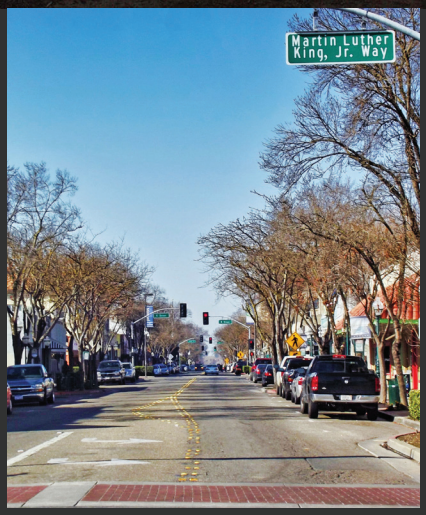
MERCED SGMA

Merced Groundwater Subbasin

GROUNDWATER SUSTAINABILITY PLAN

Image courtesy: Veronica Adrover/UC Merced



January 2025

EXECUTIVE SUMMARY

ES-1. INTRODUCTION AND PLAN AREA

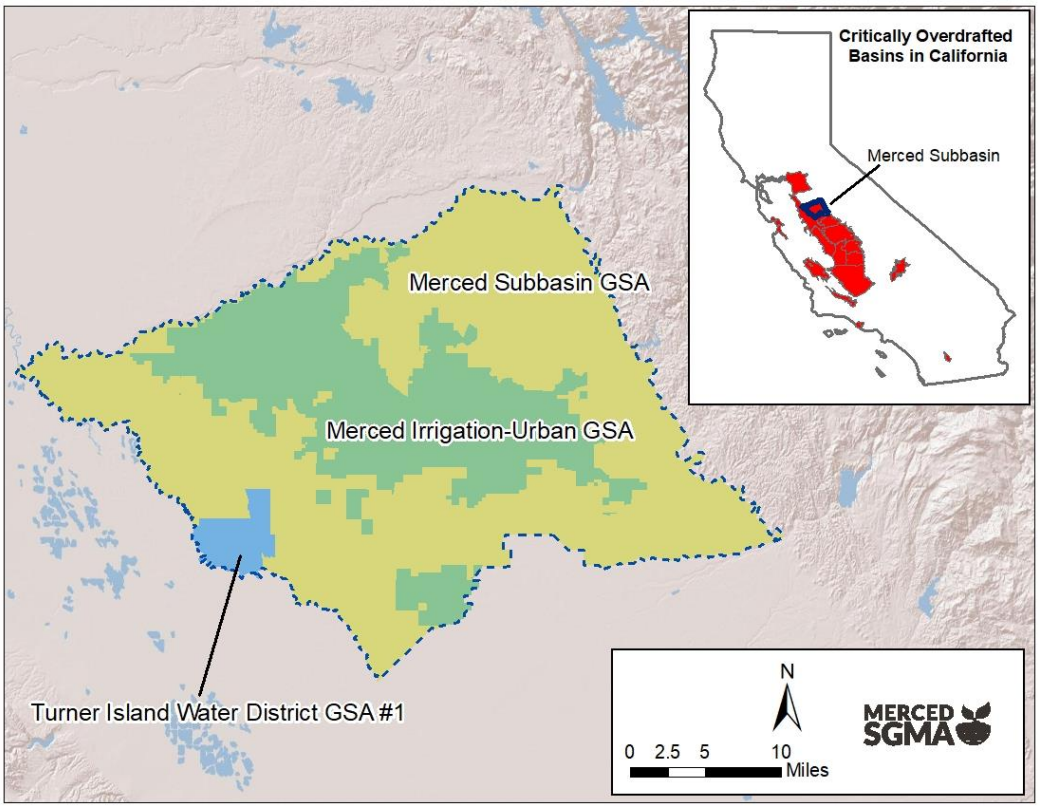
The Sustainable Groundwater Management Act (SGMA), passed in 2014, requires the formation of local Groundwater Sustainability Agencies (GSAs) to oversee the development and implementation of Groundwater Sustainability Plans (GSPs), with the ultimate goal of achieving sustainable management of California's groundwater basins. The purpose of this Groundwater Sustainability Plan is to bring the Merced Groundwater Basin (Merced Subbasin or Subbasin), a critically overdrafted basin located within the San Joaquin Valley (see Figure ES-1), into sustainable groundwater management by 2040. The Subbasin is heavily reliant on groundwater, and users recognize the Subbasin has been in overdraft for a long period of time.

The County of Merced and water purveyors and cities within the Merced Subbasin formed three GSAs in accordance with SGMA: Merced Irrigation-Urban Groundwater Sustainability Agency (MIUGSA), Merced Subbasin Groundwater Sustainability Agency (MSGSA), and Turner Island Water District Groundwater Sustainability Agency #1 (TIWD GSA-1) (see Figure ES-1-1), collectively referred to as "GSAs". The GSAs coordinated efforts to develop this GSP for the Subbasin. The GSAs have adopted the following sustainability goal for the Merced Subbasin:

> **Achieve sustainable groundwater management on a long-term average basis by increasing recharge and/or reducing groundwater pumping, while avoiding undesirable results.**

This goal will be achieved by allocating a portion of the estimated Subbasin sustainable yield to each of the GSAs, implementing demand management and allocation programs within each GSA, and coordinating the implementation of programs and projects to increase both direct and in-lieu groundwater recharge, which will in turn increase the groundwater and / or surface water available in the Subbasin.

Figure ES-1-1: Merced Subbasin Location Map and GSAs



Development and implementation of the GSP are guided by a Coordination Committee composed of members appointed by the GSA Boards to provide recommendations on technical and substantive basin-wide issues. The Coordination Committee and GSA Boards are also informed by a Stakeholder Advisory Committee, which consists of a broad group of groundwater beneficial users (also appointed by the GSA Boards) to review groundwater conditions, management issues and needs, and projects and management actions to improve sustainability in the basin. Extensive outreach has also been conducted to seek input from additional beneficial users of groundwater through multiple venues including public workshops held in locations specifically selected to provide access to disadvantaged communities. Figure ES-1-2 illustrates the relationship among the groups described above.

Figure ES-1-2: Diagram of Levels of Engagement and

This 2025 GSP Update includes revisions to the July 2022 GSP in response to changes in Subbasin conditions, Subbasin management, and to the Statement of Findings issued by the California

Department of Water Resources (DWR) on August 4, 2023 (DWR, 2023). A redlined version of the GSP that highlights the edits can be found on MercedSGMA.org.

ES-2. BASIN SETTING

Hydrogeologic Conceptual Model

The Merced Subbasin contains three principal aquifers that are defined by their relationship to the Corcoran Clay aquitard, a laterally-extensive silt and clay layer that underlies approximately the western half of the Subbasin and acts as a significant confining layer.

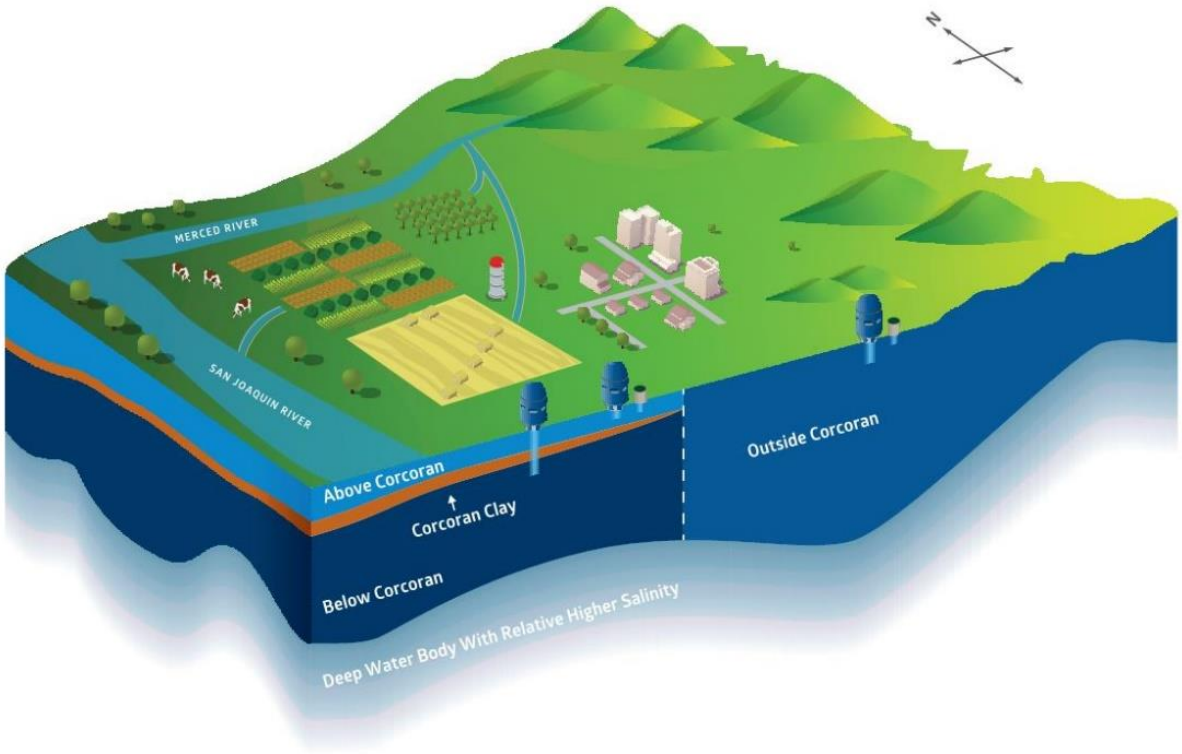
The **Above Corcoran Principal Aquifer** includes all aquifer units that exist above the Corcoran Clay Aquitard and generally contains moderate to large hydraulic conductivities and yields for domestic and irrigation uses.

The **Below Corcoran Principal Aquifer** includes all aquifer units that exist below the Corcoran Clay Aquitard and contains hydraulic conductivities and yields ranging from small to large for irrigation as well as some domestic and municipal uses.

The **Outside Corcoran Principal Aquifer** includes all aquifers that exist outside of the eastern lateral extent of the Corcoran Clay. The Outside Corcoran Principal Aquifer is connected laterally with the Above Corcoran Principal Aquifer at shallower depths and the Below Corcoran Principal Aquifer at deeper depths. Major uses of water in the Outside Corcoran Principal Aquifer include irrigation, domestic, and municipal uses.

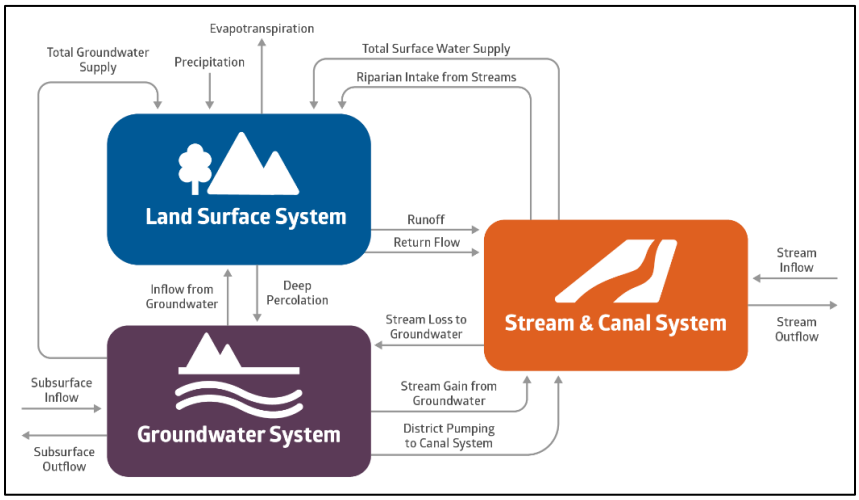
The Principal Aquifers are underlain by a deep aquifer with higher salinity relative to the principal aquifers. See Figure ES-1-3 for a 3D illustration demonstrating the relationship between the principal aquifers, deeper higher-salinity water body, and the Corcoran Clay aquitard.

Figure ES-1-3: 3D Illustration of Merced Subbasin Principal Aquifers and Aquitard



Water Budget Information

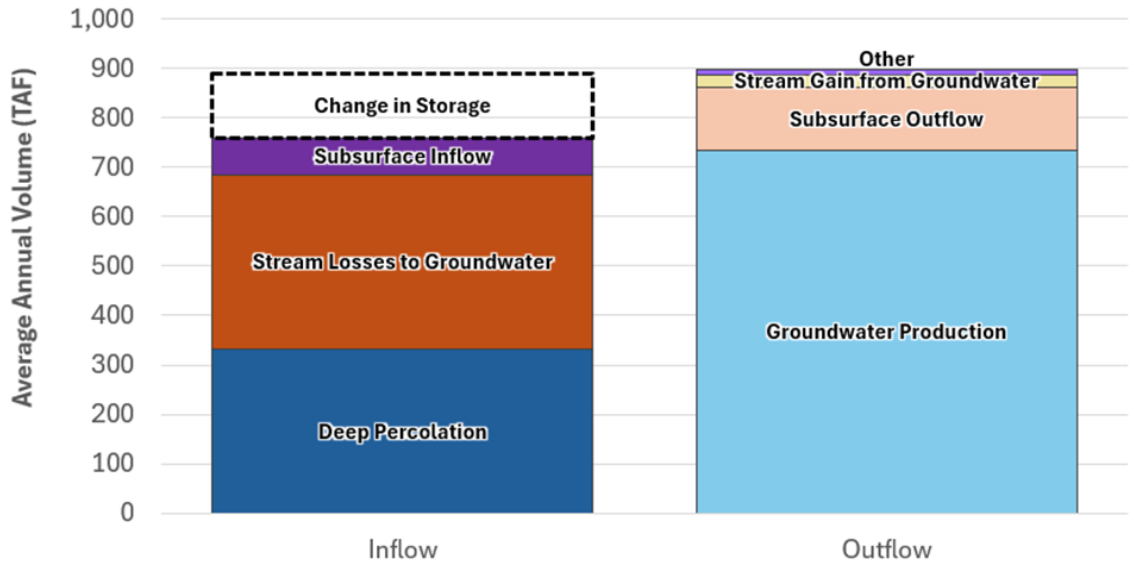
Figure ES-1-4: Generalized Water Budget Diagram



Water budgets provide quantitative accounting of water entering and leaving the Merced Subbasin and can be used to help estimate the extent of overdraft occurring now and in the future. Consistent with SGMA requirements, water budgets for historical, current, projected, and sustainable conditions were developed for the Merced Subbasin. An additional projected conditions scenario that includes existing and planned projects and management actions was also developed. Within each of these conditions, water budgets were developed for the groundwater system, the land surface system, and the stream and canal system. These water budgets were developed using the Merced Water Resources Model

(MercedWRM), a fully integrated surface and groundwater flow model developed and calibrated specifically for the Subbasin. See Figure ES-1-4 for a conceptual diagram of the inputs and outputs quantified by the model. The historical conditions water budget (see Figure ES-1-5) shows an annual average rate of overdraft ("Change in Storage") of 129,000 acre-feet per year (AFY) over water years 2006 through 2022. In this Figure, the "Change in Storage" represents the average annual decline in storage resulting from the Subbasin outflows, principally groundwater pumping.

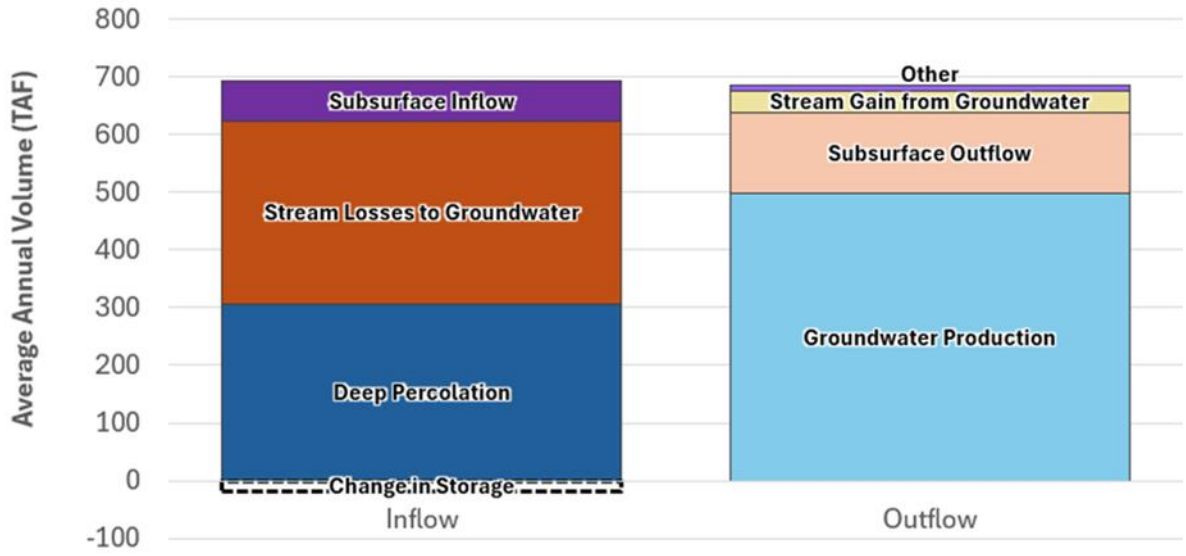
Figure ES-1-5: Historical Conditions Water Budget (2006-2022)



SGMA defines sustainable yield as "the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result" (California Water Code §10721(w)).

For the Merced Subbasin, sustainable yield was estimated by modifying conditions in the groundwater model to balance out the change in stored water over time and avoid undesirable results. In order to achieve a net-zero change in groundwater storage over a long--term average condition and avoid undesirable results, current agricultural and urban groundwater demand in the Merced Subbasin would need to be reduced by approximately 8 percent beyond the modeled implementation of completed and proposed supply-side or recharge projects and demand reduction programs. Figure ES-1-6 illustrates the Subbasin water budget under long term sustainable conditions. It is noted that the sustainable yield estimate is heavily dependent on the management of neighboring subbasins and on the nature of future hydrology. The difference in pumping between modeled projects/management actions and the sustainable yield scenario is considered within the margin of error of the model estimate and the GSAs intend to adaptively implement projects and management actions during GSP implementation to ultimately achieve sustainability through avoidance of undesirable results.

Figure ES-1-6: Groundwater Water Budget under Sustainable Groundwater Management Conditions Long-Term (50-Year) Average Annual



ES-3. SUSTAINABLE MANAGEMENT CRITERIA

SGMA requires consideration of six sustainability indicators. For each indicator, the GSP must define undesirable results for the basin ("significant and unreasonable" negative impacts) and determine if they could occur. For the indicators with the potential for undesirable results, the GSP must establish sustainable management criteria that are intended to prevent undesirable results from occurring and establish a monitoring network.

Sustainable management criteria were developed to be protective of beneficial uses in the Merced Subbasin and to support the Subbasin's sustainability goal. Demonstration by 2040 of meeting the sustainability management criteria and an absence of undesirable results will support a determination that the basin is operating within its sustainable yield, and thus that the sustainability goal has been achieved.

A summary of the sustainable management criteria for the Merced Subbasin is shown in Table ES-1-1.

Table ES-1-1: Summary of Sustainable Management Criteria

Sustainability Indicator	Minimum Threshold (MT)	Interim Milestone (IM)	Measurable Objective (MO)	Undesirable Result
Groundwater Levels	Fall 2015 groundwater elevation	Based on range of projected values that account for hydrologic uncertainty, more details in Section 3.3.3.	November or October 2011 groundwater elevation (measured, or estimation if historical record not available)	Greater than 25% of representative wells fall below MT in 2 consecutive years
Groundwater Storage	Groundwater levels used as a proxy for this sustainability indicator			
Seawater Intrusion	Not applicable - not present and not likely to occur due to the distance between the Subbasin and the Pacific Ocean (and Sacramento-San Joaquin Delta)			
Degraded Water Quality	1,000 mg/L TDS	1,000 mg/L TDS	500 mg/L TDS	At least 25% representative wells exceed MT for 2 consecutive years
Land Subsidence	0 ft/year, subject to uncertainty of +/-0.16 ft/year	2025: -0.75 ft/year 2030: -0.5 ft/year 2035: -0.25 ft/year	0 ft/year	Exceedance of MT at 3 or more representative sites for 2 consecutive years
Depletions of Interconnected Surface Waters	Groundwater levels used as a proxy for this sustainability indicator			

Sustainable management criteria were established to be protective of Subbasin beneficial uses as described below.

Minimum thresholds for **chronic declining groundwater levels** were developed based on the fall 2015 elevation recorded at each representative monitoring well. This threshold keeps groundwater levels generally above levels that have been experienced in the past. In this way, impacts to shallow well users and other beneficial users of groundwater will generally not exceed what has historically been experienced in the Subbasin. Sustainable management criteria for declining groundwater levels were evaluated against the depths of the shallowest domestic and public water supply wells in Merced County's well permitting database. Groundwater levels are also being used as a proxy indicator for reduction of groundwater storage and depletions of interconnected surface waters.

Significant and unreasonable **reduction of groundwater storage** are not likely to occur in the Subbasin, since historical reductions have been insignificant relative to the total volume of

freshwater water storage in the Subbasin. However, based on a recommendation from DWR, the Subbasin has decided to manage this sustainability indicator using groundwater levels as a proxy.

Degraded water quality is unique among the six sustainability indicators because it is already the subject of extensive federal, state, and local regulations carried out by numerous entities, and SGMA does not directly address the role of GSAs relative to these other entities (Moran & Belin, 2019). SGMA does not specify water quality constituents that must have minimum thresholds. Groundwater management (e.g., via controls on pumping and/or recharge) is the mechanism available to GSAs to implement SGMA. Establishing minimum thresholds for constituents that cannot be managed by increasing or decreasing pumping was deemed inappropriate by the GSAs and basin stakeholders. The major water quality issue being addressed by sustainable groundwater management is the migration of relatively higher salinity water into the freshwater principal aquifers. The nexus between water quality and water supply management exists for the pumping-induced movement of low-quality water from the west and northwest to the east. Other water quality concerns are being addressed through various water quality programs and agencies that have the authority and responsibility to address them.

While **land subsidence** has been recognized by the GSAs as an area of concern within the Merced Subbasin, it is not considered to have caused a significant and unreasonable reduction in the viability of the use of infrastructure. However, it is noted that subsidence has caused a reduction in freeboard of the Middle Eastside Bypass over the last 50 years and has caused problems in neighboring subbasins, highlighting the need for ongoing monitoring and management in the Merced Subbasin and surrounding subbasins. Sustainable management criteria were established based on the long-term avoidance of land subsidence, set with the recognition that the interconnectedness of the Merced Subbasin with surrounding subbasins makes meeting the sustainability management criteria dependent on the successful management of all nearby subbasins. The criteria are also set to be consistent with the sustainable management criteria for groundwater levels which seek to keep levels above 2015 conditions. A management action has also been developed to avoid declines in storage below historical levels, further reducing the risk of subsidence.

Depletions of interconnected surface waters will be managed using groundwater levels as a proxy due to the challenges inability to directly measure streamflow depletions and because of the significant correlation between groundwater levels and depletions.

ES-4. MONITORING NETWORKS

Consistent with SGMA requirements, the GSAs have established monitoring networks for each sustainability indicator to monitor trends in the Subbasin and evaluate GSP implementation against sustainable management criteria. The groundwater level monitoring network consists of wells originally evaluated for the California Statewide Groundwater Elevation Monitoring (CASGEM) Program that were selected to provide representative conditions for groundwater levels across the Subbasin. The groundwater quality monitoring network includes a combination

of wells in the Subbasin that are part of the East San Joaquin Water Quality Coalition Groundwater Quality Trend Monitoring Program as well as public water system wells that report data to the Division of Drinking Water. The subsidence monitoring network relies on control points monitored by the United States Bureau of Reclamation as part of the San Joaquin River Restoration Program. While the monitoring networks reflect a robust history of monitoring Subbasin conditions and numerous data gaps have been filled in the initial GSP was developed, additional data gaps still exist and plans to continue filling these data gaps for each sustainability indicator are described in this GSP.

ES-5. DATA MANAGEMENT SYSTEM

The Merced Subbasin Data Management System (DMS) was developed to serve as a data sharing portal to enable utilization of the same data and tools for visualization and analysis to support sustainable groundwater management and transparent reporting of data and results. Monitoring data can be manually input by users or batch uploaded via template and includes groundwater level, groundwater quality, streamflow, and subsidence data. All monitoring locations can be viewed spatially (map or list format) and data records per site can be viewed temporally (chart or list format). Ad-hoc queries and standard reports greatly assist in answering questions about basin characterization, providing input for decision-making, and developing reports to meet annual report submittal requirements.

ES-6. PROJECTS AND MANAGEMENT ACTIONS TO ACHIEVE SUSTAINABILITY GOAL

SGMA requires that GSPs describe the projects and management actions to be implemented as part of bringing the Subbasin into sustainability. The primary means for achieving sustainability in the Subbasin will be reduction in groundwater pumping achieved through implementation of management actions within each GSA's jurisdiction to allocate or otherwise manage the sustainable yield of the basin.

Since the initial GSP development, several projects have been fully implemented and numerous new projects have been identified and fully or partially funded. Projects and management actions typically either increase surface water supplies to augment the sustainable groundwater yield or increase groundwater recharge, which will in turn increase the amount of groundwater that may be sustainably used; or reduce groundwater demands.

ES-7. PLAN IMPLEMENTATION

Implementation of the GSP will be a substantial undertaking that will include implementation of the projects and management actions as well as GSAs administration, public outreach, implementation of the monitoring programs and filling data gaps, development of annual reports, and development of a 5-year periodic evaluation report. The GSAs have developed an implementation schedule (see Table ES-1-2) and estimated costs for all activities, as well as potential funding mechanism options. Implementation of the GSP is projected to be $1.6M per year. Costs for projects and management actions are estimated to be an additional $72.0M in total, with costs for individual projects or management actions ranging between $26,000 to $31M in total.

Table ES-1-2: GSP Implementation Schedule (2025-2040)

2025	2030	2035	2040
Preparation for Allocations and Low Capital Outlay Projects	**Prepare for Sustainability**	**Implement Sustainable Operations**	
• GSAs conduct 5-year evaluation/update • Monitoring and reporting continue, filling additional data gaps as necessary	• GSAs conduct 5-year evaluation/update • Monitoring and reporting continue	• GSAs conduct 5-year evaluation/update • Monitoring and reporting continue	
• Continued coordination on allocation program • As-needed demand reduction to reach Sustainable Yield allocation • Implement Metering program	• As-needed demand reduction to reach Sustainable Yield allocation	• Full implementation demand reduction as needed to reach Sustainable Yield allocation by 2040	
• Planning/ Design/ Construction for small to medium sized projects	• Planning/ Design/ Construction for larger projects begins	• Project implementation completed	
• Outreach regarding GSP and allocations continues	• Outreach continues	• Outreach continues	