EXECUTIVE SUMMARY

ES.1. Introduction

On 16 September 2014, the California legislature enacted the Sustainable Groundwater Management Act (SGMA) for the primary purpose of achieving and maintaining sustainability within the State's high and medium priority groundwater basins. Key tenets of SGMA are preservation of local control, use of best available data and science, and active engagement and consideration of all beneficial uses and users of groundwater. SGMA requires local agencies to form Groundwater Sustainability Agencies (GSAs) tasked with managing basins sustainably through the development and implementation of Groundwater Sustainability Plans (GSPs). Under SGMA, GSPs must contain certain elements, the most significant of which include: a Sustainability Goal; a description of the area covered by the GSP (i.e., the "Plan Area"); a description of the Basin Setting, including the hydrogeologic conceptual model (HCM), historical and current groundwater conditions, and a water budget; locally-defined Sustainable Management Criteria (SMCs); monitoring networks and protocols for each applicable sustainability indicator; and a description of projects and/or management actions (P/MAs) that will be implemented to achieve or maintain sustainability. SGMA also requires active stakeholder outreach to ensure that all beneficial uses and users of groundwater have the opportunity to provide input into the GSP development and implementation process.

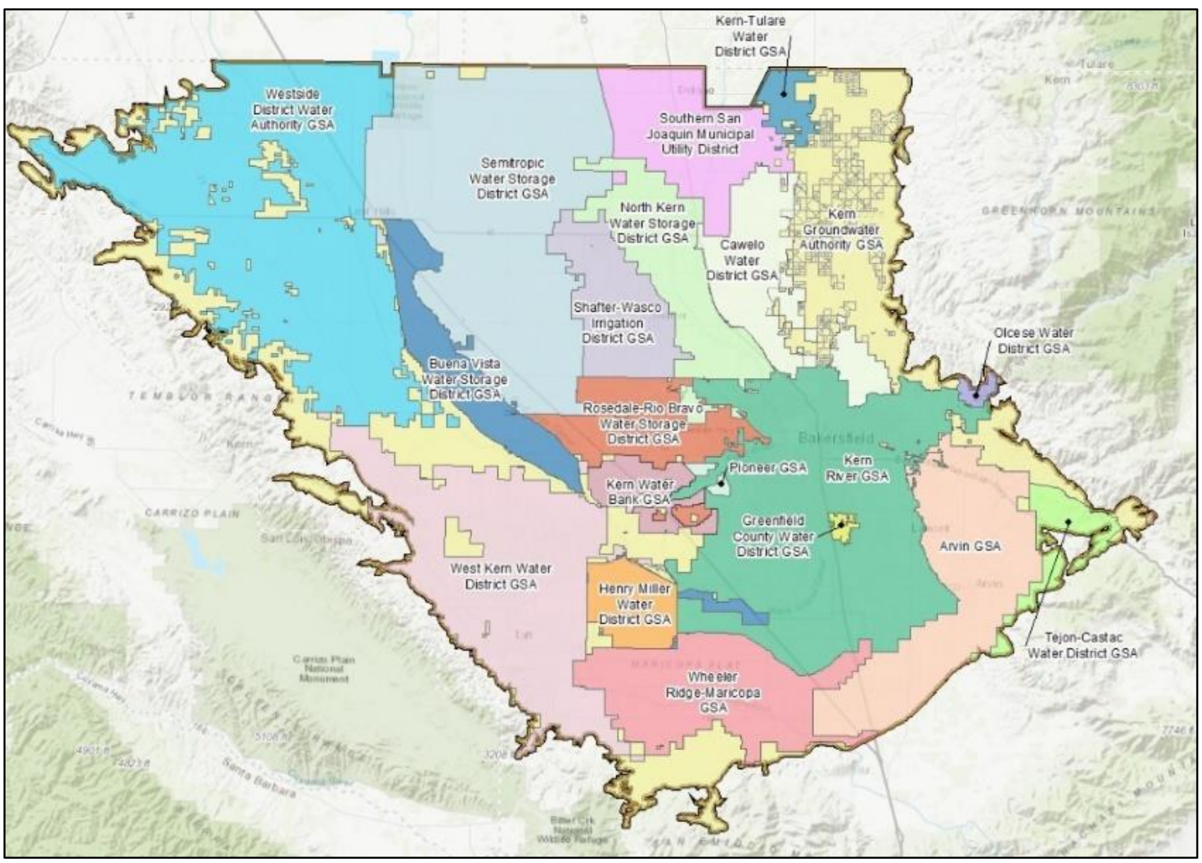


Figure ES-1. Kern County Subbasin GSAs

The Kern County Subbasin of the San Joaquin Valley Groundwater Basin[1] (referred to herein as the “Kern Subbasin” or “Subbasin”; Figure ES-1) is one of 21 basins and subbasins identified by the California Department of Water Resources (DWR) as being critically overdrafted. This designation triggered an accelerated timeline for GSP development by 2020 and long-term sustainability by 2040.

Intra-Basin Coordination
Subbasin GSAs have implemented intra-basin coordination activities, including greater engagement regarding the development, planning, financing, environmental review, permitting, implementation, and long-term monitoring of GSP activities.

Technical Working Group (TWG)
In May 2023, the Subbasin GSAs assembled the TWG to produce Subbasin-wide technical solutions to address DWR deficiencies. The TWG meets weekly to discuss work products and to develop technical recommendations.

In compliance with this timeline, the Subbasin GSAs submitted five GSPs (collectively the “Plan”) to DWR in January 2020 (2020 GSPs). DWR designated the Plan as “incomplete” in January 2022 and identified three main deficiencies with the Subbasin Plan. In July 2022, the GSAs amended and resubmitted six GSPs to DWR to address the identified deficiencies (2022 GSPs). In March 2023, DWR designated the Plan as “inadequate” after reviewing the 2022 GSPs. As a result, the Subbasin is subject to the state intervention process defined in SGMA regulations and under California Water Code (CWC) § 10735 *et seq*. The first formal step of the state intervention process would be a public hearing convened by the State Water Resources Control Board (SWRCB) to consider designating the Subbasin as probationary based on any specific deficiencies in its Plan that remain unresolved at the time of hearing.

In response to the DWR determination, the 20 Subbasin GSAs worked together to develop amendments to the 2022 GSPs and accompanying Coordination Agreement, resulting in this “Amended Subbasin Plan”, which has been designed to meet the SGMA regulatory requirements, respond to the three deficiencies identified by DWR, address comments provided by SWRCB staff during technical meetings, and increase coordination among the Subbasin GSAs, other local agencies, and stakeholders.[2] The Amended Subbasin Plan provides a clear and coordinated path to achieve sustainable groundwater management.

Revisions made in response to DWR’s Corrective Actions are highlighted throughout the Executive Summary using icons specific to each deficiency and are further detailed in the “crosswalk” Table 1-3 in Section 1 and the relevant sections of the Amended Subbasin Plan.

Deficiency #1: The GSPs do not establish Undesirable Results (URs) that are consistent for the entire Subbasin.

[1] Kern County Subbasin (DWR No. 5-022.14) located within San Joaquin Valley Groundwater Basin (DWR No. 5-022).

[2] The Amended Subbasin Plan is being submitted as multiple plans with a Coordination Agreement. The Kern Subbasin GSP is being adopted by fourteen (14) GSAs, which collectively manage the majority of the Subbasin (67.6 percent). Six (6) GSAs are each separately adopting a version of the Kern Subbasin GSP that includes supplemental information specific to the portion of the Subbasin it manages. This supplemental information is provided on blue pages so differences between the versions can be readily identified by reviewers.

Deficiency #2: The Subbasin's Chronic Lowering of Groundwater Levels Sustainable Management Criteria (SMCs) do not satisfy the requirements of SGMA and the GSP Regulations.

Deficiency #3: The Subbasin's Land Subsidence SMCs do not satisfy the requirements of SGMA and the GSP Regulations.

In addition to revisions that were made to address the DWR Corrective Actions, the GSAs updated this Amended Subbasin Plan to incorporate current data and information and made revisions that address feedback received during the nine technical meetings with SWRCB staff or other comments in DWR's determination letter. These revisions are noted in this Executive Summary using the icon shown below and are further detailed in the "crosswalk" Table 1-2 in Section 1 and the relevant sections of the Amended Subbasin Plan.

Additional Revision: Revision to incorporate new data or information or respond to DWR and SWRCB comments that were not identified as Corrective Actions.

ES.2. Sustainability Goal

The Subbasin GSAs share a common groundwater management Sustainability Goal for the Subbasin, which is foundational to the development and implementation of the Amended Subbasin Plan. The sustainability goal for the Kern County Subbasin is to implement the Amended Subbasin Plan to achieve sustainable groundwater management within the 20-year implementation schedule. Achieving the sustainability goal will be demonstrated by eliminating chronic lowering of groundwater levels caused by overdraft conditions and avoiding Undesirable Results for groundwater levels, groundwater storage, land subsidence, and groundwater quality. This goal will be accomplished through the following objectives:

- Implement the Subbasin Community Engagement Plan.
- Eliminate long-term groundwater overdraft and attain sustainability through conjunctive use, water banking, and demand management programs.
- Continuously monitor and evaluate groundwater conditions to avoid undesirable results.
- Maintain long-term sustainability of water resources available to the Subbasin.
- Maintain a comprehensive database of beneficial uses and users to inform on the efficacy of groundwater management policies and programs.

ES.3. Agency Information

The Amended Subbasin Plan has been prepared by 20 GSAs and one coordinated groundwater management area. Each GSA applied for and was granted exclusive GSA status for a portion of the Subbasin under CWC §10723(c) and §10723.8. The Coordination Agreement establishes the governance structure for the GSAs' cooperative and coordinated exercise of authorities and responsibilities under SGMA. Each GSA has designated representative(s) to help lead or participate in coordination activities among Subbasin GSAs, State agencies, local governments, local water suppliers, neighboring entities, non-governmental organizations, and other stakeholders. Pursuant to 23 CCR §357.4(b)(1), a single Subbasin "Plan Manager" (Point of Contact) has been established as shown in Table ES-1, for the purposes of organizing the various coordination and Technical Working Group (TWG) activities and ensuring cohesion between GSA activities.

Table ES-1. Plan Manager Contact Information

Plan Manager	E-mail	Phone
Kristin Pittack	kpittack@rinconconsultants.com	559-228-9925 (O) 760-223-5062 (C)

ES.4. GSP Organization

The Amended Subbasin Plan details and consolidates the GSAs' plans for achieving long-term sustainability in the Subbasin. The Amended Subbasin Plan also addresses DWR's inadequate determination and feedback provided by the SWRCB staff. It follows the organizational structure required under the GSP regulations, including Introduction (Section 1), Sustainability Goal (Sections 2 and 12), Agency Information (Section 3), GSP Organization (Section 4), Description of Plan Area (Section 5), Basin Setting (Sections 6 through 9), Management Areas (Section 10), Sustainable Management Criteria (Sections 11 through 13), Projects and Management Actions (Section 14), Monitoring Networks (Section 15), and Plan Implementation (Section 16). Several figures, tables, and sources are provided which outline the GSAs' analyses and review that was used to formulate the implementation actions and the planned P/MAs to achieve the Sustainability Goal.

ES.5. Plan Area

The 1.78-million-acre Subbasin covers a large portion of the southern end of the Tulare Lake Hydrologic Region, including most of the San Joaquin Valley area within Kern County. As shown on Figure ES-2**,** the Subbasin neighbors four separate and distinct groundwater subbasins: (1) the Tulare Lake Subbasin (DWR 5-022.12), (2) the Tule Subbasin (DWR 5-022-13), (3) the Kettleman Plain Subbasin (DWR 5-022.17), and (4) the White Wolf Subbasin (DWR 5-022.18), all also located within the San Joaquin Valley Groundwater Basin. The Tulare Lake and Tule subbasins are similarly categorized as "high priority" and "critically overdrafted" by DWR. The adjacent Tulare Lake, Tule, and White Wolf subbasins are each managed according to separate GSPs and SGMA-related activities but the Subbasin GSAs have consulted with

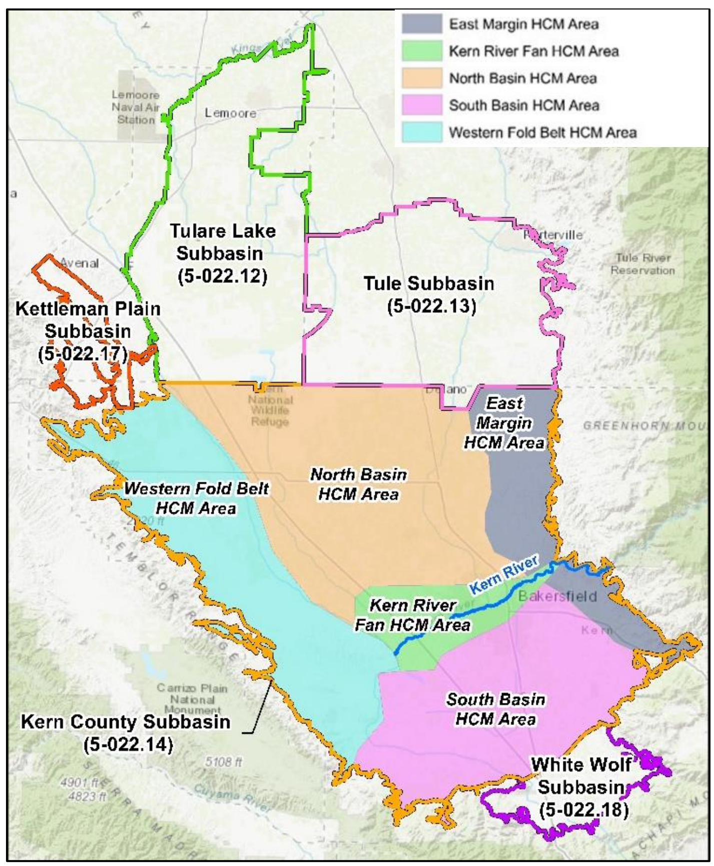


Figure ES-2. HCM Areas and Adjacent Subbasins

these subbasins to coordinate cross-boundary interactions (e.g., accounting for groundwater subsurface inflows and outflows and evaluating consistency of SMCs).

For purposes of this Amended Subbasin Plan, the Subbasin has been separated into five HCM areas that are characterized by specific geologic and hydrogeologic attributes that dictate land and water uses in the area. The HCM areas include the Western Fold Belt, East Margin, Kern River Fan, North Basin (North of Kern River Fan), and South Basin (South of Kern River Fan), as shown on Figure ES-2.

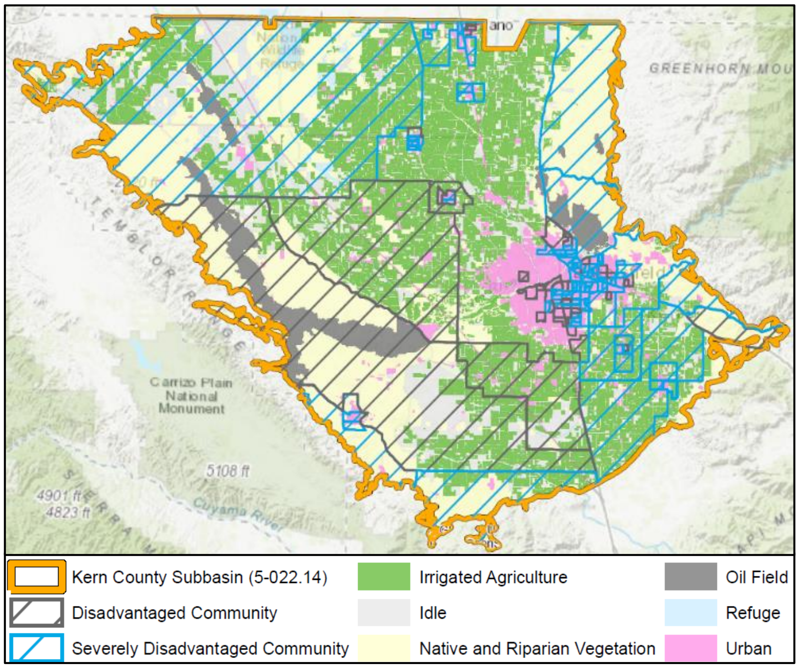


Figure ES- 3. Land Use and Disadvantaged Communities

As shown on Figure ES- 3, the 1.78 million acres of land within the Subbasin (the "Plan Area") are predominately irrigated agriculture, including a diverse array of crop types dictated largely by the economics of private farming and water supply availability. Actively cropped agricultural lands encompass around 644,000 acres of the Subbasin, or approximately 36 percent of the total area. Roughly 15 percent of the Plan Area includes idle agricultural lands not actively irrigated (256,000 acres), another eight percent includes urban, suburban, and rural communities (81,000 acres), five percent of lands are industrial oil fields (159,000 acres), and the remaining 36 percent of land uses include native and riparian vegetation, refuge, recharge basins, and other land uses. Water demands are met with diversions from the Kern River and other local creeks, imported surface water from the State Water Project (SWP) and Central Valley Project (CVP), groundwater, and in more recent years, recycled water.

The Subbasin is completely contained within Kern County and includes eight incorporated cities (Arvin, Bakersfield, Delano, Maricopa, McFarland, Shafter, Taft, and Wasco) as well as numerous unincorporated communities (census designated places), including: Buttonwillow, Cherokee Strip, Derby Acres, Dustin Acres, Edison, Edmundson Acres, Famoso, Fellows, Ford City, Fuller Acres, Greenacres, Greenfield, Lamont, Lost Hills, McKittrick, Mettler, Mexican Colony, Oildale, Rosedale, Smith Corner, South Taft, Taft Heights, Tupman, Valley Acres, and Weedpatch, as shown on Figure 5-8 in Section 5.

Disadvantaged communities (DACs) or severely disadvantaged communities (SDACs) identified based on the median household income (MHI) of the area compared to the statewide MHI, cover approximately 1.445 million acres, or 81 percent of the Subbasin.

ES.6. Basin Setting - Hydrogeologic Conceptual Model

Situated within the topographic horseshoe that is bordered on the east and southeast by the Sierra Nevada, on the west by the Southern Coast Ranges, and on the south by the San Emigdio and Tehachapi Mountains, the Subbasin is large and geologically complex with regional faulting, folding, and three principal aquifers.

The three principal aquifers within the Subbasin include the Primary Alluvial Principal Aquifer, the Santa Margarita Principal Aquifer, and the Olcese Principal Aquifer. The Primary Alluvial Principal Aquifer extends over most of the Subbasin and consists of the Tulare and Kern River Formations plus the overlying recent alluvium. It exhibits varying groundwater conditions and is classified as confined in areas with laterally extensive clay aquitards, semiconfined where vertical flow is impeded, and unconfined in various portions of the Subbasin. The Primary Alluvial Principal Aquifer is the most productive freshwater aquifer and the source of nearly all groundwater used within the Subbasin. The Santa Margarita Principal Aquifer is a confined unit located in the northeastern portion of the Subbasin and is comprised of both the Santa Margarita Formation and Olcese Sand. The Olcese Principal Aquifer is a confined unit located in the vicinity of where the Kern River enters the eastern portion of the Subbasin and consists of the Olcese Sand.

The Subbasin contains several surface water features. The Kern River is the largest river in the Subbasin and flows east to west through the center of the Subbasin, as shown on Figure ES-2. The Subbasin also contains significant infrastructure that conveys imported water supplies, including the Friant-Kern Canal, California Aqueduct, and local canals.

Significant direct recharge in the Subbasin occurs through managed conjunctive use projects and water banking (storage) projects along the Kern River and in other areas of the Subbasin. The conjunctive use projects are dedicated to the replenishment of the Subbasin, while the water banking projects store surplus surface water supplies from the SWP, CVP, Kern River, and other flood waters for subsequent recovery for beneficial uses. [3]

A series of hydrogeologic cross-sections have been developed to illustrate the Subbasin physical characteristics and the formations present in the Plan Area. An example cross section is provided on Figure ES-4 to illustrate the conditions parallel to the southern Subbasin boundary. Cross sections for other portions of the Subbasin are shown in Section 7. This example shows the prevalence of Tulare and Kern River Formations, with the Santa Margarita Formation and Olcese Sand shallowing in the East Margin, and the extent of clay layers which tend to dictate groundwater percolation and lateral flows. The cross sections developed improve understanding of Subbasin conditions across the HCM Areas and provide the information necessary to develop water budgets from the Subbasin’s local numerical model, establish representative monitoring networks, develop applicable SMCs, and effectively convey hydrogeologic conditions to stakeholder groups.

[3] “The storing of water underground … constitutes a beneficial use of water if the water so stored is thereafter applied to the beneficial purposes for which the appropriation for storage was made.” CWC § 1242.

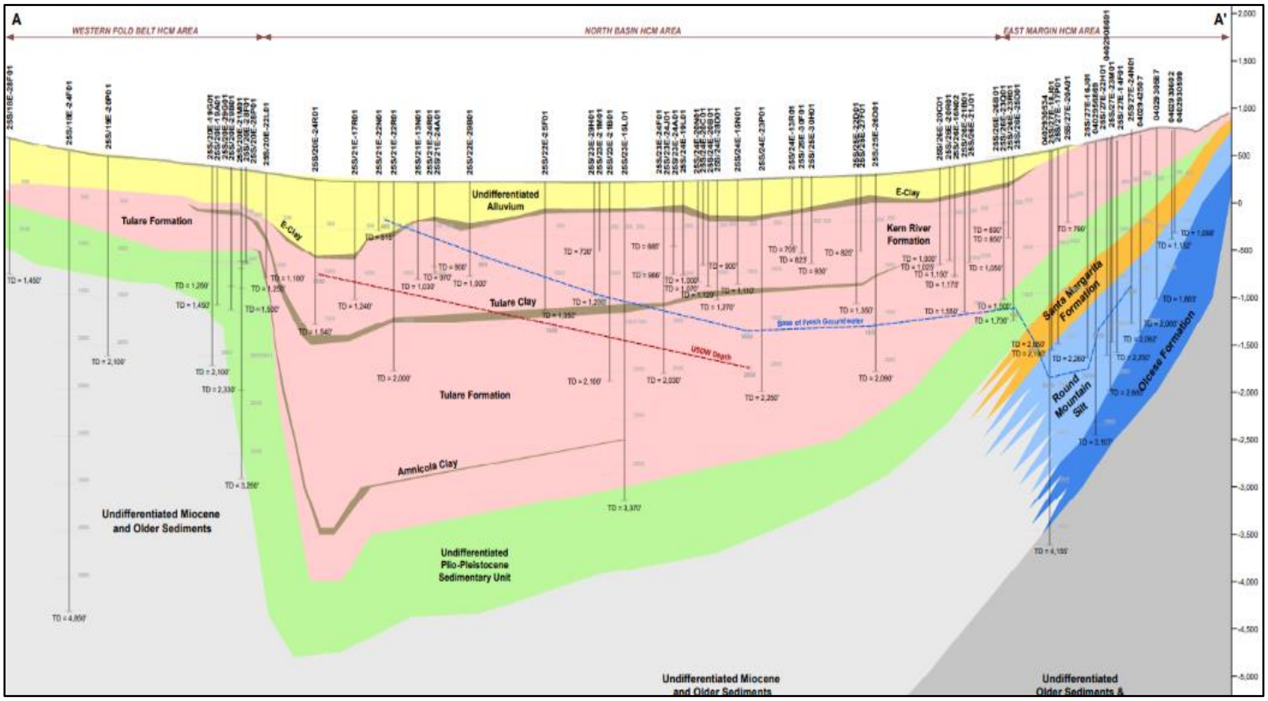


Figure ES-4*. Subbasin Cross Section*

ES.7. Basin Setting - Current and Historical Groundwater Conditions

Information on the Subbasin's current groundwater conditions with respect to the SGMA-defined "Sustainability Indicators" are presented in the Amended Subbasin Plan and summarized below.

Groundwater Levels: Groundwater levels within the Subbasin are presented using contour maps depicting the current (2023) seasonal high and seasonal low for each principal aquifer (Primary Alluvial Principal Aquifer, Santa Margarita Principal Aquifer, and Olcese Principal Aquifer) and hydrographs for various wells across the Subbasin depicting long-term groundwater elevations, historical highs and lows, and hydraulic gradients between principal aquifers. The available data indicate that the Kern River effectively bisects the Plan Area (as shown in Figure ES-2**)** and acts as a groundwater divide whereby groundwater tends to diverge from the river, with groundwater north or south of the river flowing toward extraction areas. Relative highs and lows appear to be controlled, at least in part, by the distribution of groundwater pumping and surface water deliveries. Hydrographs show the long-term positive effects of surface water importation and managed aquifer recharge and water banking activities in raising groundwater levels, tempered by the effects of the recent severe droughts**.**

Groundwater Storage: Changes in groundwater storage over selected time periods were calculated from the Subbasin's local numerical model (C2VSimFG-Kern) and validated through a groundwater storage calculation that considers changes in measured groundwater elevations across the Subbasin. The estimated total usable storage in the Primary Alluvial Principal Aquifer ranges from 90 to 260 million acre-feet (AF). The change in groundwater storage over the historical and current water budget periods of Water Years (WYs) 1995-2023 generally corresponds with the variation in climatic conditions and surface water supply availability. The most significant annual changes in overall storage have historically occurred in the Subbasin's water banking areas where significant surface water storage occurs in wet years, and significant recovery pumping occurs in dry years.

Groundwater Quality: Certain constituents of concern (COCs) have been identified in the Subbasin above drinking water standards and/or agricultural water quality goals. The Subbasin employed the SWRCB's methodology for identifying COCs from State and Regional Water Board datasets, and assessed the following constituents: 1,2,3-trichloropropane (1,2,3-TCP), arsenic, benzene, dibromochloropropane (DBCP), ethylene dibromide (EDB), gross alpha radiation, nitrate (as N), nitrate + nitrite (as N), nitrite (as N), perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), selenium, total dissolved solids (TDS), and uranium. A potential correlation with groundwater elevations and/or groundwater pumping has been identified in some localized areas of the Subbasin for 1,2,3-TCP, arsenic, and nitrate. The GSAs have identified several Representative Monitoring Wells for Degraded Water Quality (RMWs-WQ) to collect coincident groundwater elevation and groundwater quality data in these areas to better understand the relationship between COC concentrations and groundwater management in the future. SMCs have been established for a subset of the COCs assessed (arsenic, nitrate, nitrite, nitrate + nitrite, TDS, 1,2,3-TCP, and uranium).

Land Subsidence: Land subsidence has been documented within the San Joaquin Valley over both historical and recent timeframes, with the greatest documented subsidence occurring north of the Subbasin (see Figure ES-5). Land subsidence rates within the Subbasin range from 0 to 0.3 feet per year resulting in a cumulative land subsidence of 0 to 2.41 feet since 2015. Land subsidence caused by factors within the GSAs' authority to manage is due to aquitard depressurization following groundwater withdrawal, which tends to be greater in the areas that rely solely on groundwater for water supply (agricultural and urban pumping) and are underlain by a greater proportion of fine-grained deposits. Additional causes of subsidence that are outside of the GSAs' control, include oil and gas extraction, natural processes (i.e. faulting), expansive soil types susceptible to hydrocompaction, and others (e.g., deficient Aqueduct pre-construction hydro-compaction, age of infrastructure, etc.). Recent technical studies commissioned by the GSAs have been able to differentiate the subsidence signals associated with these other causal factors.

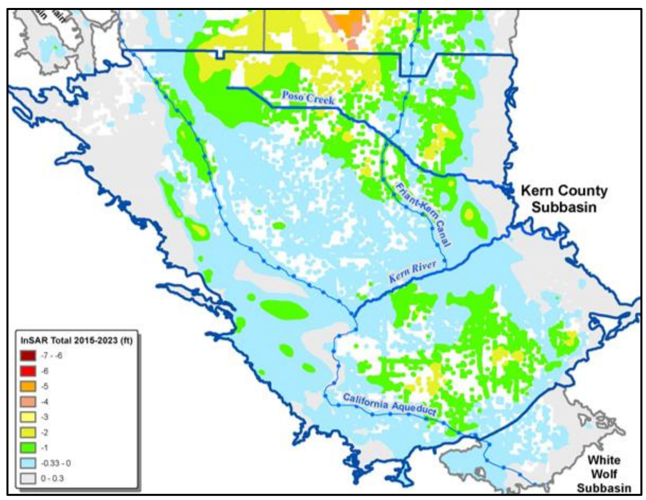


Figure ES-5. Cumulative Subsidence between 2015 – 2023 (ft) based on InSAR data

Land subsidence has the potential to affect Regional Critical Infrastructure (i.e., the California Aqueduct and Friant-Kern Canal) and local GSA Area Critical Infrastructure, including gravity-driven water conveyance systems (canals). To assess subsidence, the Subbasin has conducted a series of studies and continues on-going collaboration and communication with the California Aqueduct Subsidence Program (CASP) and the Friant Water Authority.

Seawater Intrusion: The Subbasin is located far from coastal areas, and therefore seawater intrusion is not considered to be a relevant Sustainability Indicator.

Interconnected Surface Water: Data on depth to groundwater and other local conditions indicate that the vast majority of surface water features in the Subbasin are not connected to groundwater, and in the few limited areas where a connection may occur, the connection is likely transient, short-lived, and involves shallow or perched groundwater that is not part of the principal aquifer systems. As such, the areas of vegetation mapped as Natural Communities Commonly Associated with Groundwater (NCCAG) are not likely groundwater dependent ecosystems (GDEs) but rather supported by irrigation water infiltration and agricultural return flows. In these areas, infiltration of irrigation water and agricultural return flows is impeded by clay soils and subsurface clay sediments creating shallow perched groundwater that is disconnected from groundwater in the principal aquifers that are the focus of SGMA.

ES.8. Basin Setting – Water Budget Information

The GSAs coordinated on the development of a single, coordinated Subbasin-wide water budget presented in this Amended Subbasin Plan using a local numerical model (C2VSimFG-Kern) based on the California Central Valley Groundwater/Surface Water Simulation Model (C2VSim).

The model was extended to incorporate recent conditions and estimate the current water budget over WYs 2015-2023. Modeling results show that the Subbasin, as a whole, had a total storage deficit of approximately 274,200 acre-feet per year (AFY) over the historical period (i.e., WYs 1995-2014) and approximately 344,000 AFY over the current period (i.e., WYs 2015-2023). The Sustainable Yield has been conservatively estimated to be approximately 1.31 million AFY based on results for the historical period using model-calculated groundwater pumping and recharge to quantify the volume of water that, if pumped over the water budget period of interest, would have resulted in zero change in storage.

Water budget information under projected (future) conditions has also been developed for the Subbasin using C2VSimFG-Kern with DWR-provided inputs for climate variables (i.e., adjusted precipitation and evapotranspiration) and water supply assumptions (i.e., changes to imported water supplies). This approach allows for inclusion of more complex variables, including factors influenced by climate change, resulting in more accurate projections. The projected water budget assesses the magnitude of the net water supply deficit under future conditions that would need to be addressed through P/MAs to prevent URs and achieve the Sustainability Goal. Three projected water budget scenarios have been developed for this analysis: (1) a Baseline Scenario, (2) a 2030 Climate Change Scenario, and (3) a 2070 Climate Change Scenario. The P/MAs developed by the Subbasin GSAs have also been incorporated into the C2VSimFG-Kern 2030 Climate Change Scenario input files to evaluate their effectiveness in addressing the projected deficit of 372,000 AFY by 2040 (identified as “With Projects” scenarios in Table ES-2 below). The results in Table ES-2 demonstrate that the planned P/MAs, once fully implemented, provide a reasonable approach to achieve sustainable groundwater management.

There are inherent limitations in using models to predict future conditions given the uncertainties surrounding input variables (e.g., uncertain future hydrologic conditions, recharge, and pumping volumes). A revised Subbasin-wide model is being developed and calibrated as part of Plan implementation and as additional information becomes available through the Basin Study (P/MA KSB-4, see Appendix P).

Table ES-2. Summary of Simulated Change in Groundwater Storage Results

Period / Scenario	General Hydrologic Conditions of Period	Change in Groundwater Storage (acre-feet per year)
Historical Period (WYs 1995-2015)	Average	-274,200
Current Period (WYs 2015-2023)	Dry	-344,019
Projected Period (WYs 2041-2070) Baseline	Average	-324,326
Projected Period (WYs 2041-2070) Baseline with Projects	Average	85,578
Projected Period (WYs 2041-2070) 2030 Climate Change	Average with DWR climate change adjustments	-372,120
Projected Period (WYs 2041-2070) 2030 Climate Change with Projects	Average with DWR climate change adjustments	46,829
Projected Period (WYs 2041-2070) 2070 Climate Change	Average with DWR climate change adjustments	-472,336
Projected Period (WYs 2041-2070) 2070 Climate Change with Projects	Average with DWR climate change adjustments	-45,969

Note: a negative change in groundwater storage indicates a deficit and a positive change in groundwater storage indicates a surplus.

ES.9. Sustainable Management Criteria

SMCs are the metrics by which groundwater sustainability is evaluated under SGMA. Uniform definitions for the following SMC components have been developed in the Amended Subbasin Plan through a coordinated effort of the GSAs.

- **Undesirable Results (URs):** URs are the significant and unreasonable occurrence of conditions, for any of the six Sustainability Indicators (shown in Table ES-3), that adversely affect beneficial uses and users and substantially interfere with surface land uses in the Subbasin.
- **Minimum Thresholds (MTs):** MTs are the numeric criteria for each Sustainability Indicator that, if exceeded in a locally defined combination of monitoring sites, may constitute an UR for that indicator.
- **Measurable Objectives (MOs):** MOs are specific, quantifiable goals for the maintenance or improvement of groundwater conditions. MOs use the same units and metrics as the MTs allowing for direct comparison.
- **Interim Milestones (IMs):** IMs are a set of target values representing measurable groundwater conditions in increments of five (5) years over the 20-year statutory timeline for achieving sustainability.

Table ES-3 summarizes the revised SMCs for each applicable Sustainability Indicator in the Subbasin.

Table ES-3. Summary of Sustainable Management Criteria

Sustainability Indicator	Undesirable Result	Minimum Threshold	Measurable Objective
Chronic Lowering of Groundwater Levels	One of the following occurs: (1) More than 15 drinking water wells are reported dry in any given year. If 15 drinking water wells were impacted every year, no more than 255 drinking water wells cumulatively would be impacted by 2040, or (2) MTs are exceeded in at least 25% of RMW-WLs over a single year (i.e., two consecutive seasonal measurements)	The lower of: (1) Groundwater level in 2030 if the regional trend is extended from the 2015 low (the MO), or (2) Groundwater level that allows for operational flexibility below the 2015 low, based on an RMW-WL-specific record of groundwater level fluctuations	The 2015 low groundwater elevation.
Reduction of Groundwater Storage	A cumulative reduction in usable groundwater storage of 9.3 MAF in the Primary Principal Alluvial Aquifer relative to the baseline (WY 2015) total usable groundwater storage volume.	MTs for Chronic Lowering of Groundwater Levels used as a proxy	MOs for Chronic Lowering of Groundwater Levels used as a proxy
Seawater Intrusion	Groundwater conditions in the Subbasin show that Seawater Intrusion is not present and is not anticipated to be present in the future, and therefore, the Sustainability Indicator is not applicable.		
Degraded Water Quality	MTs for a groundwater quality COC are exceeded in three RMW-WQs in an HCM area based the average of confirmed seasonal samples and can be attributed based on a technical analysis to groundwater management actions (e.g., groundwater level changes).	The greater concentration of: (1) The applicable health-based screening standard, or (2) The maximum pre-2015 baseline concentration at each RMW-WQ. For wells with insufficient pre-2015 data, 2010-2023 data is used to determine maximum baseline concentrations at each RMW-WQ. For wells with insufficient 2010-2023 data, the MT is set as the 90^{th} percentile 2010-2023 baseline concentration in the applicable HCM area.	The greater concentration of: (1) The applicable health-based screening standard, or (2) The median pre-2015 baseline concentration at each RMW-WQ. For wells with insufficient pre-2015 data, 2010-2023 data is used to determine median baseline concentration at each RMW-WQ. For wells with insufficient 2010-2023 data, the MO is set as the 90th percentile 2010-2023 baseline concentration in the applicable HCM area.

Sustainability Indicator	Undesirable Result	Minimum Threshold	Measurable Objective
Land Subsidence	MT extent of subsidence is exceeded at any RMS-LS or as measured using InSAR data published annually by DWR averaged across an HCM area. Note: The GSAs' management authority does not extend to all activities and processes that cause Subbasin subsidence..	MTs are established along critical infrastructure as a rate and extent based on specific impacts to critical infrastructure or as an observed or allowable rate of subsidence, as determined by the Subbasin's risk-based approach. Additionally, MTs are set for the Subbasin as the average historical rate of subsidence in each HCM area from 2015-2023.	50% of the MT rate and MT extent.
Interconnected Surface Water	Groundwater conditions in the Subbasin show that there are a few areas with potential Interconnected Surface Waters. However, data show the connection is likely transient, short-lived, and involves shallow or perched groundwater that is not part of the principal aquifer systems. Therefore, the Sustainability Indicator is not applicable to the Subbasin.		

Justification of Sustainable Management Criteria:

The primary beneficial uses and users of groundwater in the Subbasin include agricultural users, industrial users, domestic well owners, small community wells, and municipal well operators. Additionally, surface land uses susceptible to land subsidence (infrastructure) have been categorized based on their subsidence vulnerability and impacts to beneficial users (critical regional, GSA area, and other). The SMCs in Table ES-3 have been developed to prevent significant and unreasonable impacts to groundwater uses and users and surface land uses and are justified (i.e., will not result in significant and unreasonable impacts) as follows for all applicable Sustainability Indicators.

Chronic Lowering of Groundwater Levels

- Impacts to Beneficial Users: A robust Subbasin-wide well impacts analysis has been conducted using the revised MTs and the Subbasin well inventory to quantify potential impacts to beneficial users at the MTs as compared to the Chronic Lowering of Groundwater Levels URs definition. The most likely scenario shows 77 total drinking water wells being potentially impacted by 2040 at the projected MTs, a potential impact that can be addressed effectively by the Well Mitigation Program. The Subbasin calculated the "depletion of supply" for this scenario to quantify the percentage of urban supply that may be impacted at MTs and the UR definition. Under the most likely scenario, 1.2 percent of the total estimated urban water supply would be impacted by 2040. With implementation of the proposed P/MAs, the model shows that only 13 drinking water wells would potentially be dewatered, which corresponds to < 0.01 percent of the Subbasin's urban pumping. By January 2025, the Subbasin GSAs plan to implement a Well Mitigation Program to address potential impacts from Chronic Lowering of Groundwater Levels to domestic and small community wells.
- Consideration of Adjacent Basins: Groundwater level SMCs were compared to those in the neighboring Tule, Tulare Lake, and White Wolf Subbasins and are not projected to

cause a change in historical gradients or prevent neighboring subbasins from achieving their Sustainability Goals.

Reduction of Groundwater Storage: A cumulative reduction of 9.3 MAF (up to 10 percent) of the total usable storage in the Subbasin relative to the 2015 baseline equates to the difference in storage between the MT and MO groundwater levels. This decline in groundwater storage, which allows for a four-year drought, is not unreasonable given the large size of the basin and total usable storage estimates, and it is similar to the storage change observed during recent multi-year droughts without unreasonable dewatering of wells. Therefore, the Chronic Lowering of Groundwater Levels SMCs serve as a reasonable proxy for Reduction of Groundwater Storage. The four to ten percent reduction of total usable storage is calculated by assuming that all Primary Alluvial Principal Aquifer Representative Monitoring Wells for Chronic Lowering of Groundwater Levels (RMW-WLs) exceed the MTs. However, URs for Chronic Lowering of Groundwater Levels are defined to occur when 25 percent of RMW-WLs exceed their MTs, which would correspond to a lower decline in storage than the UR criteria for Reduction of Groundwater Storage, thus sufficiently protecting against impacts to beneficial uses and users.

Degraded Water Quality

- Impacts to Beneficial Users: The MTs for Degraded Water Quality are based on the greater of (a) the primary Maximum Contaminant Levels (MCLs) or (b) pre-2015 baseline concentrations for each RMW. Where pre-2015 historical data is insufficient, the HCM area baseline is used as proxy for pre-2015 baseline concentrations. MTs are identified for six COCs, including arsenic, nitrate, nitrite, TDS, 1,2,3-TCP, and uranium. Primary MCLs are health-based regulatory drinking water standards set to protect drinking water use, which is the most sensitive beneficial use. In some areas of the Subbasin, water quality has been historically degraded and not used for drinking water. For those areas of the Subbasin it is appropriate to set MTs as a baseline condition, as "the plan may, but is not required to, address undesirable results that occurred before, and have not been corrected by, January 1, 2015" (CWC § 10727.2(b)(4)).
- Consideration of Adjacent Basins: The Chronic Lowering of Groundwater Levels MTs are not predicted to cause significant changes to local groundwater gradients and are thus should be protective in terms of preventing migration of poor-quality water within the Subbasin. Groundwater flow exits the Subbasin across the northern Subbasin boundary (Figure 8-1). The adjacent subbasins similarly have SMCs established for key COCs that impact drinking water users.

Land Subsidence: The SMCs for Land Subsidence have been developed in recognition that subsidence in the Subbasin has been caused by several factors, some of which are within the GSAs' authorities to control ("GSA-related" subsidence - e.g., groundwater pumping for agricultural and urban uses), and others that are outside of the GSAs' authorities to control ("non-GSA" subsidence – e.g., oil and gas extraction, natural processes, and expansive soil types susceptible to hydro-compaction). The SMCs for Land Subsidence have been developed to avoid impacts of subsidence caused by GSA-managed activities through a risk-based approach that considers subsidence potential and vulnerability.

- Impacts to Beneficial Users: MTs for Regional Critical Infrastructure were developed in coordination with operators of the infrastructure (i.e., Friant Water Authority and CASP) and designed to avoid significant and unreasonable impacts to infrastructure functionality. The MTs for GSA Area Critical Infrastructure are based on subsidence rates that have historically occurred and have been managed by Subbasin GSAs through ongoing maintenance and improvements to facilities. A change in slope analysis shows that for 98 percent of the Critical Infrastructure, the change in slope between 2024 and 2040 MTs is not projected to exceed typical safety factors. In addition to infrastructure specific MTs, MTs for the entire Subbasin are set based on HCM Area historical average subsidence rates. As such, the Subbasin will continue to monitor and report subsidence throughout the entire Subbasin, and coordinate with other entities that have interests in and responsibilities for land subsidence \ caused or influenced by activities or processes outside of the GSAs' management authorities.
- Consideration of Adjacent Basins**:** MT extents in the Subbasin are half the MT extents in the adjacent northward Tule and Tulare Lake subbasins. Therefore, implementation of the Amended Subbasin Plan would not prevent neighboring subbasins from achieving their Land Subsidence sustainability goal(s). Although Land Subsidence MTs in the adjacent southern White Wolf Subbasin are currently set using groundwater levels as a proxy, Subbasin GSAs are actively collaborating with the White Wolf GSA to ensure consistency as the White Wolf GSA develops more specific Land Subsidence SMCs.

Relationships Between Sustainability Indicators:

- **Chronic Lowering of Groundwater Levels** and **Reduction in Groundwater Storage** are directly, if not linearly, related. As shown in Table ES-3, groundwater level MTs are used as a proxy for Reduction of Groundwater Storage. If water levels in all Primary Alluvial Principal Aquifer RMW-WLs were to exceed MTs, a four to ten percent decline in total usable groundwater storage would occur relative to the baseline, which is not considered to be unreasonable.
- A trending analysis between **Degraded Water Quality** and **Chronic Lowering of Groundwater Levels** (and **Reduction of Groundwater Storage**, by proxy) shows no correlation for the majority of the Subbasin, except in some localized areas. RMWs have been selected in these areas to facilitate ongoing monitoring of the potential relationship between groundwater levels and water quality.
- An analysis has been conducted using historical groundwater level declines and cumulative **Land Subsidence** to project the future subsidence that would occur at **Chronic Lowering of Groundwater Level** MTs. The analysis shows that subsidence projected to occur at groundwater level MTs is less than the MTs for Land Subsidence along all critical infrastructure, which are considered protective of the functionality of critical infrastructure. Therefore, groundwater level MTs are protective of URs caused by Land Subsidence. However, it is noted that other non-GSA related subsidence could still contribute toward potential URs. The GSAs are integrating subsidence into the Subbasin's groundwater flow model as part of implementation of the Amended Subbasin Plan; results of which will be used to ensure that MTs for Chronic Lowering of Groundwater Levels are protective of MTs set for Land Subsidence.

- A potential effect of URs due to **Land Subsidence** is a **Reduction of Groundwater Storage** due to compaction of fine-grained subsurface layers during groundwater pumping. Through the correlation with Chronic Lowering of Groundwater Level SMCs, it is reasonable to conclude that Land Subsidence MTs will not cause an unreasonable Reduction of Groundwater Storage.
- Studies suggest that consolidation of subsurface layers with high clay content may liberate arsenic and cause **Degradation of Groundwater Quality**. However, there has been no observed correlation between **Land Subsidence** and any water quality COCs in the Subbasin. RMW--WQs have been selected in areas with historical subsidence to continue to monitor the potential relationship between subsidence and arsenic.

ES.10. Monitoring Network

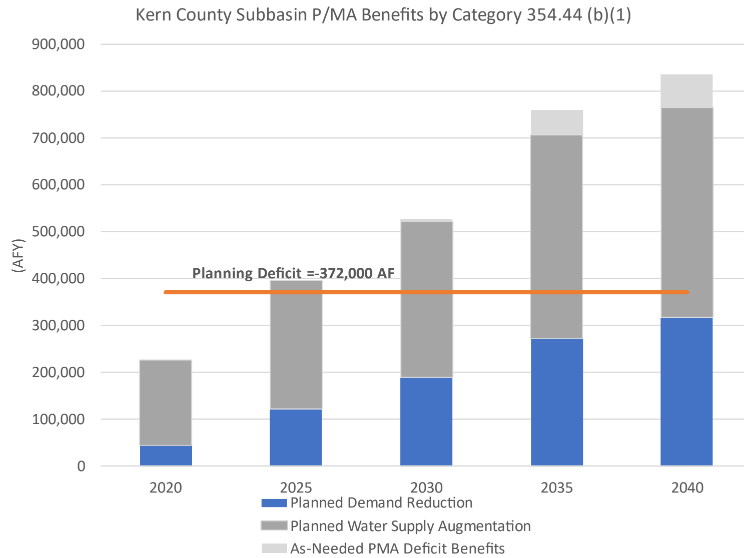
The objective of the SGMA Monitoring Networks is to continue to collect sufficient data to allow for assessment of the Sustainability Indicators relevant to the Subbasin and determination of potential impacts to the beneficial uses and users of groundwater. The proposed SGMA Monitoring Network has been improved to ensure sufficient spatial distribution and spatial density. In the Subbasin, the SGMA Monitoring Network consists of 185 RMWs for groundwater levels (RMW-WL) and (by proxy) groundwater storage, 51 RMWs for monitoring groundwater quality (RWM-WQ), and 144 representative monitoring sites (RMSs) for monitoring land subsidence (including extensometers, benchmarks, and GPS). Additionally, the Subbasin will continue to rely on InSAR data to assess land subsidence across the Subbasin.

The SGMA Monitoring Networks for the Subbasin supplement other active monitoring networks and programs such as DWR's California Statewide Groundwater Elevation Monitoring (CASGEM) program, Irrigated Lands Regulatory Program (ILRP), Central Valley-Salinity Alternatives for Long-term Sustainability (CV-SALTS), and local groundwater monitoring programs, etc.

Data collected from the SGMA Monitoring Networks for the Subbasin will be uploaded to the Kern Subbasin Data Management System (DMS) that is maintained for the Subbasin and reported to the DWR in accordance with the Monitoring Protocols developed for the Subbasin. Data collected will undergo quality assurance and quality control at the GSA level prior to being uploaded in the DMS. In the instance of a single MT exceedance, all Subbasin GSAs will be notified which will initiate the MT Exceedance Policy and associated investigations (see Appendix Q).

ES.11. Projects and Management Actions (P/MAs)

Achieving sustainability in the Subbasin will require the implementation of P/MAs to address projected water budget deficits that contribute to groundwater level and storage declines, land subsidence, and water quality impacts. As such, the GSAs have developed a portfolio of P/MAs, each with specific projected benefits, implementation triggers, and costs; the portfolio includes 48 demand reduction management actions and 82 water supply augmentation projects.



A linear "glide path" has been developed that will result in closing the projected Subbasin deficit[4] of approximately 372,000 AFY by 2040, of which over 80 percent is projected to be met with demand reduction P/MAs (see Figure ES-6). Subbasin GSAs have also included supply augmentation P/MAs. The Amended Subbasin Plan includes significantly more P/MAs than are required to address the projected deficit. In the event full estimated P/MA benefits are not ultimately realized, there is a built-in "safety factor" of nearly 2.0 and a plan to ensure the Subbasin projected deficit is reduced by 2040. Furthermore, under the MT Exceedance Policy, accelerated implementation of P/MAs could be triggered if MT exceedances occur.

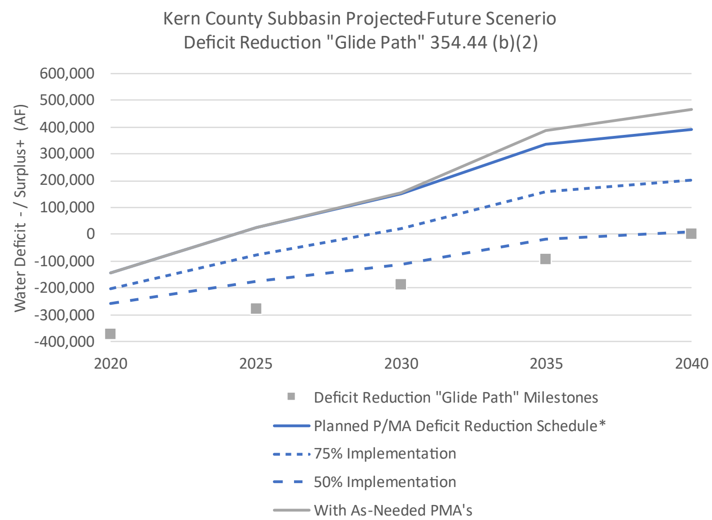


Figure ES-6. Projected-Future Scenario Overdraft Correction "Glide Path"

The supply augmentation and demand reduction P/MAs identified by the Subbasin GSAs comprise a diverse portfolio of options that can be implemented as necessary to achieve sustainability from a total water quantity and water quality perspective. Additionally, eight Subbasin P/MAs establish Subbasin-wide programs, policies, collaborations, and ongoing data gap filling.

[4] The net deficit to be addressed by the 2040 GSP implementation deadline is the estimated deficit under the 2030 Climate Change scenario.

The modeled simulated results for the planned P/MAs indicate that P/MA implementation along the planned glide path will successfully achieve sustainability and avoid URs for Groundwater Levels (and by proxy for the other applicable Sustainability Indicators) throughout the Subbasin. Specifically, the local numerical model results have been used to compare simulated groundwater levels to the MTs and MOs for each RMW-WL. In general, across most of the Subbasin, groundwater levels fall near or below MTs without P/MAs implementation but are typically above the MT for the simulations that include P/MAs (see Figure ES-7).

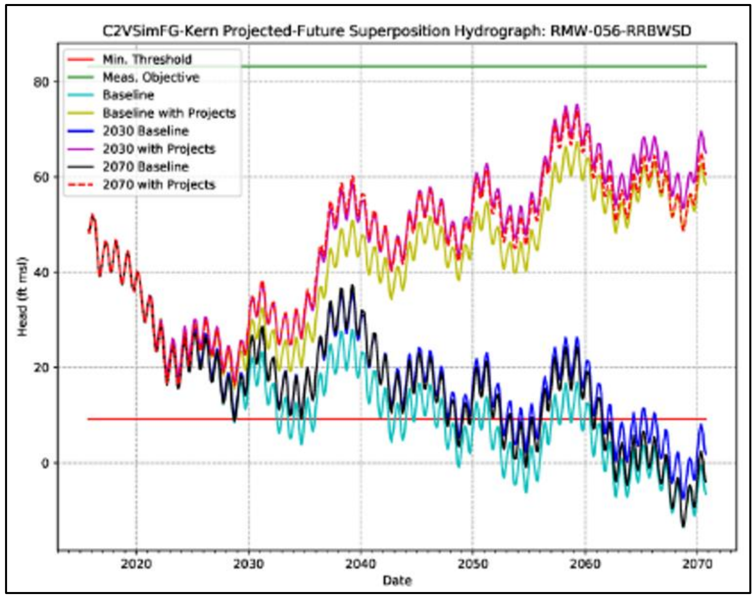


Figure ES-7. C2VSim-FG-Kern Projected Future Superposition Hydrograph (2030 Climate Change)

The implementation glide path identified by the Subbasin GSAs provides a general guide to how quickly these benefits are to be realized. To date the Subbasin GSAs have taken action on multiple P/MAs (e.g., development of new recharge basins). The exact schedule and order of implementation for other P/MAs, as seen in Figure ES-6, will be adaptively managed. Further analysis will be conducted to prioritize the P/MAs in consideration of factors such as permitting, engineering feasibility, cost effectiveness, need to prevent particular URs, funding opportunities, etc. In general, P/MAs being considered for implementation will be discussed during regular Board Meetings of each Subbasin GSA, which are noticed and open to the public. Additional stakeholder outreach efforts will be conducted prior to and during P/MA implementation, as required by law.

ES.12. Plan Implementation

Key SGMA and groundwater management implementation activities to be undertaken by the GSAs through 2040 include:

- Annual reporting.
- Monitoring and data collection.
- Data gap filling.
- P/MA implementation, including policy development to support Plan implementation.
- Technical and non-technical coordination with other water management entities within and outside the Subbasin.
- Continued outreach and engagement with stakeholders.
- Enforcement and response actions, including:

- MT Exceedance Policy
- Well Mitigation Program to be operational by 2025
- Evaluation and updates of this Plan as part of the required periodic evaluations (i.e., “five-year updates”).

Collectively, the SGMA implementation activities described herein demonstrate the Subbasin GSAs have been actively implementing specific P/MAs, policies, and programs to sustainably manage groundwater resources for all beneficial uses and users and continue to meet the Sustainability Goal defined for the Subbasin in Section ES.2 above, and in Section 2 and Section 12.

The costs associated with continued activities by the GSAs fall under two main categories: (1) costs for Subbasin-wide groundwater management activities, and (2) costs to individual GSAs to implement P/MAs within their jurisdictions, including capital/one-time costs and ongoing costs. Most costs for Subbasin-wide groundwater management activities are shared equally between the Subbasin GSAs and are estimated as an annual cost of approximately $1.4 million. For GSA-specific P/MA implementation, the GSAs intend to meet these cost obligations through a combination of landowner contributions (within their jurisdictions), partnering agencies, grant funding (DWR, United State Bureau of Reclamation, Federal Emergency Management Agency, etc.), locally available funds, and other available sources to be determined.

ES.13. Conclusion

The GSAs recognize that management of groundwater resources in California fundamentally changed with the passage of SGMA. SGMA has introduced well-defined concepts, actions, and deadlines necessary to achieve the stated goals and to avoid URs. For the “high priority” and “critically overdrafted” subbasins, there is a renewed sense of urgency to better monitor, prepare for, and respond to these issues. The GSAs are exercising their authorities to strategically plan and implement the coordinated groundwater management program established in this Amended Subbasin Plan within their jurisdictions. The Subbasin GSAs have committed to the coordinated SMCs established in this Amended Subbasin Plan to ensure that URs do not occur, and that any potential impacts to beneficial uses and users of groundwater that may occur as a result of groundwater management, especially to drinking water users, will be mitigated. Through the comprehensive monitoring network and P/MAs developed to meet modeled projected water budget under 2030 climate change conditions, the GSAs are confident they can achieve the Subbasin’s Sustainability Goal by the SGMA deadline. The GSAs are committed to long-term coordinated groundwater management, engaging with communities and stakeholders, and building consensus to ensure sufficient groundwater resources are reliably available for current and future generations.