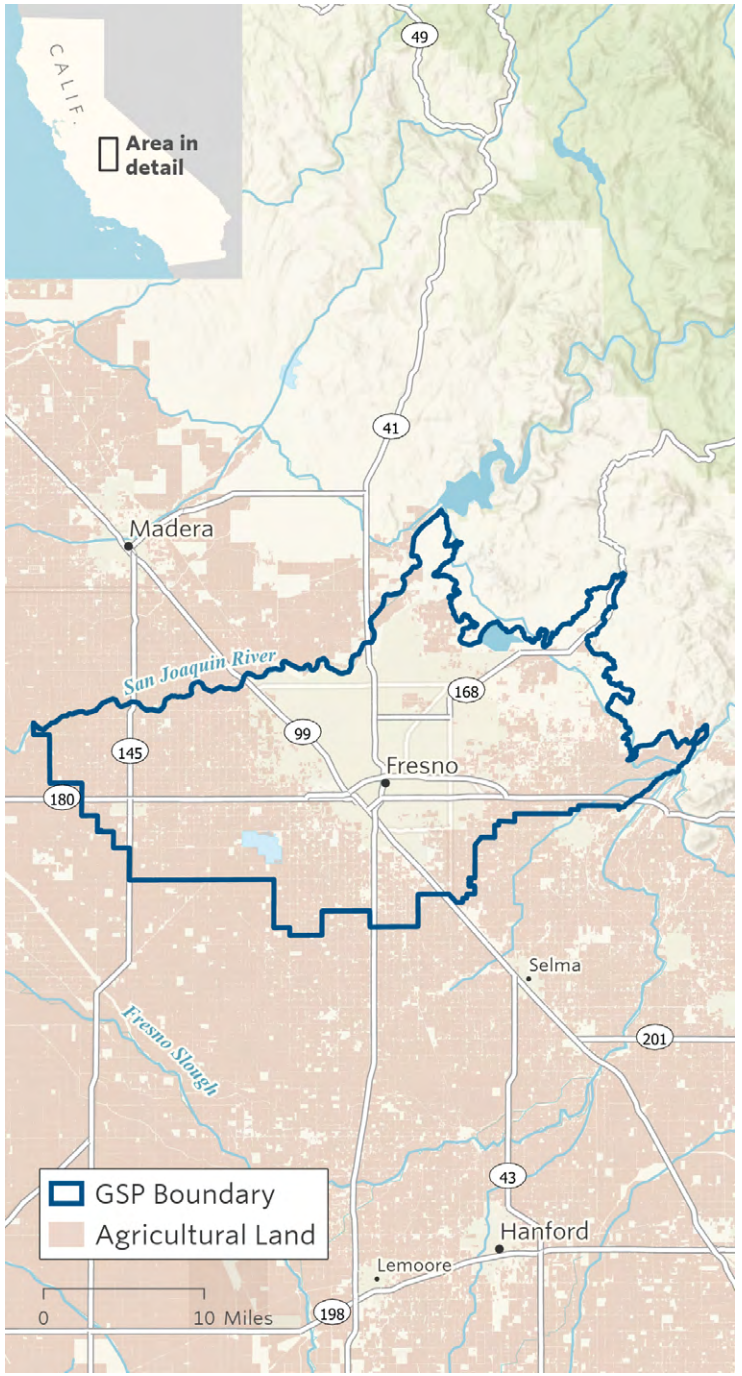
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	3	GDEs were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths. GDEs were rejected due to being surface water dependent without considering the shifting reliance of GDEs on both surface water and groundwater.
	Identification & Consideration of ISW	1	ISWs were incorrectly removed based on lack of continuous saturation between surface water and groundwater.
	Environment Specified in Water Budget	4	Consumptive use is estimated for riparian vegetation.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	Management criteria for ISWs were not developed because ISWs are incorrectly dismissed.
	Environmental Stakeholders	1	The GSP does not state how environmental stakeholders were engaged.
	Projects & Management Actions	2	Environmental benefits and/or multiple benefits are rarely included as criteria for assessing project priorities.
	Monitoring Network	2	Data gaps in the monitoring network are acknowledged but not filled by future monitoring plans.
AVERAGE SCORE		**1.9**	**The GSP does not adequately protect GDEs and ISWs through Sustainable Management Criteria or future monitoring.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

North Kings

Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	3	GDEs were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths.
	Identification & Consideration of ISW	2	ISWs were incorrectly removed based on characterization of losing streams as disconnected.
	Environment Specified in Water Budget	1	Water use by the environment is not acknowledged in GSP water budgets.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	Management criteria for ISWs were not developed because ISWs are incorrectly dismissed.
	Environmental Stakeholders	2	The GSP acknowledges environmental stakeholders but does not state how they were engaged.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	2	Data gaps in the monitoring network are acknowledged but not filled by future monitoring plans.
AVERAGE SCORE		**1.6**	**The GSP does not adequately protect GDEs and ISWs through Sustainable Management Criteria or future monitoring.**

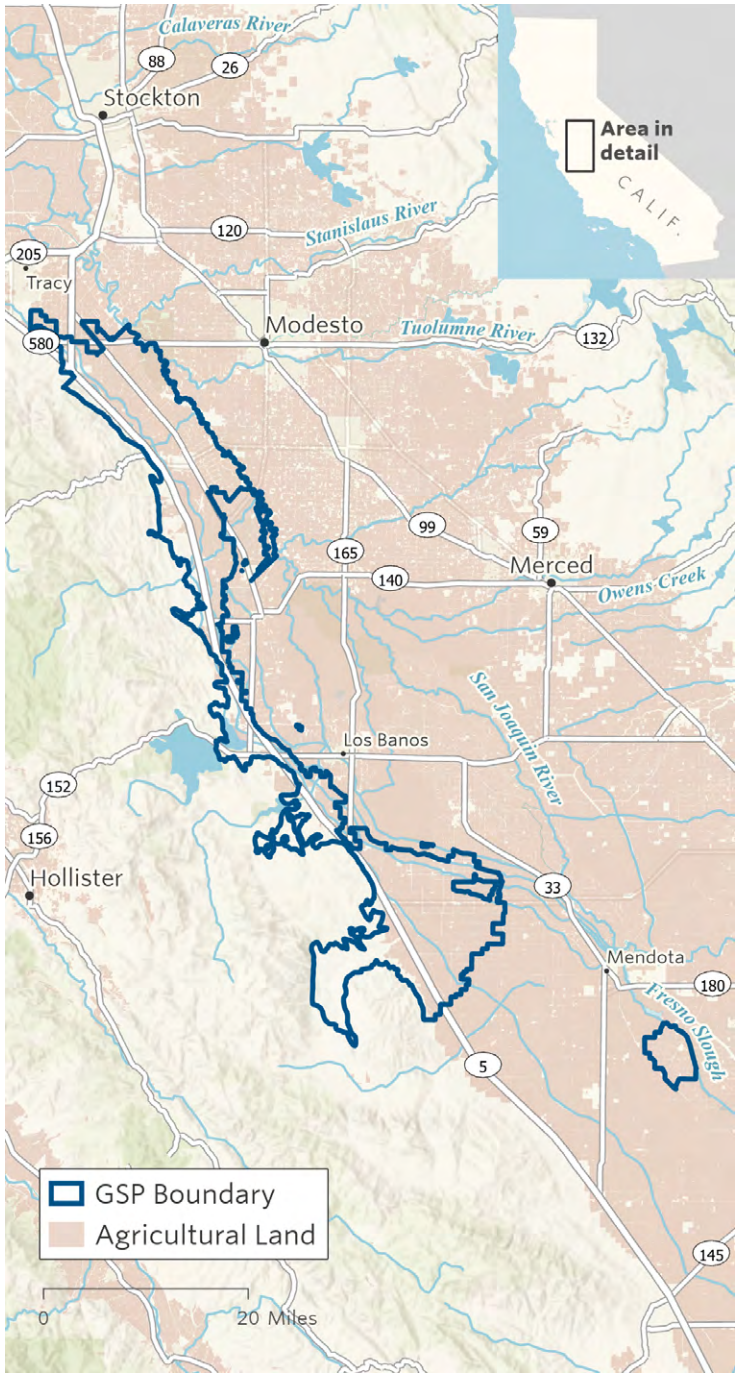


DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Northern and Central Delta–Mendota Region

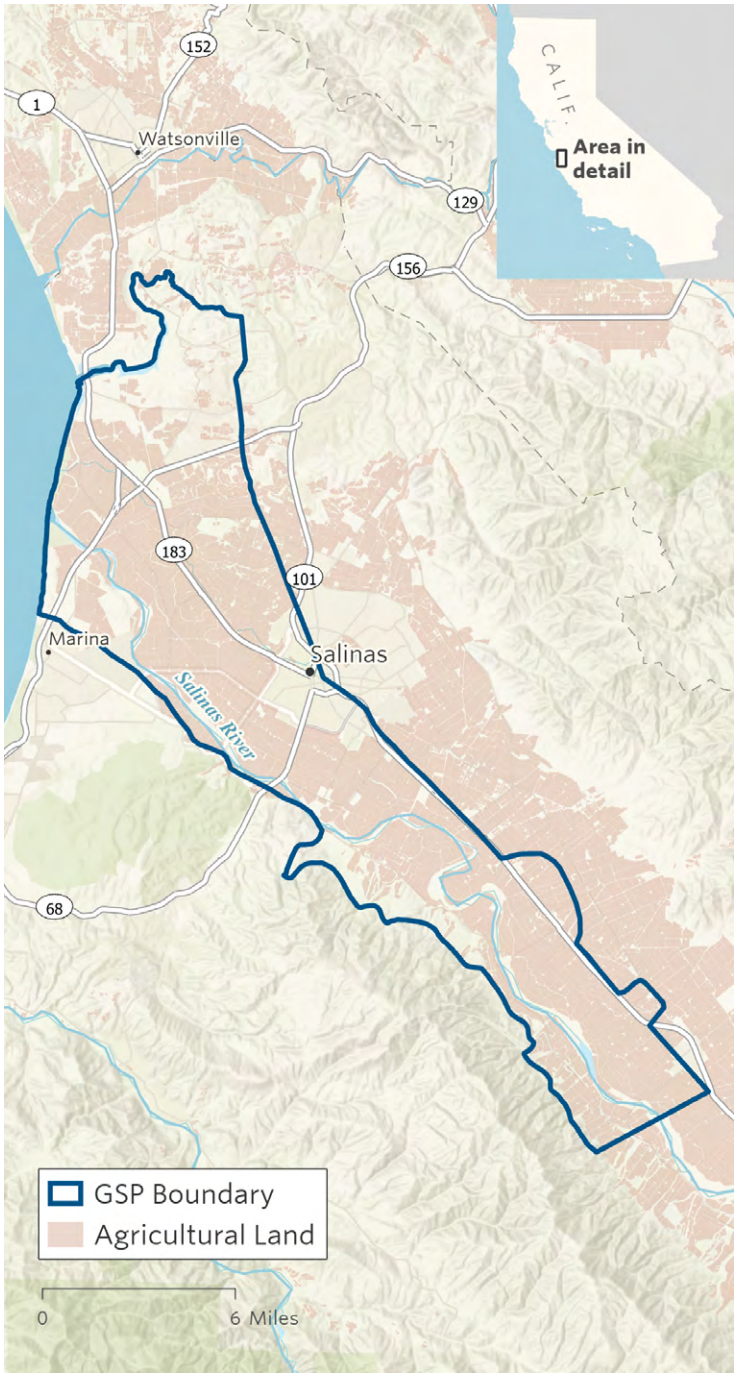
(Includes Central Delta-Mendota, City of Patterson, DM-II, Northwestern Delta-Mendota, Oro Loma Water District, Patterson Irrigation District, West Stanislaus Irrigation District, and Widren Water District)

Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	5	Wetland and vegetative GDEs were identified and mapped using The Nature Conservancy's data.
	Identification & Consideration of ISW	2	ISWs were identified but inappropriately dismissed because they are assumed to be ephemeral.
	Environment Specified in Water Budget	3	Consumptive use by the environment is combined with agricultural use.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	Management criteria were not developed for ISWs due to insufficient data.
	Environmental Stakeholders	3	Environmental stakeholders are represented in a technical advisory group.
	Projects & Management Actions	2	There are no projects defined to address GDEs and ISWs. The environment is included as non-quantified benefits for each of their identified project and management actions.
	Monitoring Network	2	ISWs are monitored where recognized. Data gaps in the monitoring network are acknowledged but not filled by future monitoring plans.
AVERAGE SCORE		**2.4**	**The GSP acknowledges ISWs for the SJR but not the west side drainages, which are assumed 100% ephemeral and disconnected. The GSP identifies GDEs and acknowledges data gaps but does not specify sustainable management criteria or have a plan to monitor.**



Salinas Valley Basin (180-400)

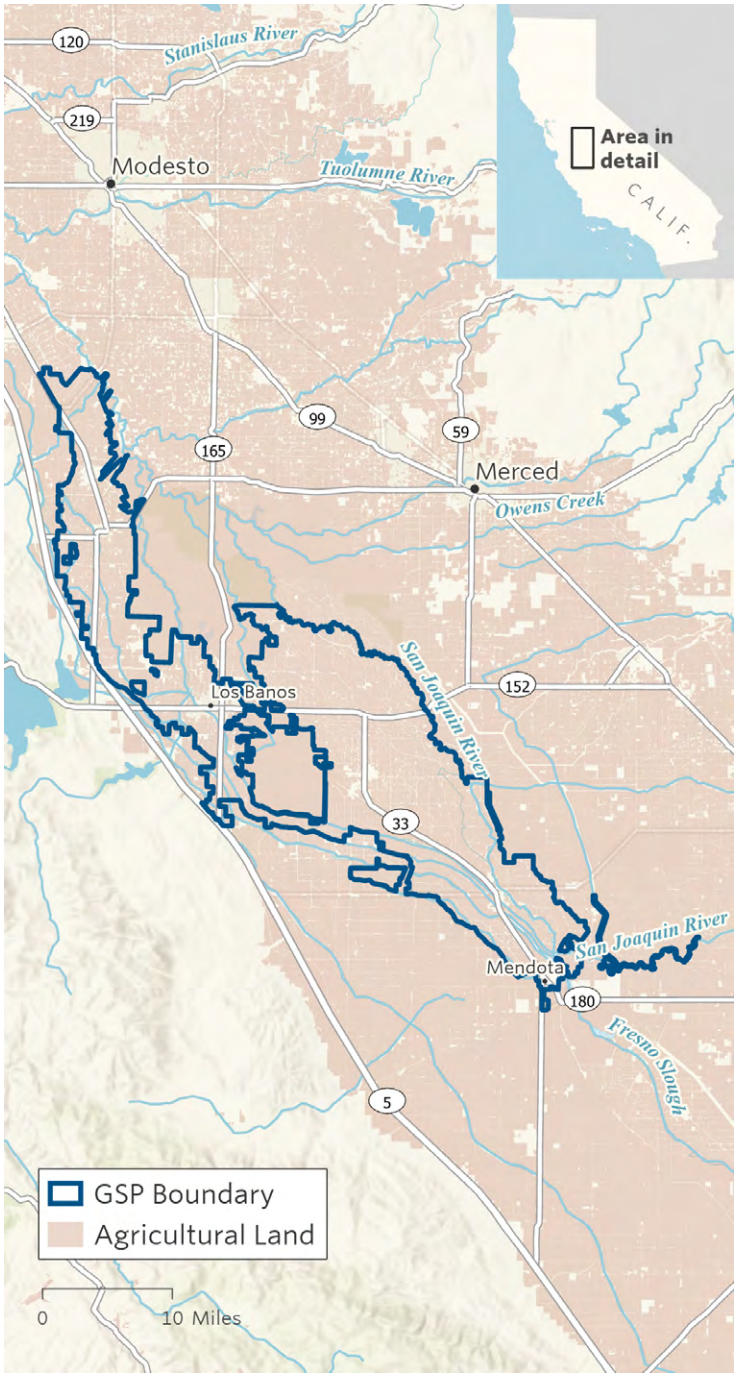
Metric	Sustainability Metric	Points (1-5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	2	GDEs were rejected based on a single depth to groundwater without considering seasonal and interannual groundwater fluctuations or rooting depths.
	Identification & Consideration of ISW	2	ISWs were inadequately analyzed based on the incorrect assertion that the shallow aquifer is not a principal aquifer.
	Environment Specified in Water Budget	1	Water use by the environment is not acknowledged in GSP water budgets.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	2	Management criteria for ISWs depend on model results that are updated on a 5-year cycle, thus lacking triggers to avoid undesirable results which leaves ecosystems vulnerable to decline.
	Environmental Stakeholders	5	The GSA has engaged with environmental stakeholders throughout the plan review process.
	Projects & Management Actions	2	Projects are proposed which have potential environmental benefits but these benefits are not described or elaborated upon.
	Monitoring Network	1	The proposed monitoring well network is inadequate to assess the potential effects of groundwater pumping and management on ISWs and GDEs.
AVERAGE SCORE		**2.0**	**The GSP does not adequately protect GDEs and ISWs through Sustainable Management Criteria or future monitoring.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

San Joaquin River Exchange Contractors Water Authority

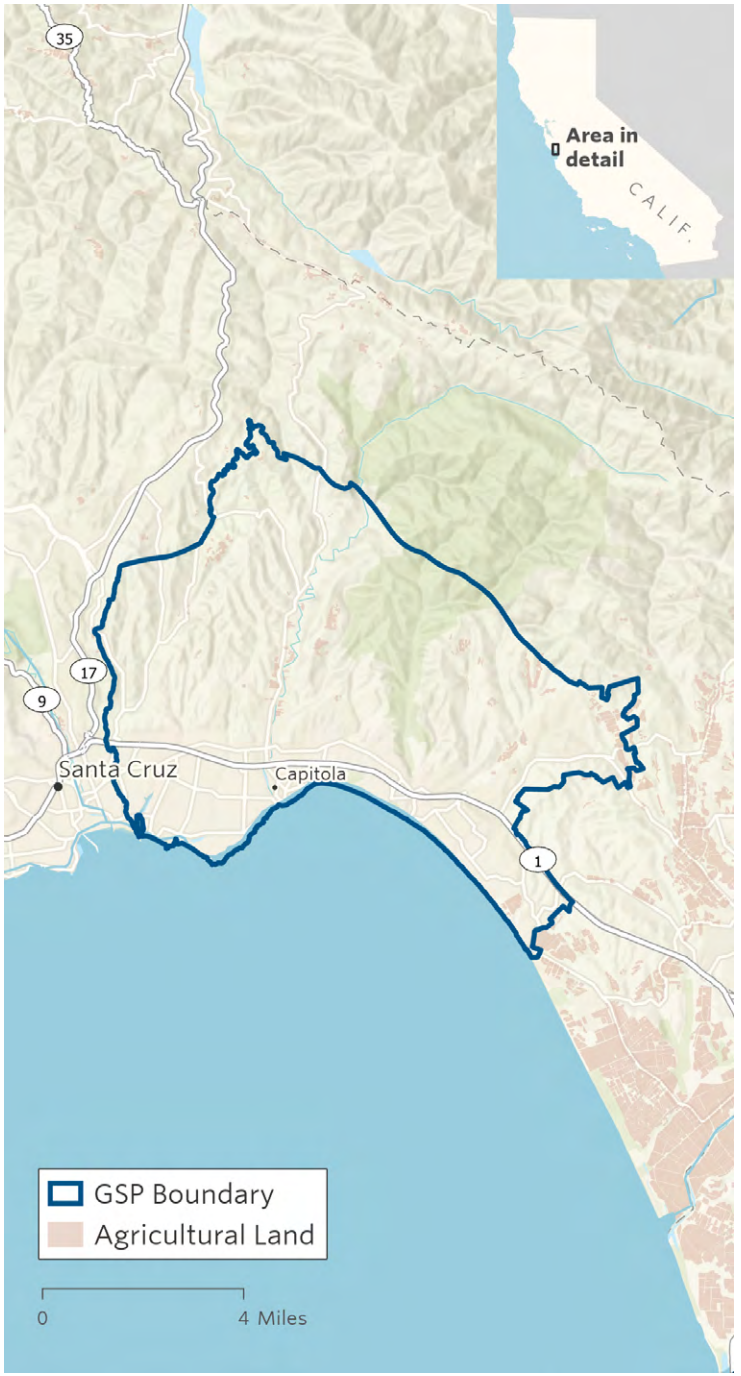
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	4	GDEs were rejected based on an unidentified 'deep water level' without considering seasonal and interannual groundwater fluctuations or rooting depths. GDEs were rejected due to being surface water dependent without considering the shifting reliance of GDEs on both surface water and groundwater.
	Identification & Consideration of ISW	3	Interconnected reaches were identified but no further analysis was conducted.
	Environment Specified in Water Budget	3	Consumptive use for phreatophytes is lumped under a miscellaneous category for evapotranspiration.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	2	Narrative management criteria for ISWs do not protect surface water areas.
	Environmental Stakeholders	3	The GSA has engaged with environmental stakeholders throughout the plan review process.
	Projects & Management Actions	3	Projects are proposed which have potential environmental benefits but these benefits are not described or elaborated upon.
	Monitoring Network	1	Data gaps in the monitoring network are not acknowledged.
AVERAGE SCORE		**2.5**	**The GSP does not adequately protect GDEs or ISWs through Sustainable Management Criteria or future monitoring.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Santa Cruz Mid-County

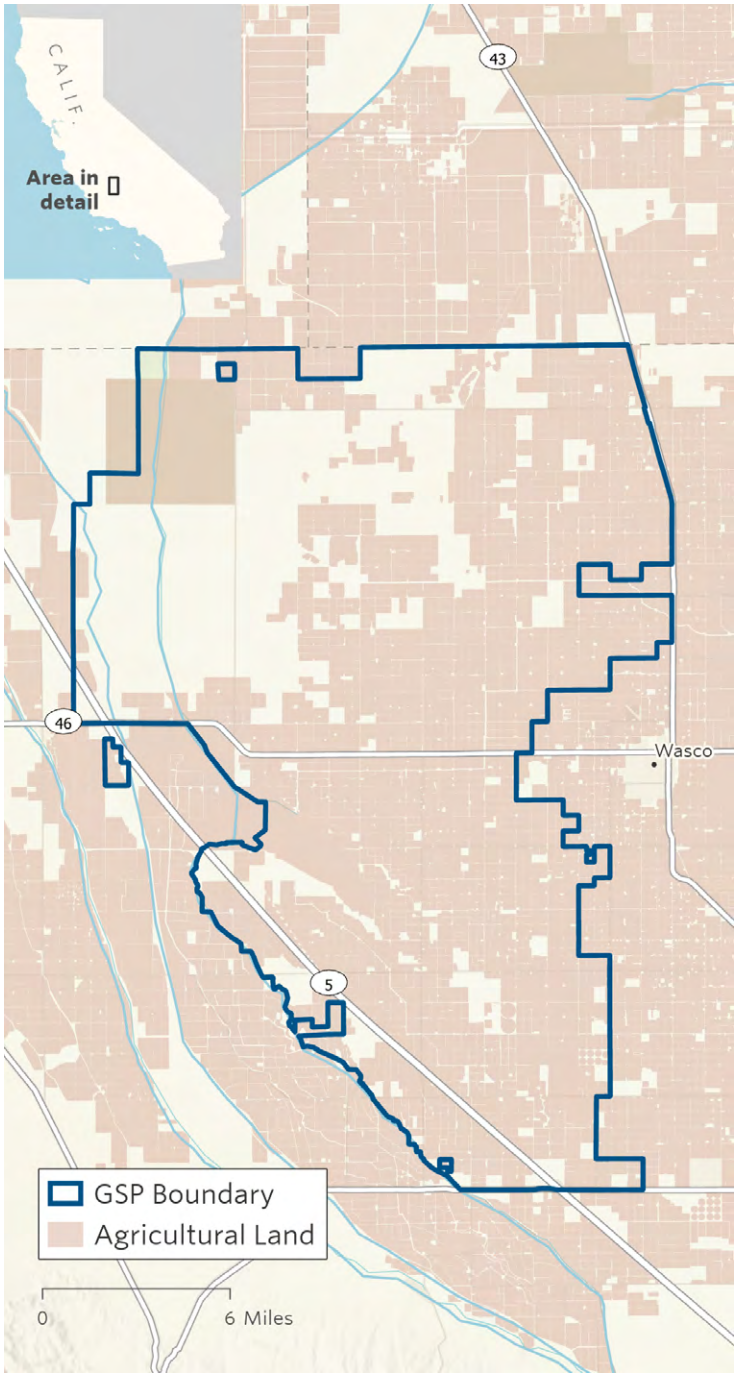
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	5	Wetland and vegetative GDEs were identified and mapped using TNC data.
	Identification & Consideration of ISW	4	ISWs were defined based on a surface water/ groundwater model of the basin.
	Environment Specified in Water Budget	3	Consumptive use by EBUs is combined with agricultural use.
	SG/SMCs for GDEs	3	Management criteria consider impacts to GDEs.
	SG/SMCs for ISW	2	The management criteria for ISWs use groundwater levels to consider impacts to surface water.
	Environmental Stakeholders	4	Environmental stakeholders are represented in a technical advisory group.
	Projects & Management Actions	2	Environmental benefits and/or multiple benefits are rarely included as criteria for assessing project priorities.
	Monitoring Network	3	ISWs are monitored and data gaps in the monitoring network are planned to be filled. Further monitoring of GDEs is needed.
AVERAGE SCORE		**3.3**	**The GSP adequately identifies GDEs and ISWs but the management criteria and monitoring are inadequate for determining impacts to nature.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Semitropic Water Storage District

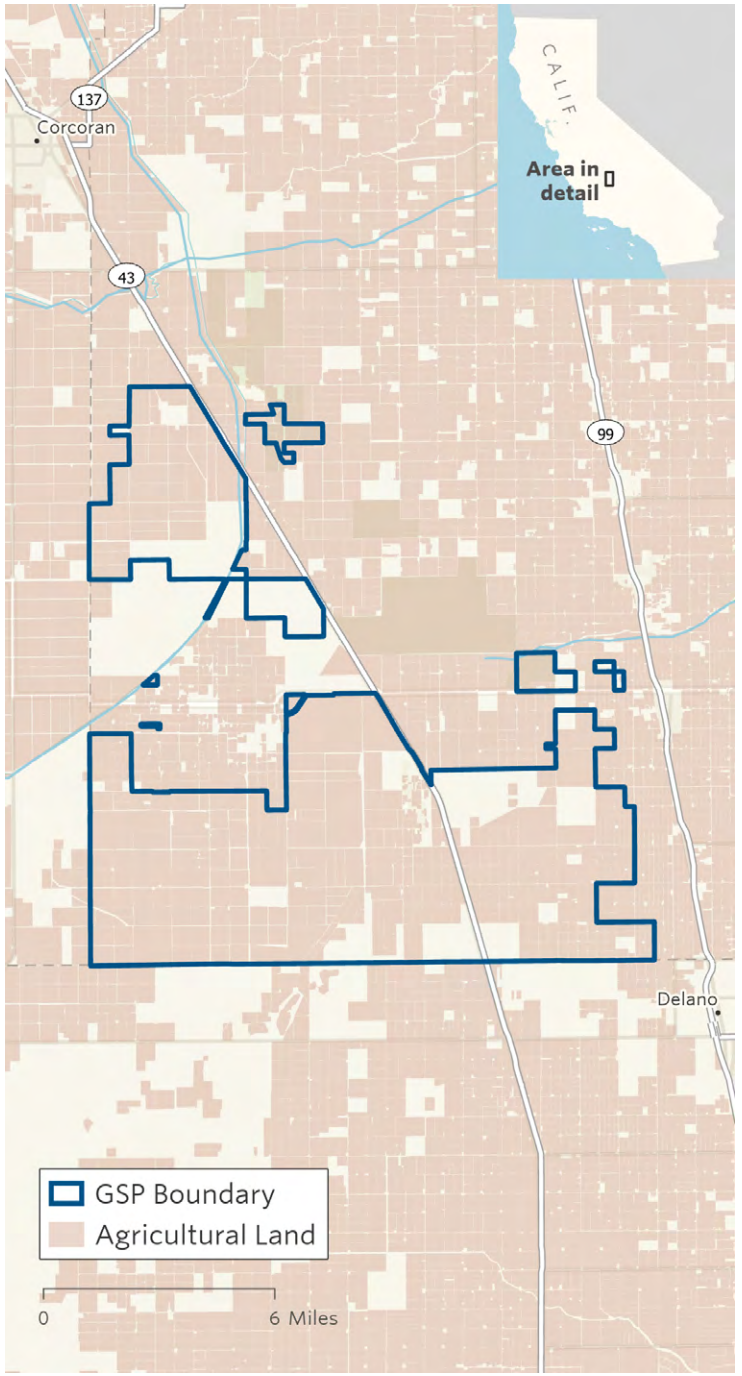
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	5	Wetland and vegetative GDEs were identified and mapped using The Nature Conservancy's data but not quantified.
	Identification & Consideration of ISW	2	ISWs were incorrectly removed based on lack of continuous saturation between surface water and groundwater.
	Environment Specified in Water Budget	1	Water use by the environment is not acknowledged in GSP water budgets.
	SG/SMCs for GDEs	3	The management criteria consider GDEs but there is no impact or threat expected.
	SG/SMCs for ISW	1	Management criteria for ISWs were not developed due to insufficient data.
	Environmental Stakeholders	2	The GSP acknowledges environmental stakeholders but does not state now they were engaged.
	Projects & Management Actions	4	Environmental benefits explicitly addressed in a management action.
	Monitoring Network	3	Data gaps in the monitoring network are acknowledged but not filled by future monitoring plans.
AVERAGE SCORE		2.6	**The GSP characterizes and considers impacts to GDEs but does not acknowledge the presence of ISWs or include Sustainable Management Criteria to protect ISWs.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Tri-County Water Authority

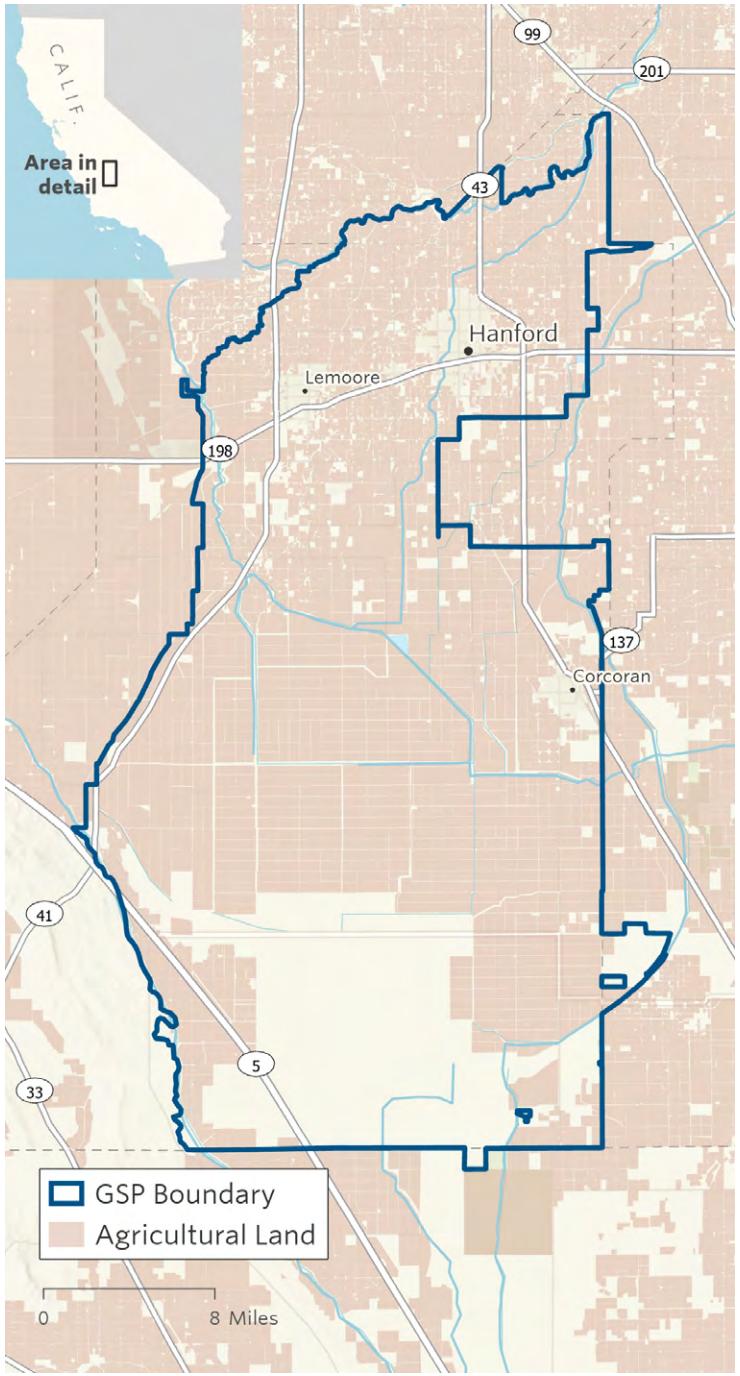
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	5	Wetland and vegetative GDEs were identified and mapped using The Nature Conservancy's data.
	Identification & Consideration of ISW	2	ISWs were incorrectly removed based on lack of continuous saturation between surface water and groundwater.
	Environment Specified in Water Budget	1	Water use by the environment is not acknowledged in GSP water budgets.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	Management criteria were not developed for ISWs due to insufficient data.
	Environmental Stakeholders	4	Environmental stakeholders are represented in the technical advisory group.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	2	Data gaps in the monitoring network are acknowledged for shallow groundwater, and planned to be filled. No similar effort is described for ISWs.
AVERAGE SCORE		2.1	**The GSP does not adequately protect GDEs and ISWs through Sustainable Management Criteria or future monitoring.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Tulare Lake Subbasin

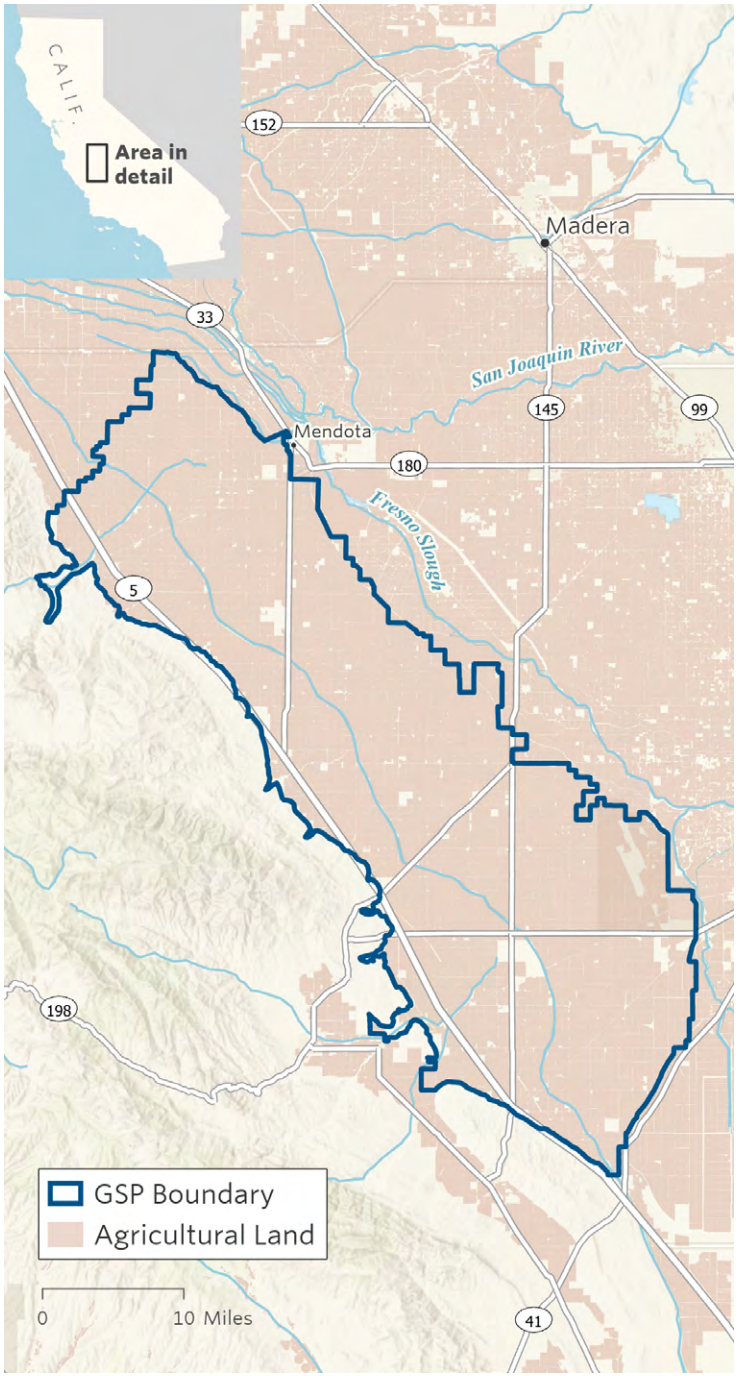
Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	1	They were rejected due to lack of interconnected surface waters. Data gaps were not acknowledged.
	Identification & Consideration of ISW	1	ISWs were not identified due to local development. Data gaps were acknowledged.
	Environment Specified in Water Budget	1	Consumptive use by the environment is combined with agricultural use.
	SG/SMCs for GDEs	1	Management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	The management criteria for ISWs do not consider impacts to the environment.
	Environmental Stakeholders	1	Environmental stakeholders are not identified in the GSP.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
AVERAGE SCORE		1.0	**The GSP is inadequate in addressing environmental needs and in meeting the ecosystem objectives of SGMA.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Westlands Water District

Metric	Sustainability Metric	Points (1–5)	Evaluation of Sustainability Metric
	Identification & Consideration of GDEs	1	Wetland and vegetative GDEs were identified and mapped using The Nature Conservancy's data but not quantified.
	Identification & Consideration of ISW	1	ISWs were identified but not quantified. Data gaps were acknowledged.
	Environment Specified in Water Budget	3	Consumptive use by the environment is combined with agricultural use.
	SG/SMCs for GDEs	1	The management criteria do not consider impacts to GDEs.
	SG/SMCs for ISW	1	Management criteria for ISWs were not developed because ISWs are incorrectly dismissed.
	Environmental Stakeholders	1	Environmental stakeholders are not identified in the GSP.
	Projects & Management Actions	1	Environmental benefits and/or multiple benefits are not included as criteria for assessing project priorities.
	Monitoring Network	1	The environment was not identified and addressed by the monitoring network.
AVERAGE SCORE		1.3	**The GSP used the The Nature Conservancy's guidance to identify GDEs but provides nothing beyond identification. ISWs are acknowledged as potential and that there is a data gap understanding them but there is no explicitly plan to monitor or confirm their existence.**



DATA SOURCES: GSP Boundaries - DWR, Highways - Caltrans, Rivers - NHD, Basemap - Esri

Conclusion

ACCOUNTING FOR NATURE

Examples from Grassland GSA and Fox Canyon Groundwater Management Agency demonstrate best practices for accounting for nature's needs in GSPs.

Mapping and Identifying Impacts to Groundwater Dependent Ecosystems (GDEs): Grassland GSA conducted a thoughtful characterization of Wetland GDEs and Vegetative GDEs in the GSA area. The agency used DWR's NC Dataset Viewer to develop GDE maps and a wetland delineation dataset from Ducks Unlimited to further refine the maps. The Grassland GSP provides additional description of the types and extent of managed and natural wetlands, upland GDEs, and acreages of different types of GDEs. The GSA took time to fully characterize and describe the impacts of the GSP to GDEs and to recognize the role of groundwater in the preservation of habitat and ecosystems in the largest remaining wetland in the United States.

Engaging Environmental Stakeholders and Setting Sustainable Management Criteria: In Fox Canyon, the GSA included an environmental representative on its Technical Advisory Group (TAG) from beginning of GSP development. Having representation for the environment allowed for a deep engagement in the GSP process. A TAG subcommittee was able to directly support the Fox Canyon Groundwater Management Agency (FCGMA) in identifying and evaluating GDEs in the subbasin. The impact of the TAG group extends beyond the Fox Canyon GSP because their efforts helped to develop a GDE guidance document that is now being used by dozens of GSAs across the state. In addition, the TAG convened a workshop to discuss GDEs and solicit input from the public. The Fox Canyon – Oxnard Basin GSP also includes and considers environmental uses of groundwater within its management criteria.

The GSPs submitted in 2020 provide an important first step in defining and charting a path toward sustainable groundwater management locally and statewide. To be truly sustainable, planning and management actions must consider all groundwater users, including nature. This report presents a summary of TNC's evaluation of how well 30 GSPs account for nature's needs in critically overdrafted subbasins across the state. The good news is that there are some positive examples of GSPs that sufficiently address nature's needs from Grassland GSA and Fox Canyon Groundwater Management Agency.

For most GSAs, achieving groundwater sustainability and fully accounting for nature's needs in their Plans will be a work in progress. Our review of Plans finds that there is room for improvement in nearly all GSPs. To encourage GSAs to incorporate nature's needs into GSPs, TNC provided comments on draft and final Plans to these 30 GSAs and the Department of Water Resources. TNC also offers tools, case studies, and resources that can help GSAs better account for nature as they respond to feedback on their plans from the Department of Water Resources and prepare their five-year update.

The metrics and scores highlight gaps in GSPs regionally and at the GSA level. These gaps leave nature vulnerable to not having its needs met and could potentially lead to the loss of some of the few remaining groundwater dependent ecosystems. It is our hope that these scores are a starting point and, with time and support, GSAs will build their capacity to better engage environmental stakeholders and incorporate nature into their Plans and management actions.

Supporting Regulations

Metric		Regulation(s)	
1		Requirement to map and identify Groundwater Dependent Ecosystems in Groundwater Sustainability Plans	• 23 CCR § 354.16(g) – Each plan shall provide a description of current and historic groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes [...] identification of GDEs within the basin, utilizing data available from the Department, as specified in Section 353.2, or the best available information. • Water Code § 10727.4A – GSP shall include, where appropriate and in collaboration with the appropriate local agencies, all of the following: [...] impacts on GDEs.
2		Requirement to map and identify Interconnected Surface Waters in Groundwater Sustainability Plans	• 23 CCR §354.28(c)(6) – Depletions of Interconnected Surface Water. The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results. • Water Code § 10723.2(e) – The GSA shall consider the interests of all beneficial uses and users of groundwater as well as those responsible for implementing GSPs. These interests include, but are not limited to, [...] environmental users of groundwater.
3		Requirement to include the water use of nature (groundwater dependent ecosystems, interconnected surface waters, native vegetation, managed wetlands, etc.) in the water budget of the Groundwater Sustainability Plan	• GDEs commonly fall within the GSP Regulations definition of "Water use sectors." *§ 351(al) "Water use sector" refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation."* Native vegetation that depends on groundwater is commonly a major component of GDEs. • 23 CCR § 354.18(b)(1) The water budget shall quantify the following, either through direct measurements or estimates based on data, [...] total surface water entering and leaving a basin by water source type. • 23 CCR § 354.18(c) Each Plan shall quantify the current, historical, and projected water budget for the basin.
4		Requirement to describe potential impacts to groundwater dependent ecosystems and environmental beneficial users in the description of undesirable results	• 23 CCR § 354.26(b)(3) The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.
5		Requirement for sustainability management criteria to include potential impacts to all environmental beneficial users, including impacts to surface users via impacts to interconnected surface waters	• 23 CCR § 354.26(a)[...] Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.
6		Requirement to include the interests of all beneficial users of groundwater and incorporate public feedback on Groundwater Sustainability Plans	• Water Code 10723.2 GSAs must consider interests of all beneficial uses and users of groundwater. These interests include, but are not limited to [...] environmental users. • 23 CCR §355.4(b)(10) The GSA must "adequately respond to comments that raise credible technical or policy issues with the Plan."
7		Requirement to describe projects and management actions, the benefits that they will provide, and how benefits will be evaluated	• 23 CCR § 354.44(b)(5) Each plan shall include a description of the projects and management actions that include [...] an explanation of the benefits that are expected to be realized from the project or management action and how those benefits will be evaluated. • 23 CCR § 354.44(a) Each plan shall include a description of the projects and management actions the GSA has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.
8		Requirement to include monitoring of trends in groundwater conditions and impacts to all beneficial users, including the environment	• 23 CCR §354.34 (a) and (b)) "[...] monitoring must address trends in groundwater and related surface conditions." This includes "the tools and methods necessary to calculate depletions" and "[o]ther factors that may be necessary to identify adverse impacts on beneficial uses of the surface water," including impacts to GDEs. • 23 CCR § 354.34(f)(3) The GSA shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon [...] impacts to beneficial uses and users of groundwater and land uses, property interest affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal.

Table of Scores

Groundwater Sustainability Plan	Metric 1	Metric 2	Metric 3	Metric 4	Metric 5	Metric 6	Metric 7	Metric 8	Score (1–5)
Central Kings	4	1	1	1	1	1	1	2	1.5
Chowchilla Subbasin	3	1	5	4	1	3	3	3	2.9
Cuyama	3	5	5	1	2	2	1	2	2.6
Eastern San Joaquin	3	3	5	2	1	4	1	3	2.8
Fox Canyon–Los Posas	4	3	4	1	1	4	5	1	2.9
Fox Canyon–Oxnard	5	5	5	4	4	4	1	4	4.0
Fox Canyon–Pleasant Valley	5	5	5	5	5	4	5	5	4.9
Fresno County (Management Areas A & B)	5	4	4	3	3	4	1	2	3.3
Grasslands	5	3	5	4	5	5	5	3	4.4
Greater Kaweah	1	1	4	1	1	4	1	2	1.9
Indian Wells	5	1	4	1	1	2	1	2	2.1
Joint GSA: SLO County, Paso Robles, San Miguel CSD, Shandon–San Juan	5	1	4	2	1	1	1	3	2.3
Kern Groundwater Authority	1	2	1	1	1	2	1	1	1.3
Kings River East	4	3	1	1	1	1	1	1	1.6
Lower Tule River Irrigation District	1	1	3	1	1	3	1	3	1.8
Madera Subbasin	3	1	5	4	1	3	3	3	2.9
McMullin	1	1	1	1	1	2	1	1	1.1
Merced	3	4	1	1	1	3	4	1	2.3
Mid-Kaweah Joint Powers Authority	1	N/A	4	1	N/A	4	3	1	2.3
North and South Yuba	3	4	5	1	1	3	3	4	3.0
North Fork Kings	3	1	4	1	1	1	2	2	1.9
North Kings	3	2	1	1	1	2	1	2	1.6
Northern and Central Delta-Mendota Region	5	2	3	1	1	3	2	2	2.4
Salinas Valley Basin (180–400)	2	2	1	1	2	5	2	1	2.0
San Joaquin River Exchange Contractors Water Authority	4	3	3	1	2	3	3	1	2.5
Santa Cruz Mid-County	5	4	3	3	2	4	2	3	3.3
Semitropic Water Storage District	5	2	1	3	1	2	4	3	2.6
Tri-County Water Authority	5	2	1	1	1	4	1	2	2.1
Tulare Lake Subbasin	1	1	1	1	1	1	1	1	1.0
Westlands Water District	1	1	3	1	1	1	1	1	1.3
AVERAGE SCORE BY METRIC (OUT OF 5 POINTS)	**3.3**	**2.4**	**3.1**	**1.8**	**1.6**	**2.8**	**2.1**	**2.2**	**2.4**