MERCED GROUNDWATER SUBBASIN GROUNDWATER SUSTAINABILITY PLAN PERIODIC EVALUATION 2025

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
µg/L	micrograms per liter
AEM	airborne electromagnetic
AF	acre-feet
AFY	acre-feet per year
bgs	below ground surface
BHMWC	Buchanan Hollow Mutual Water Company
CCR	California Code of Regulations
CDEC	California Data Exchange Center
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
CWC	California Water Code
CWD	Chowchilla Water District
DAC	disadvantaged community
DBCP	dibromochloropropane
DDW	Division of Drinking Water
DWR	Department of Water Resources
EC	electrical conductivity
EDB	ethylene dibromide

EPA	Environmental Protection Agency
ESJWQC	East San Joaquin Water Quality Coalition
Flood-MAR	Flood-Managed Aquifer Recharge
ft	feet
GAMA	Groundwater Ambient Monitoring and Assessment
GDE	Groundwater Dependent Ecosystem
GPS	global positioning system
GQTM	Groundwater Quality Trend Monitoring
GQTMP	Groundwater Quality Trend Monitoring Program
GSA	Groundwater Sustainability Agency
GSAs	MIUGSA, MSGSA, and TIWD GSA-1
GSP	Groundwater Sustainability Plan
GW	groundwater
HCM	Hydrogeologic Conceptual Model
IRWM	Integrated Regional Water Management
LGAWD	Le Grand-Athlone Water District
LiDAR	Light Detection and Ranging
LPMWC	La Paloma Mutual Water Company
MCL	Maximum Contaminant Level
MCWD	Merquin County Water District
MercedWRM	Merced Water Resources Model
mg/L	milligrams per liter
MID	Merced Irrigation District
MIUGSA	Merced Irrigation-Urban Groundwater Sustainability Agency
MSGSA	Merced Subbasin Groundwater Sustainability Agency
MSL	mean sea level
MTBE	methyl tert-butyl ether
NO_3	nitrate
OSWCR	Online System for Well Completion Reports
PCE	perchloroethylene
PLSS	Public Land Survey System
PMA	projects and management actions
PRISM	Parameter-Elevation Regressions on Independent Slopes Model
PWS	public water system
SDAC	severely disadvantaged community
SGM	Sustainable Groundwater Management
SGMA	Sustainable Groundwater Management Act
SJRRP	San Joaquin River Restoration Program
SMCL	secondary maximum contaminant level
Subbasin	Merced Subbasin
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TCA	Trichloroacetic acid
TCE	trichloroethylene
TCP	1,2,3-trichloropropane
TDS	total dissolved solids

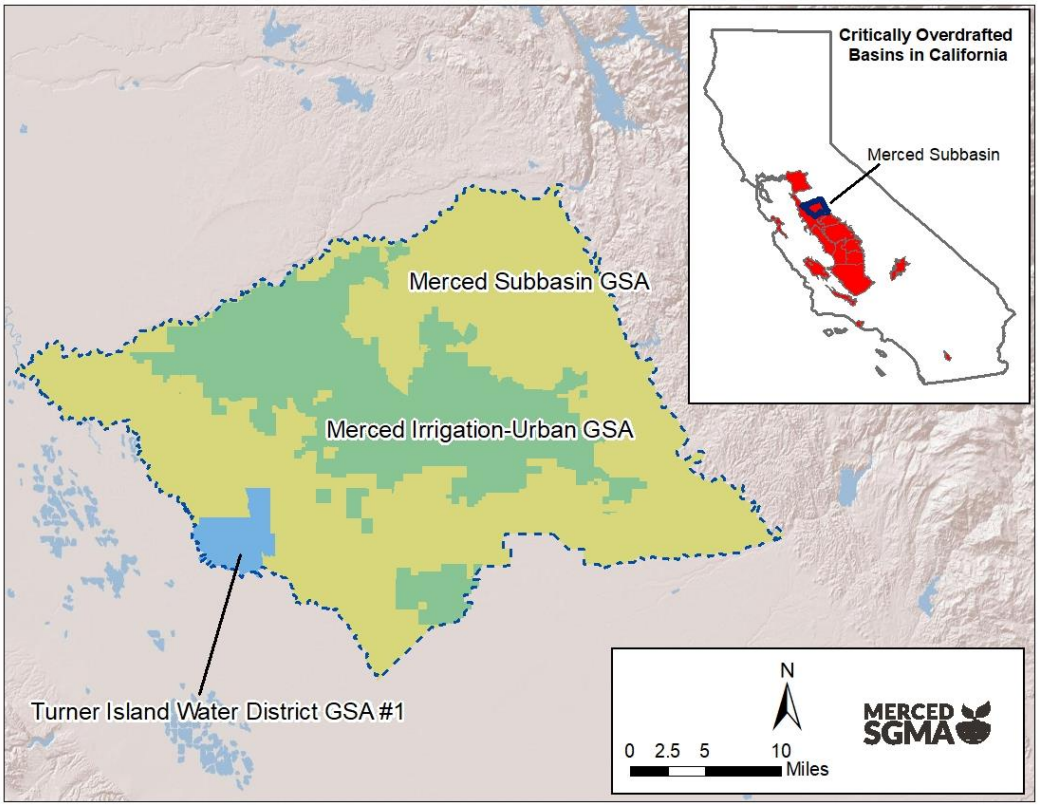
TIWD	Turner Island Water District
TIWD GSA-1	Turner Island Water District Groundwater Sustainability Agency #1
TUP	Temporary Use Permit
UC Merced	University of California, Merced
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WY	water year

EXECUTIVE SUMMARY

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 goal of achieving sustainable management of California's groundwater basins. Additionally, SGMA requires GSPs to be evaluated in the form of Periodic Evaluations every five years and whenever a GSP is amended. The purpose of this Periodic Evaluation is to provide an update to the Department of Water Resources, interested parties, and the public on the progress the GSAs have made on implementing the Merced Groundwater Subbasin GSP.

The County of Merced and water districts 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), collectively referred to as the "GSAs" (see **Figure ES-1**). The GSAs most recently revised and submitted the GSP to the California Department of Water Resources (DWR) in July 2022 (referred to as the 2022 GSP), which was approved in 2023. The GSAs coordinated efforts to develop this Periodic Evaluation for the Subbasin.

Figure ES-1: Merced Subbasin Location Map and GSAs



This Periodic Evaluation assesses the implementation period between the water years (WYs) 2020 through 2024 (referred to throughout this document as "evaluation period") and is accompanied by the Amended Merced Groundwater Subbasin Groundwater Sustainability Plan 2025 (referred to as the 2025 GSP), which was amended and adopted by all three GSAs in December 2024/January 2025.

New Information Collected

During the evaluation cycle, significant new information warranted changes to numerous sections of the GSP. For instance, in 2023, DWR published results of the airborne electromagnetic (AEM) survey conducted in the Merced Subbasin which also provided a description of the well data collected along the planned flight lines. Together, the AEM and additional well data were used to refine the Hydrogeologic Conceptual Model and update the Basin Setting.

The Merced Water Resources Model (MercedWRM) is updated on an annual basis with the latest data available to evaluate recent groundwater conditions within the Subbasin. Updated components of the MercedWRM include surface water diversions and deliveries, groundwater extraction volumes, population changes, land use changes, precipitation data, streamflow data, groundwater elevations, Merced Irrigation District (MID) canal recharge from monthly diversions, and inter-basin flow estimates. In addition, significant updates and refinements were made to the MercedWRM during the preparation of the 2025 GSP.

Groundwater Conditions Relative to Sustainable Management Criteria

The sustainability goal for the Merced Subbasin is to:

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

The sustainability goal is supported by the locally defined minimum thresholds that prevent undesirable results. Achievement of the goal is demonstrated by the avoidance of undesirable results.

Groundwater Levels

The 2022 GSP defines undesirable results as "when November groundwater levels at greater than 25 percent of representative monitoring wells (at least 8 of 29) fall below their minimum thresholds for two consecutive years" (MIUGSA, MSGSA, & TIWD GSA-1, 2022). Fourteen representative monitoring wells exceeded their respective minimum thresholds during the evaluation cycle, reflecting both drought hydrology and the need for the implementation of PMAs under development by the GSAs. However, time is required to develop, fund, and implement PMAs to achieve sustainability. As expected in the original 2020 GSP, groundwater levels have continued to decline since the adoption of that Plan, which is accounted for through planned Interim Milestones while PMAs are being developed and implemented.

Reduction of Groundwater Storage

In the 2022 GSP, the reduction of groundwater storage sustainability indicator was not considered applicable to the Subbasin, and sustainable management criteria were not established. However, DWR recommended that due to the critically overdrafted status of the Subbasin and the continued decline in groundwater levels, the reduction of groundwater storage should be included as an applicable indicator and that sustainable management criteria should be established. While the GSAs have documented that undesirable results for reductions of groundwater in storage have not occurred and are not expected to occur in the Subbasin due to the volume of available groundwater in storage, the GSAs have elected to define sustainable management criteria for this indicator via groundwater levels as a proxy.

Degraded Water Quality

In the 2022 GSP, the GSAs established a minimum threshold of 1,000 mg/L of Total Dissolved Solids (TDS) for the degraded water quality sustainability indicator. The measurable objective and all interim milestones were set at 500 mg/L TDS. Undesirable results are defined in the GSP as "during GSP implementation when at least 25% of representative monitoring wells (6 of 22 sites) exceed the minimum threshold for degraded water quality for two consecutive years" (MIUGSA, MSGSA, & TIWD GSA-1, 2022). During the evaluation cycle, TDS concentrations observed in the Subbasin's monitoring network did not exceed the minimum threshold. Additionally, sixteen monitoring locations consistently achieved the measurable objective.

DWR recommended that the 2025 GSP include additional justification and explanation for how water quality constituents, such as arsenic and nitrate, will be managed and monitored, and how impacts to beneficial uses and users will be addressed should there be degradation of water quality during plan implementation when lower groundwater elevations are expected. Results from analysis show that no significant trend exists between groundwater elevation changes and changes in concentrations of nitrate, arsenic, or other common constituents within the Subbasin.

Inelastic Land Subsidence

In the 2022 GSP, the GSAs established a minimum threshold of 0 ft/year (subject to uncertainty of ±0.16 ft/year) at four representative monitoring stations. The measurable objective is also 0 ft/year, with interim milestones of -0.75 ft/year (2025), -0.50 ft/year (2030), and -0.25 ft/year (2035) of subsidence. The GSP identifies undesirable results for subsidence as "exceedances of minimum threshold rates of land subsidence at three or more monitoring sites out of four for two consecutive years" (MIUGSA, MSGSA, & TIWD GSA-1, 2022). While subsidence has typically been observed at the representative monitoring sites from 2019 to 2023, the rates of subsidence have consistently been less than the 2025 IM of -0.75 ft/yr, with the most recent rate of subsidence demonstrating an increase in land surface elevation (positive value).

Depletion of Interconnected Surface Waters

In the 2022 GSP, undesirable results for depletions of interconnected surface water include depletions that result in reductions in flow or levels of major rivers and streams that are hydrologically connected to the Subbasin such that the reduced surface water flow or levels have a significant and unreasonable adverse impact on beneficial uses of the surface waters. The chronic lowering of groundwater levels sustainability indicator was established as a proxy for depletions of interconnected surface water. Thus, an undesirable result would occur for both sustainability indicators when November groundwater levels at 25% or more representative monitoring wells exceed their respective minimum thresholds for two consecutive years. Because groundwater levels are used as a proxy for interconnected surface water, minimum thresholds, measurable objectives, and interim milestones are equivalent between both sustainability indicators at their respective locations.

Recommended Corrective Actions

DWR provided nine recommended corrective actions in the *GSP Assessment Staff Report, San Joaquin Valley – Merced Subbasin (No. 5-022.04)* dated August 4, 2023 (DWR, 2023), attached as **Appendix A**. These recommended corrective actions are summarized below in **Table ES-1**. Progress on responding to each recommendation is detailed within the Periodic Evaluation.

Table ES-1: Recommended Corrective Action Summary

Recommended Corrective Action #	Recommended Corrective Action Summary
1a	The GSAs should initiate the Domestic Well Mitigation Program prior to impacts being observed in domestic wells given that groundwater level interim milestones are below minimum thresholds and historical lows. The program should be monitored by the GSAs and the funding mechanism should be assessed should mitigation exceed the proposed budget.
1b	The GSAs are aware that the lowering of groundwater levels can cause degradation of groundwater water. DWR staff recommend the GSAs describe how potential impacts to degradation of groundwater quality will be managed, including how coordination with groundwater users, including water, environmental, and irrigation users will be conducted and how such coordination will be utilized to address groundwater quality degradation, should it occur during Plan implementation. The GSAs should describe how potential impacts to degradation of groundwater quality will be managed, including how coordination with groundwater users, including water, environmental, and irrigation users will be conducted and how such coordination will be utilized to address groundwater quality degradation.
2	The GSP should include additional assessments on the impacts to beneficial uses and users from continued overdraft anticipated from the potential short-term decline of groundwater levels related to 2025 and 2030 interim milestones.
3a	The GSAs should identify the total cumulative subsidence tolerable by critical infrastructure. The Plan should also include additional details describing measures that consider and disclose the current and potentially lasting impacts of subsidence on land uses and groundwater beneficial uses and users
3b	The GSAs should revise its application of the level of uncertainty as it relates to subsidence measurements according to standard professional practices.
4	DWR recommends the GSAs further investigate the 56 wells which are said to be drilled below the bottom of the basin and confirm to what extent they are active. If these wells are active, then the GSAs should determine their groundwater extractions and account for that activity in the Plan.

Recommended Corrective Action #	Recommended Corrective Action Summary
5	DWR recommends Sustainable Management Criteria for reduction of groundwater storage should be established by the periodic evaluation.
6a	The GSAs should evaluate how water quality constituents of concern other than TDS will be managed and monitored and how impacts to beneficial uses and users will be addressed. Consider developing sustainable management criteria for these constituents.
6b	The GSAs should provide additional details supporting the selection of TDS criteria and justify why TDS concentrations exceed the secondary maximum contaminant level.
7a	The GSAs should establish sustainable management criteria for depletions of interconnected surface water while incorporating the location, quantity, and timing of depletions. Consider utilizing the interconnected surface water guidance when issued by the DWR.
7b	The GSAs should continue to fill data gaps, collected additional monitoring data, and implement the current strategy to manage interconnected surface water depletions and define segments of interconnectivity and timing.
7c	Prioritize collaboration and coordination with local, state, and federal regulatory agencies and interested parties to understand impacts to beneficial uses and users that may be impacted by interconnected surface water depletions.
8	The GSAs should prioritize filling data gaps in the groundwater level monitoring network and describe how filling these data gaps will assist in the successful implementation of the Above Corcoran Sustainable Management Criteria Adjustment Consideration Management Action.
9	The GSAs should provide a robust discussion explaining how the implementation of the projects and management actions will restore groundwater levels up to the measurable objective by 2040 and how certain management actions will avoid impacts to the sustainability indicators.

Projects and Management Actions

Since adoption of the 2022 GSP, nine projects have been completed and are actively implemented in the Subbasin. Most of these projects were feasibility studies, incorporation of new data sources into the MercedWRM, and local policy changes. As a result, quantified benefits were not able to be determined for all projects. However, these projects have allowed the GSAs to better understand groundwater conditions in the Subbasin and informed future implementation of planned projects. The GSAs have also included nineteen additional projects, identified as part of developing applications for funding by the Sustainable Groundwater Management grant program. While several projects are currently in the conceptual phase, seven are nearing implementation and have estimated groundwater benefits. Following implementation, these projects are anticipated to provide approximately 34,000 AFY of groundwater benefits in the form of direct recharge, in-lieu recharge, and demand reductions. The GSAs intend to track project benefits through the chronic lowering of groundwater levels monitoring network and through project-specific monitoring activities. A list of completed and active projects is listed below in **Table ES-2**.

Table ES-2: Projects Lists

Completed Projects	Active Projects
El Nido Conveyance System Improvements Project	Amsterdam Water District Surface Water Conveyance and Recharge Project
Planada Groundwater Recharge Basin Pilot Project	Crocker Control Structure Rehabilitation
Meadowbrook Water System Intertie Feasibility Study	G Ranch and La Paloma Mutual Water Company Groundwater Recharge, Habitat Enhancement, and Floodplain Expansion Projects
Merced Groundwater Subbasin LiDAR	LeGrand-Athlone Water District Intertie and Recharge Project (Phase 1 & 2)
Merced Irrigation District to Lone Tree Mutual Water Company Conveyance Canal	Turner Island Water District Water Conservation
Merced Subbasin GSP Development Project for Addressing Critical Data Gaps	Vander Dussen Subsidence Priority Area Flood-MAR Project
Mini-Big Conveyance Project Feasibility Study	Vander Woude Storage Reservoir
Streamlining Permitting for Replacing Sub-Corcoran Wells	
Study for Potential Water System Intertie Facilities from MID to LeGrand-Athlone Water District (LGAWD) and Chowchilla Water District (CWD)	

Four management actions were presented in the 2022 GSP, and progress has been made in developing them during the evaluation cycle. The 2025 GSP adds the Merced Irrigation-Urban GSA Groundwater Allocation management action. The management actions in development within the Subbasin are listed below:

- Integrated Groundwater Allocation Framework
- Merced Subbasin GSA Groundwater Demand Reduction
- Merced Irrigation-Urban GSA Groundwater Allocation
- Domestic Well Mitigation Program
- Above Corcoran Sustainable Management Criteria Adjustment Consideration

Monitoring Networks

The 2022 GSP established monitoring networks for groundwater levels, degraded water quality, inelastic land subsidence, and depletions of interconnected surface waters. Since the 2022 GSP was published, reduction of groundwater in storage was incorporated as a sustainability indicator and, as a result, sustainable management criteria and a monitoring network were established, per DWR's recommendation. The 2025 GSP uses the monitoring network established for groundwater levels as a proxy for the reduction of groundwater in storage and depletions of interconnected surface waters.

A high-level summary of monitoring network changes is provided below, with more details in the main body of the Periodic Evaluation:

- Groundwater Levels - nineteen monitoring wells added, eight of which include sustainable management criteria.
- Groundwater Quality – The structure of the monitoring network remains the same, utilizing wells from the Eastern San Joaquin Water Quality Coalition (ESJWQC) Groundwater Quality Trend Monitoring (GQTM) program, as well as wells sourced from Public Water System (PWS) reporting to the Division of Drinking Water (DDW). During the evaluation cycle, some PWS wells were removed from the monitoring network as a result of being destroyed or discontinued from their respective monitoring program. Other wells were added as a result of being added to the ESJWQC GQTM or starting to report data to DDW.
- Land Subsidence – remains unchanged from the 2022 GSP.
- Groundwater Storage and Interconnected Surface Waters – mirrors changes to groundwater levels.

Data gaps were identified in the 2022 GSP for all applicable sustainability indicators. A Data Gaps Plan was prepared by the GSAs and adopted in 2021 (Woodard & Curran, 2021). The Data Gaps Plan identified data gaps presented in the Subbasin's monitoring network, prioritized the addressing data gaps for certain sustainability indicators, and planned implementing activities to fill data gaps. Overall, data gaps have been partially addressed for the groundwater level (and by proxy, groundwater storage and interconnected surface waters) and water quality monitoring networks.

Outreach and Engagement

During GSP development, the GSAs used multiple channels of outreach to communicate SGMA-related information, provide opportunities for engagement, and solicit public input. This included encouraging public participation at public meetings, providing access to GSP information online, and continuing to coordinate with entities conducting outreach to DAC communities within the Subbasin. As outreach and engagement activities are crucial in the development of the Periodic Evaluation and GSP, the GSAs regularly presented components of these documents during public meetings to gain input from stakeholders and distributed emails as key deliverables were finalized, when opportunities were either available for stakeholder input, or when items of interest to the stakeholder group arose. Topics of discussion included but were not limited to: establishment and refinement of sustainable management criteria; modeling efforts used to develop water budgets; changes to basin setting based on new information; and progress updates on PMAs. These meetings allowed the public, local stakeholders, and regulatory agencies to provide input on the GSAs' approach to developing the GSP and Periodic Evaluation.

1. INTRODUCTION

§356.4 *Each Agency shall evaluate its Plan at least every five years and whenever the Plan is amended, and provide a written assessment to the Department. The assessment shall describe whether the Plan implementation, including implementation of projects and management actions, are meeting the sustainability goal in the basin…*

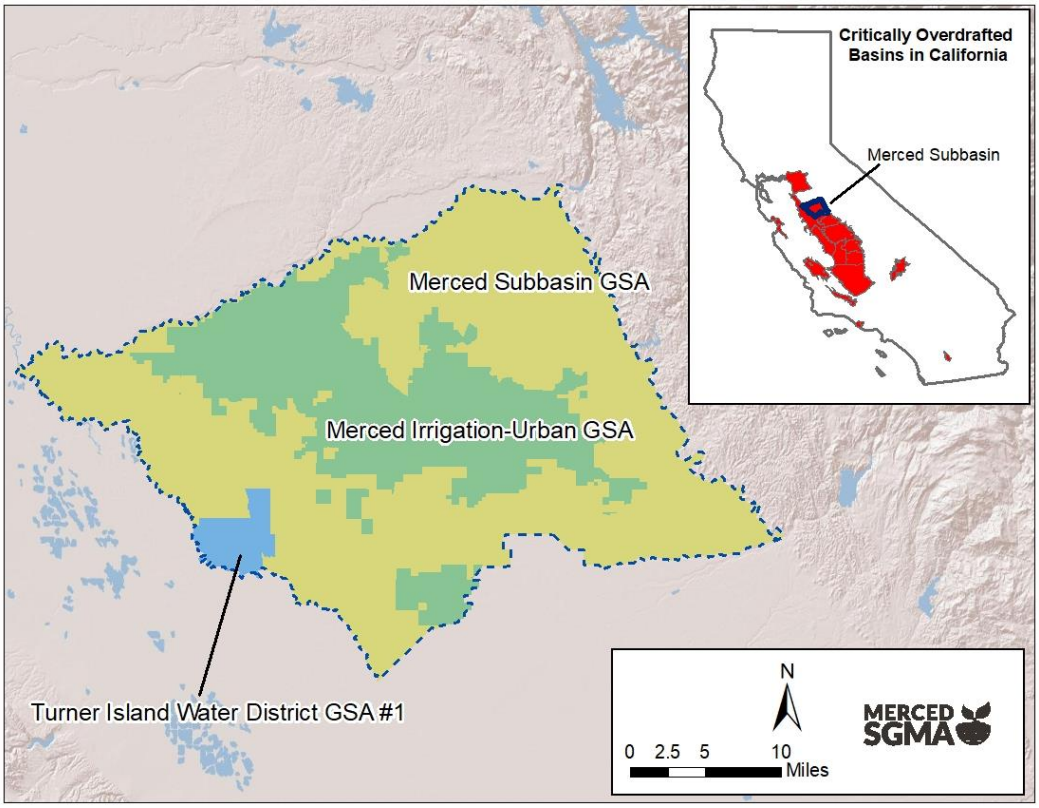
The Sustainable Groundwater Management Act (SGMA), passed in 2014, requires the formation of local Groundwater Sustainability Agencies (GSAs) to oversee the development and implementation of Groundwater Sustainability Plans (GSPs), with the goal of achieving sustainable management of California's groundwater basins. Additionally, SGMA requires GSPs to be evaluated in the form of Periodic Evaluations every five years and whenever a GSP is amended. The purpose of this Periodic Evaluation is to provide an update to the California Department of Water Resources (DWR), interested parties, and the public on changing conditions in the Merced Subbasin, the progress the GSAs within the Merced Subbasin have made on implementing the Merced Groundwater Subbasin GSP, and the need, if any, for an amendment to the GSP.

1.1 Plan Authority

The Merced Groundwater Subbasin (Subbasin) is designated as a critically overdrafted, high-priority basin by the California Department of Water Resources (DWR), resulting in the Subbasin being subject to SGMA with a requirement to adopt a GSP by January 31, 2020. In accordance with SGMA requirements, Merced County, irrigation districts, water districts, and cities within the Subbasin formed three GSAs: 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), collectively referred to as the "GSAs" (see **Figure 1-1**). The GSAs coordinated efforts to implement SGMA within the Subbasin, including developing this Periodic Evaluation.

In January 2020, the GSAs submitted the original 2020 GSP to DWR and received an incomplete determination on January 28, 2022. The GSP was revised and submitted to DWR as the July 2022 Revised Groundwater Sustainability Plan (2022 GSP) on July 26, 2022. DWR approved the 2022 GSP in the determination letter issued to the GSAs on August 4, 2023, which included recommended corrective actions to be addressed in this Periodic Evaluation.

Figure 1-1: Merced Subbasin Location Map and GSAs



This Periodic Evaluation assesses the implementation period for WYs 2020 through 2024 and is accompanied by the Amended Merced Groundwater Subbasin Groundwater Sustainability Plan, which was amended and re-adopted by all three GSAs in December 2024/January 2025.

1.2 Purpose of the Periodic Evaluation

The purpose of this Periodic Evaluation is to provide an assessment of the progress the GSAs have made toward achieving the Subbasin's sustainability goal. The Periodic Evaluation also provides DWR, interested parties, and the public with the progress the GSAs have made on implementing the 2022 GSP. Further, this Periodic Evaluation also discusses amendments to the 2022 GSP in response to the *GSP Assessment Staff Report, San Joaquin Valley – Merced Subbasin (No. 5-022.04)* issued by DWR on August 4, 2023 (DWR 2023) and in response to other changes in the Subbasin. The amendments to the 2022 GSP resulted in the adoption of the 2025 Merced Groundwater Subbasin Groundwater Sustainability Plan (2025 GSP). The 2025 GSP and a redlined version of the 2022 GSP that highlights the edits can be found on MercedSGMA.org.

This Periodic Evaluation summarizes and assesses new and significant information, groundwater conditions for each applicable sustainability indicator identified in the approved GSP, actions taken to address recommended corrective actions issued by DWR, status of projects and

management actions (PMAs), updates to the basin setting, updates to the monitoring network, and the authorities and actions taken by the GSAs during this evaluation cycle.

Development of the Periodic Evaluation was 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 were 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 PMAs to improve sustainability in the basin. Extensive outreach was also conducted to seek input from additional beneficial users of groundwater through multiple venues including public workshops.

2. NEW INFORMATION COLLECTED

§356.4(f) *A description of significant new information that has been made available since Plan adoption or amendment, or the last five-year assessment. The description shall also include whether new information warrants changes to any aspect of the Plan, including the evaluation of the basin setting, measurable objectives, minimum thresholds, or the criteria defining undesirable results.*

This section presents new and significant information acquired since adoption of the 2022 GSP. Information that was determined new and significant is summarized in **Table 2-1**. The table describes the new information, indicates which aspects of the GSP are affected, and whether the new information warranted a change to the GSP. Note that in several cases the information was not deemed substantial enough to trigger modifications to the GSP, but modifications were made to address the relatively minor changes.

Table 2-1: Significant New Information

Significant New Information	Description	Aspects of Plan Affected	Warrant Change to Any Aspects of the Plan
Airborne Electromagnetic (AEM) Data Collection	AEM data were collected in the Subbasin by DWR in April 2023. These data were incorporated into the Subbasin's groundwater model (MercedWRM) and used to modify the hydrogeologic conceptual model.	Basin Setting	No, but new information added in Section 2.1.4.3 of the 2025 GSP
Water Quality Monitoring Data and Analyses	Concentrations of arsenic, nitrate, and other constituents were compared to groundwater levels to determine if there is a correlation between groundwater level decline and concentrations.	Sustainable Management Criteria	No, but information added to Section 3.6.2 of the 2025 GSP
Groundwater Level Monitoring Data	New monitoring wells were incorporated into the monitoring network (including existing wells and new dedicated monitoring wells) between 2020 and 2023 to partially address data gaps identified in the 2022 GSP, provide future representative monitoring wells, and better evaluate progress towards achieving sustainability.	Sustainable Management Criteria, Monitoring Network	Yes, see Section 3.3 of the 2025 GSP

Significant New Information	Description	Aspects of Plan Affected	Warrant Change to Any Aspects of the Plan
Merced Water Resources Model (MercedWRM) Update	Components of the MercedWRM were updated annually to incorporate the latest available data. Further, the MercedWRM was refined to improve the overall representation of the Subbasin. Results from the model update were used to evaluate sustainable yield, the ability of PMAs to achieve sustainability, the reduction of groundwater in storage sustainability indicator, the correlation between storage and groundwater levels, and the indicator's applicability to the Subbasin.	Sustainable Management Criteria	Yes, see Section 2.3 of the 2025 GSP
Well Impact Analysis	Evaluated potential impacts to domestic and public water supply wells during periods of anticipated groundwater level decline below the groundwater level minimum threshold.	Sustainable Management Criteria, Projects and Management Actions	No, but information added in Section 3.3.2 and Section 6.2.5 of the 2025 GSP
Below Bottom of Basin Well Investigation	Analysis was conducted on wells that extended below the bottom of the Subbasin's vertical extent. Construction information on these wells was obtained and evaluated to determine potential changes to the Basin Setting.	Basin Setting	No, but information added in Section 2.1.6.2 of the 2025 GSP
Interconnected Surface Water Analysis	Updated analysis of timing and location of depletions of interconnected surface waters	Basin Setting	Yes, see section 2.2.7 of the 2025 GSP
Local Stakeholder Input	Land subsidence - critical infrastructure considerations/potential impacts	Sustainable Management Criteria	No, but activities discussed in Section 3.4.3 of the Periodic Evaluation

Significant new information warranted changes to the Basin Setting, Sustainable Management Criteria, and Monitoring Network sections of the 2022 GSP and this information was incorporated into the 2025 GSP, as described below.

Airborne Electromagnetic Data Surveys

On April 15, 2023, DWR published the *Data Report for Survey Area 5, Merced, Turlock and Modesto Groundwater Subbasins* which discussed the acquisition, processing, inversion and lithology transform for the airborne electromagnetic (AEM) survey conducted in the Merced, Turlock and Modesto Subbasins. The report also provided a description of the well data collected along the planned flight lines. Together, the AEM and additional well data were used to update the basin setting. Additional information related to the AEM survey and updates to the hydrogeologic conceptual model are discussed further in **Section 5.1** of this Periodic Evaluation and Section 2.1.4.3 of the 2025 GSP. Additionally, the *Data Report for Survey Area 5, Merced, Turlock and Modesto Groundwater Subbasins* is included in **Appendix B**.

Groundwater Level Monitoring Wells

Following the approval of the 2022 GSP, twelve monitoring wells were installed within the Subbasin to address a portion of the data gaps identified in the 2022 GSP. Six wells were installed in the Above Corcoran Clay Principal Aquifer, five wells in the Below Corcoran Clay Principal Aquifer, and one nested well (with three completions) was installed in the Outside Corcoran Clay Principal Aquifer. Sustainable management criteria were established for select new monitoring wells and the methodology for establishing these criteria are discussed in **Section 3.1** of the Periodic Evaluation and Section 3.3.2 of the 2025 GSP. Locations of the newly installed monitoring wells are discussed further in **Section 6.1** of the Periodic Evaluation and Section 4.5.1 of the 2025 GSP.

Updates to MercedWRM

The Merced Water Resources Model (MercedWRM) is updated on an annual basis with the latest data available to evaluate recent groundwater conditions within the Subbasin for each annual report. Updated components of the MercedWRM include surface water diversions and deliveries, groundwater extraction volumes, population changes, land use changes, precipitation data, streamflow data, groundwater elevations, Merced Irrigation District (MID) canal recharge from monthly diversions, and inter-basin flow estimates. Results from the latest MercedWRM update are discussed further in **Section 5.4** of the Periodic Evaluation and Section 2.3 of the 2025 GSP.

Numerous additional significant refinements to the MercedWRM were made for the 2025 GSP Update, focusing on the Land Surface and Groundwater Systems, which are described further in **Section 5.4** of the Periodic Evaluation and Section 2.3.2 of the 2025 GSP.

Data incorporated into the MercedWRM was also used to analyze the relationship between groundwater levels and groundwater storage within the Subbasin. The model results show a linear relationship between groundwater levels and storage changes, indicating a direct correlation between both components. Results related to the evaluation of groundwater storage from the MercedWRM are discussed further in **Section 5.4** of the Periodic Evaluation and Section 3.4 of the 2025 GSP.

Interim Milestone Well Impact Analysis

To evaluate the impact of a fall 2015 minimum threshold, Merced County's electronic well permitting database was used to determine the shallowest domestic or Public Water System well depth within five miles of each representative monitoring well (defined as a circle around the monitoring well with radius of five miles). The Merced County well permitting database includes domestic and Public Water System wells permitted by the county since the early- to mid-1990s. While DWR's Online System for Well Completion Reports (OSWCR) contains additional wells permitted before the 1990s, the Merced County well permitting database was assumed to provide a reliable current representation of active domestic wells in the Subbasin. Additionally, it provides more specific information about these wells such as detailed location from latitude/longitude coordinates, address, or APN, as well as well status as part of the county's permit approval workflow process. The Merced County well permitting database was filtered to omit known inactive wells, resulting in approximately 3,298 wells with locations that could be plotted geographically within the Subbasin and that had a total well depth reported. 3,185 of these wells (99.5%) are located within 5 miles of one of the representative monitoring wells. Additional analysis resulted in the filtering out of additional wells from the subset of 3,185 as described in the bullets below. However, it is likely that the resulting dataset still includes wells that have become inactive but are not flagged in the county's database.

- 8 wells reviewed manually and confirmed to be associated with a later well destruction record
- 8 wells that do not meet county domestic well annular seal requirements (depth of 50 feet or less)
- 181 wells flagged as other outliers

Total well depths were compared to the minimum threshold. At three out of 29 representative monitoring wells, minimum threshold (fall 2015) elevation data are lower than the shallowest domestic well depth, indicating that these domestic wells may already have been dewatered and replaced. The five station IDs are 28392 (21 wells, equivalent to 41% of nearby wells), 38884 (1 well, equivalent to 2% of nearby wells), and 52716 (1 well, equivalent to 5% of nearby wells), 60562 (3 wells, equivalent to 2% of nearby wells), 47575 (1 well, equivalent to 1% of nearby wells). Again, it is expected that these wells have likely since been deepened or abandoned and replaced given that groundwater levels have declined to this level in the past. Thus, returning to this level would not be expected to dewater these wells again. Recall that available datasets often include wells that are no longer in use for a variety of reasons.

Additional analysis was performed for domestic and Public Water System (PWS) wells that could potentially be dewatered during the implementation period of 2020 through 2040 when groundwater levels at representative monitoring wells may temporarily decline below minimum thresholds while PMAs are put in place. Domestic and PWS wells were flagged where their total well depth is deeper than the MT, but shallower than the 2025 and 2030 Interim Milestones. The station IDs are 10200 (estimated 2 wells), 28392 (estimated 8 wells), 38884 (estimated 2-3 wells

depending on IM), 47542 (estimated 1 well), 60562 (estimated 5 wells), and 52716 (estimated 1 well).

Below Bottom of Basin Well Investigation

Additional analysis was performed on the deep wells and the relationship with the bottom of the basin. Further investigation found 14 wells with screen intervals (or total depth where screen information was not available) that extended below the GSP-defined bottom of the basin. The previously published analysis only considered total well depth and did not take into consideration screen depth. These wells are all located in the eastern corner of the subbasin, southeast of Planada along South Santa Fe Avenue, near Buchanan Hollow Rd just east of South Santa Fe Avenue, and northwest of Planada between Highway 140 and Flying M Airport, near Bear Creek. The wells are all private agricultural wells and no reporting of use is required. However, the GSP and associated analysis incorporates all groundwater use for the area, as agricultural groundwater use is based on crop type and other factors as described in GSP section 2.3.2. Monitoring and enforcement of groundwater extraction from these wells would generally not be different from other wells in the Subbasin. Additional detail on this small number of deep wells and the potential for further study is included in the revised GSP in Section 2.1.6.2.

Depletion of Interconnected Surface Water Analysis

Depletions were quantified during the evaluation cycle through a modeling exercise to isolate the impacts of pumping on interconnected surface waters. The historical conditions simulation of the MercedWRM was used together with a newly developed simulation that removed pumping from the Merced Subbasin. The scenarios were simulated over a 30-year period from water years 1994 to 2023. This allowed for a comparison between historical conditions and a no-pumping simulation that could inform the impact of pumping on surface water bodies. Stream depletion was calculated by obtaining the difference in the stream-groundwater flow with and without groundwater pumping.

The time response in which the effects of pumping are seen in the stream depletions depend on many factors, including geologic structure, hydraulic properties of the groundwater system and the streambed, location of pumping, and location of surface water bodies amongst other factors. In the case of the Merced Subbasin, an estimate from MercedWRM indicates that about 50% of the pumped volume results in depletions or changes in out-of-basin subsurface flows in the 10 years following pumping, and about 70% happen within the 30-year simulation period. Based on an average of water years 2018 to 2023 conditions, the model estimated 504,400 AFY of depletions and 141,800 AFY of increase in subsurface groundwater inflow (eventually out-of-Subbasin depletions) conditions.

3. GROUNDWATER CONDITIONS RELATIVE TO SUSTAINABLE MANAGEMENT CRITERIA

§356.4(a) *A description of current groundwater conditions for each applicable sustainability indicator relative to measurable objectives, interim milestones and minimum thresholds.*

3.1 Groundwater Levels

3.1.1 Overview based on 2022 GSP

As documented in the 2023 Annual Report, groundwater levels are generally above the 2025 interim milestones (IMs) developed to guide GSP implementation. IMs were established to facilitate the Subbasin reaching its measurable objectives for groundwater levels. The GSAs expect some level of continued groundwater level decline in much of the Subbasin (as was observed during critically dry conditions in WYs 2015-2017, 2020-2022) while PMAs are developed and implemented, and due to hydrologic uncertainty. Thus, the IMs for groundwater levels allow for temporary further groundwater level decline below the minimum threshold (MT).

3.1.2 Recent Conditions

The 2022 GSP defines undesirable results as "when November groundwater levels at greater than 25 percent of representative monitoring wells (at least 8 of 29) fall below their minimum thresholds for two consecutive years" (MIUGSA, MSGSA, & TIWD GSA-1, 2022). Per DWR's draft Best Management Practice guidance document for sustainable management criteria, "Avoidance of the defined undesirable results must be achieved within 20 years of GSP implementation…Some basins may experience undesirable results within the 20-year period, particularly if the basin has existing undesirable results as of January 1, 2015. The occurrence of one or more undesirable results within the initial 20-year period does not, by itself, necessarily indicate that a basin is not being managed sustainably, or that it will not achieve sustainability within the 20-year period" (DWR, 2017).

Fourteen representative monitoring wells exceeded their respective MTs during the evaluation cycle, reflecting both drought hydrology and the need for the implementation of PMAs under development by the GSAs.

As discussed previously, time is required to develop, fund, and implement PMAs to achieve sustainability. As expected in the 2020 GSP, groundwater levels have continued to decline since the adoption of that Plan, while PMAs are being developed. While there have been several successful projects to augment water supplies, most of the anticipated benefits will occur in the future as described in Section 2.3.4.4 of the 2025 GSP. Thus, groundwater level trends declined or remained stable from WYs 2021 through 2024 compared to WY 2020 for all three principal aquifers. However, groundwater levels have increased at fifteen representative monitoring wells (RMWs) from fall 2022 to fall 2023. Based on data from 18 wells in the Above Corcoran Clay

Principal Aquifer, average groundwater level decline was 3.8 ft from fall 2019 to fall 2023. Based on data from 36 wells in the Below Corcoran Clay Principal Aquifer, average groundwater level decline was 18.8 ft from fall 2019 to fall 2023. Based on data from 14 wells in the Outside Corcoran Clay Principal Aquifer, average groundwater level decline was 23.2 ft from fall 2019 to fall 2023. These values do not consider that monitoring wells are not evenly distributed throughout the Subbasin, but the overall values still function to provide an overview of trends based on available data.

Figure 3-1 shows the location of the wells in the Subbasin's monitoring network for groundwater levels. **Figure 3-2** through **Figure 3-4** show the total change in groundwater levels between fall 2019 and fall 2023 for each principal aquifer, based on comparing the interpolated groundwater level surfaces. The Above Corcoran Clay Principal Aquifer generally shows a slight net decrease in groundwater levels throughout most of the aquifer. In the Below Corcoran Clay and Outside Corcoran Clay Principal Aquifers, groundwater levels were also found to decrease across most of the aquifers' extents. **Table 3-1** presents groundwater level data collected during the evaluation cycle and the sustainable management criteria associated with their respective monitoring site. Individual hydrographs for these wells are located in Appendix F of the 2025 GSP. All available data are shown, except for measurements flagged for quality control reasons. Hydrographs for representative monitoring wells also display the minimum threshold, measurable objective, and 2025 interim milestone, which were developed in Chapter 3 (Sustainability Indicators) of the 2022 GSP, and updated in the 2025 GSP. The hydrographs also show a water year type indicator according to the San Joaquin Valley Water Year Hydrologic Classification Index.

Figure 3-1: Groundwater Level Monitoring Network

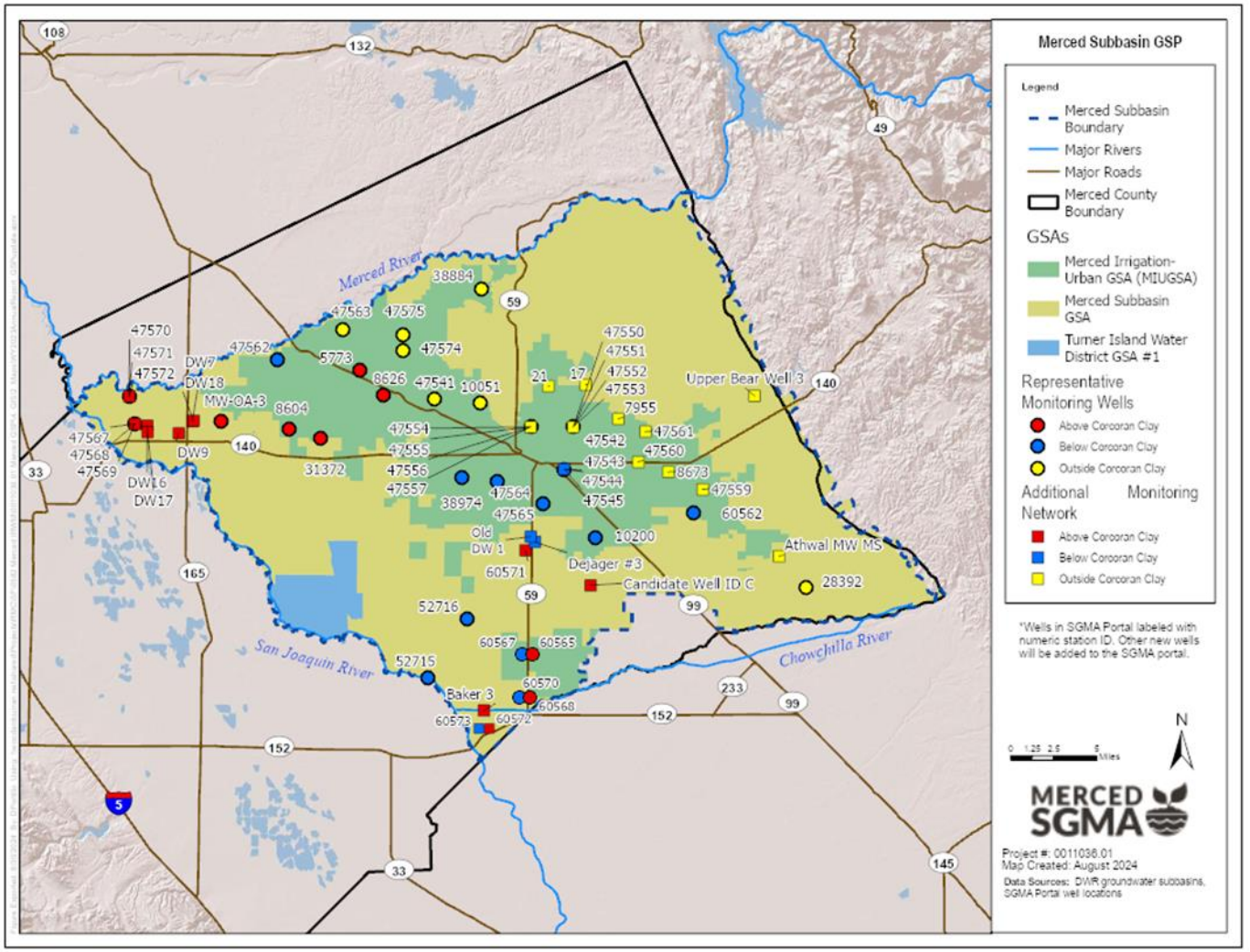


Figure 3-2: Total Change in Groundwater Levels Fall 2019 to Fall 2023, Above Corcoran Clay

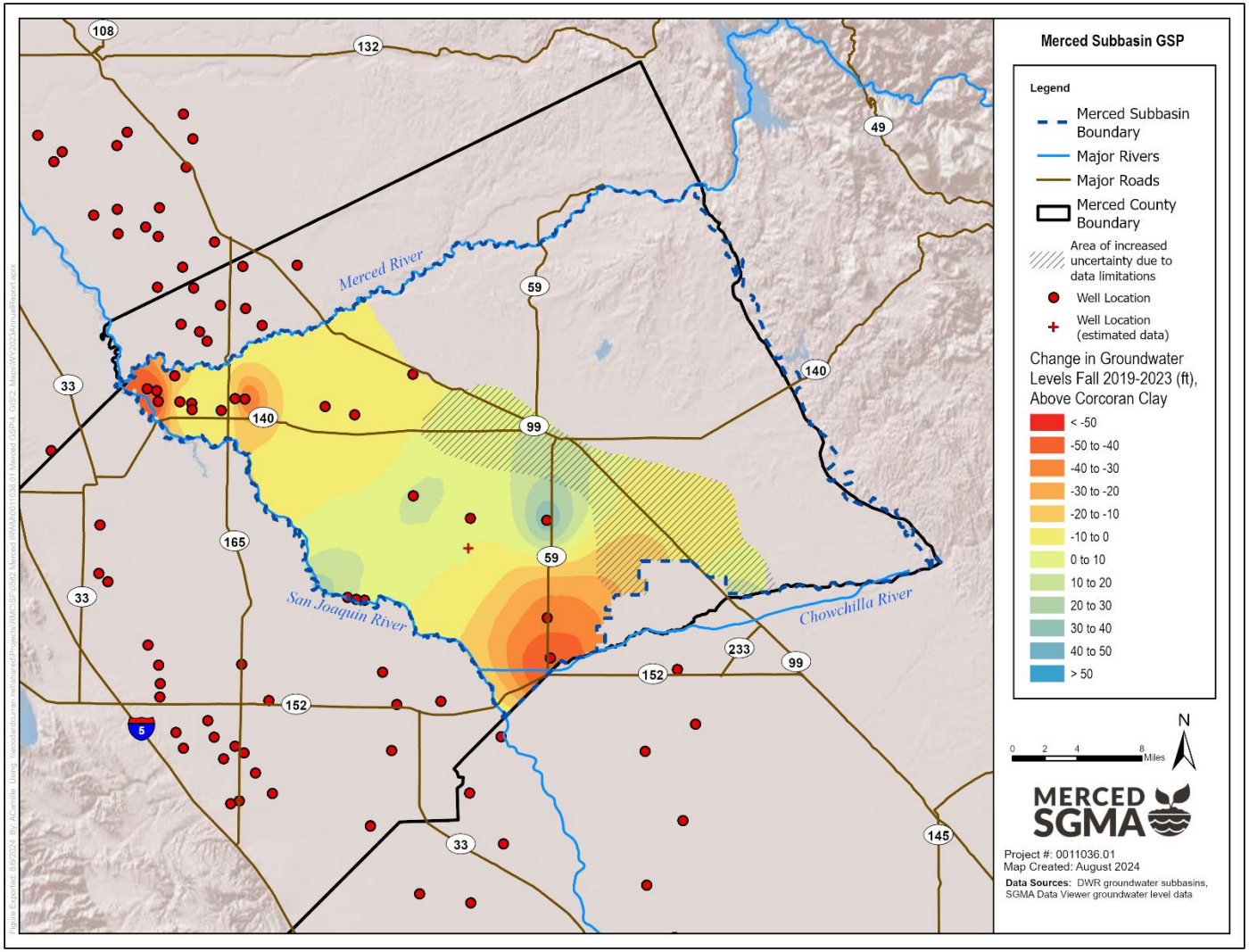


Figure 3-3: Total Change in Groundwater Levels Fall 2019 to Fall 2023, Below Corcoran Clay

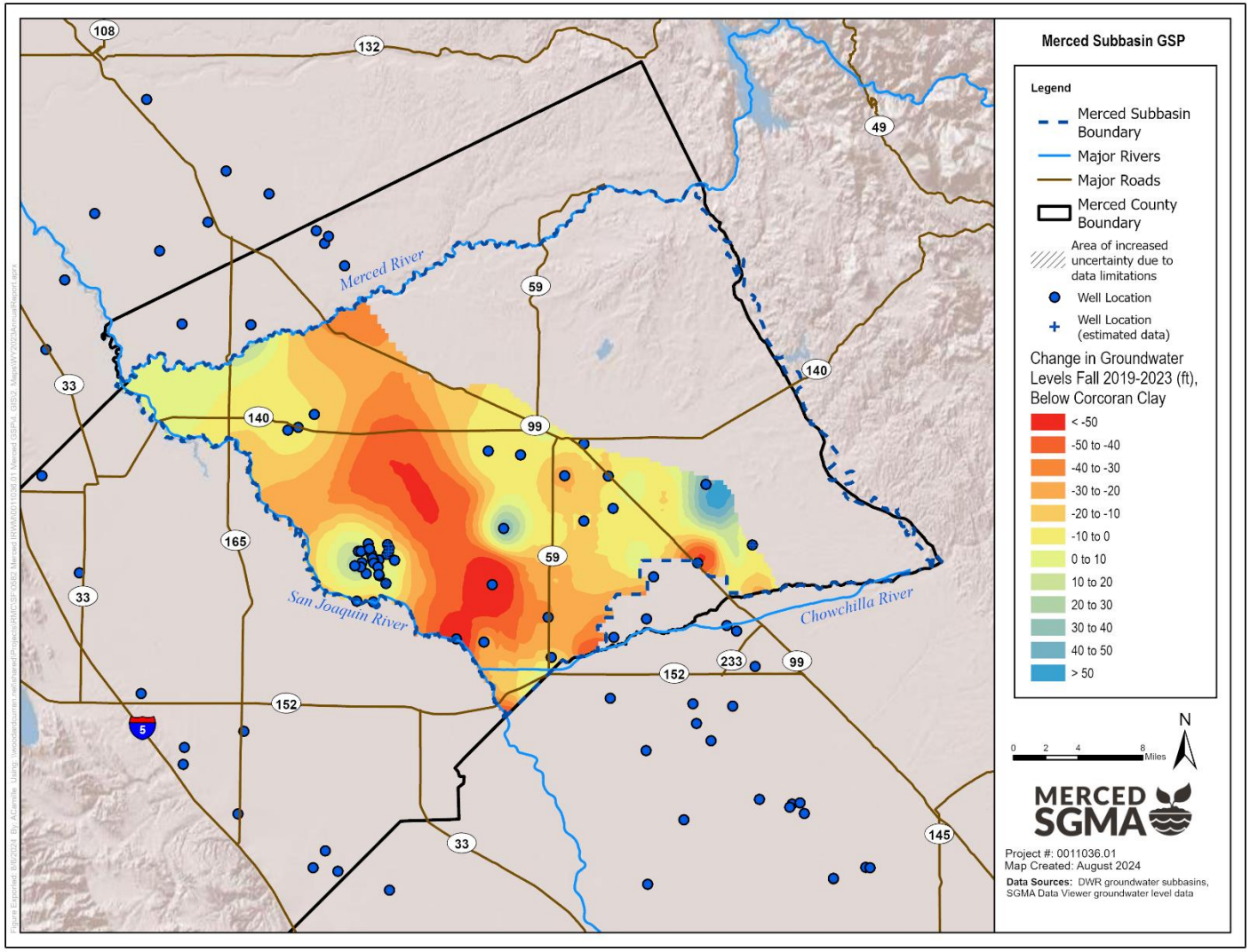


Figure 3-4: Total Change in Groundwater Levels Fall 2020 to Fall 2023, Outside Corcoran Clay

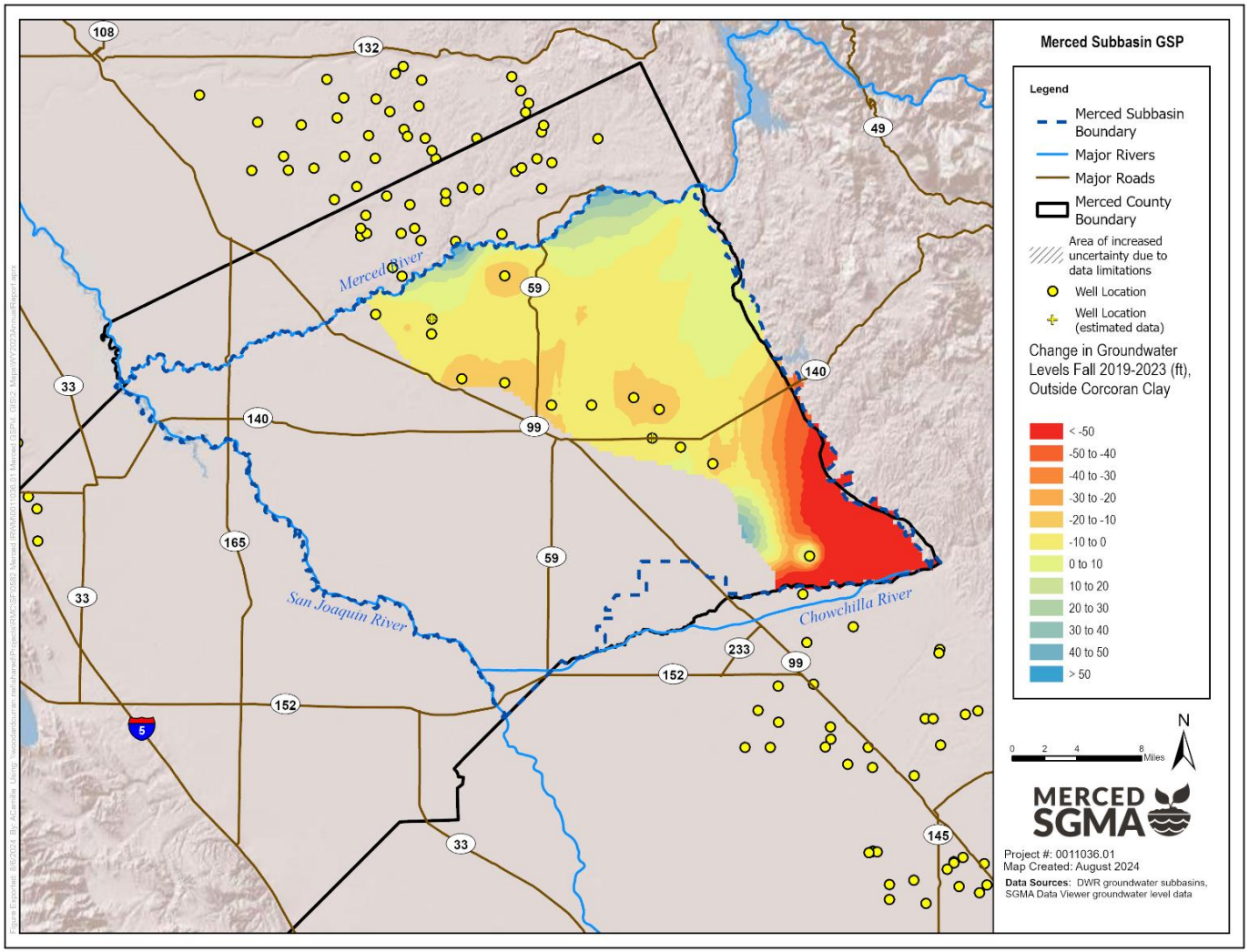


Table 3-1: Groundwater Elevations at Representative Monitoring Wells

State Well Number	SGMA Station ID	Principal Aquifer	WY 2020 GW Elevation	WY 2021 GW Elevation	WY 2022 GW Elevation	WY 2023 GW Elevation	WY 2024 GW Elevation	Minimum Threshold Elevation	Measurable Objective Elevation	Interim Milestone 2025
06S12E33D001M	5773	Above	53.49	50.49	**45.5**	**40.49**	**39.5**	46.5	73.8	26.8
07S11E15H001M	8604	Above	**58.02**	**57.42**	59.4	**52.52**	**55.0**	59	67	55.9
07S12E03F001M	8626	Above	54.33	52.93	**32.12**	**41.93**	**48.5**	48.9	78	15.5
07S11E24A001M	31372	Above	55.13	55.33	54.3	**42.33**	**49.2**	50.8	75.6	33.9
07S10E17D003M	47569	Above	67.65	64.68	65.9	63.98	68.1	61.2	68.2	59.4
07S10E06K002M	47571	Above	65.52	60.29	60.9	59.39	66.4	56.8	66.3	53.8
08S14E15R002M	10200	Below	74.16	73.16	**61.1**	**61.06**	66.7	67.2	145.2	11.5
07S13E32H001M	38974	Below	95.4	90.7	74.1	76.6	95.4	73.9	104.4	61.8
07S14E35E001M	47542	Below	74.44	**4.94**	**63.4**	**59.44**	**65.4**	73.7	112.6	38.3
06S11E27F001M	47562	Below	66.52	68.42	64.23	62.82	74.8	58.8	75.3	48.8
07S13E34G001M	47564	Below	85.7	85.9	**63.82**	**53.8**	81.7	70.2	108.7	53.5
08S14E06G001M	47565	Below	82.36	69.46	**53**	**48.66**	56.2	55.9	100.9	28.5
07S13E09A001M	10051	Outside	**69.74**	**69.54**	**57.63**	**61.74**	**56.7**	73.7	92.6	48.1
08S16E34J001M	28392	Outside	**-119.5**	NA	NA	**-99.90**	-88.9	-94.5	47.5	-169.7
06S13E04H001M	38884	Outside	80.31	78.61	**63.3**	**51.21**	**62.0**	70.7	100.4	40.4
07S12E07C001M	47541	Outside	**48.12**	**44.12**	**25.8**	**40.12**	**32.1**	56.1	66.4	29.9
07S14E16F004M	47553	Outside	**83.64**	**81.44**	**74.4**	**73.44**	**72.5**	87.4	118.1	56.8
07S13E13H004M	47557	Outside	68.37	**-0.23**	**59**	**59.77**	**61.6**	62.4	102.1	37.4
06S12E17M001M	47563	Outside	59.48	65.08	55.53	**49.48**	NA	50.5	81	33.1
06S12E23P001M	47574	Outside	**53**	**44**	**55.8**	**45.00**	**46.6**	56	80	40
06S12E23C001M	47575	Outside	60	55	51.3	NA	NA	45	89	26.1

1. *All elevations reported in feet above sea level, datum NAVD88.*
2. *Water levels were recorded in October of the specific water year; exceptions are noted below.*
3. *Minimum threshold exceedances are **bolded**, interim milestone exceedances are underlined.*
4. *Station IDs 8454, 10213, and 5226 were not recorded in water year 2020.*
5. *Measurements from Fall 2020 Station ID 28392 was -46.5 ft and recorded in December instead of October. The measurement had a Questionable Measurable flag of "nearby pump operating".*
6. *Measurements from Fall 2021 Station IDs 8626 and 47564 had a QA flag of "Other" with no other comments provided.*
7. *Station ID 28392 was not recorded in WY 2021.*
8. *Station IDs 10200, 10051, and 47574 were not measured in November 2022; the displayed measurement is from October 2022.*

9. *Station IDs 47563 and 47575 were not recorded in fall 2023 (last available measurement was March 2023).*
10. *In previous years, Station IDs 47562, 10051, and 47563 have had a QA flag of "Oil or foreign substance in casing". While they were not flagged for this issue this year, it is likely the issue persists. Oil layer depths were not measured and thus an adjusted water surface elevation cannot be estimated.*

3.1.3 Recommended Corrective Actions and Modifications to 2025 GSP

The determination issued by DWR provided one recommended corrective action related to groundwater levels (DWR 2023). DWR recommended that additional assessments be conducted to understand the impacts of decline groundwater levels on beneficial uses and users when interim milestones are reached. The determination recommended that the GSAs include a well impact analysis containing information on the number of wells that may go dry during groundwater level decline, the duration of these wells remaining dry, and how dry wells will impact beneficial uses and users.

A well impact analysis was conducted per DWR's recommendation. The analysis compared the 2025, 2030, and 2035 interim milestones at each representative monitoring well to total depths of domestic and public water supply (PWS) wells in their vicinity. More details were described in **Section 2**. The results of well impact analysis concluded that at five out of 29 representative monitoring wells, minimum threshold (fall 2015) elevation data are lower than the shallowest domestic well depth, indicating that these domestic wells may already have been dewatered and replaced. The five station IDs are 28392 (21 wells, equivalent to 41% of nearby wells), 38884 (1 well, equivalent to 2% of nearby wells), and 52716 (1 well, equivalent to 5% of nearby wells), 60562 (3 wells, equivalent to 2% of nearby wells), 47575 (1 well, equivalent to 1% of nearby wells). Again, it is expected that these wells have likely since been deepened or abandoned and replaced given that groundwater levels have declined to this level in the past. Thus, returning to this level would not be expected to dewater these wells again. Available datasets often include wells that are no longer in use for a variety of reasons.

Additional analysis was performed for domestic and PWS wells that could potentially be dewatered during the implementation period of 2020 through 2040 when groundwater levels at representative monitoring wells may temporarily decline below minimum thresholds while PMAs are put in place. Domestic and PWS wells were flagged where their total well depth is deeper than the MT, but shallower than the 2025 and 2030 Interim Milestones. The station IDs are 10200 (estimated 2 wells), 28392 (estimated 8 wells), 38884 (estimated 2-3 wells depending on IM), 47542 (estimated 1 well), 60562 (estimated 5 wells), and 52716 (estimated 1 well).

3.2 Reduction of Groundwater in Storage

3.2.1 Overview based on 2022 GSP

In the 2022 GSP, the reduction of groundwater storage sustainability indicator was not considered applicable to the Subbasin, and sustainable management criteria were not established.

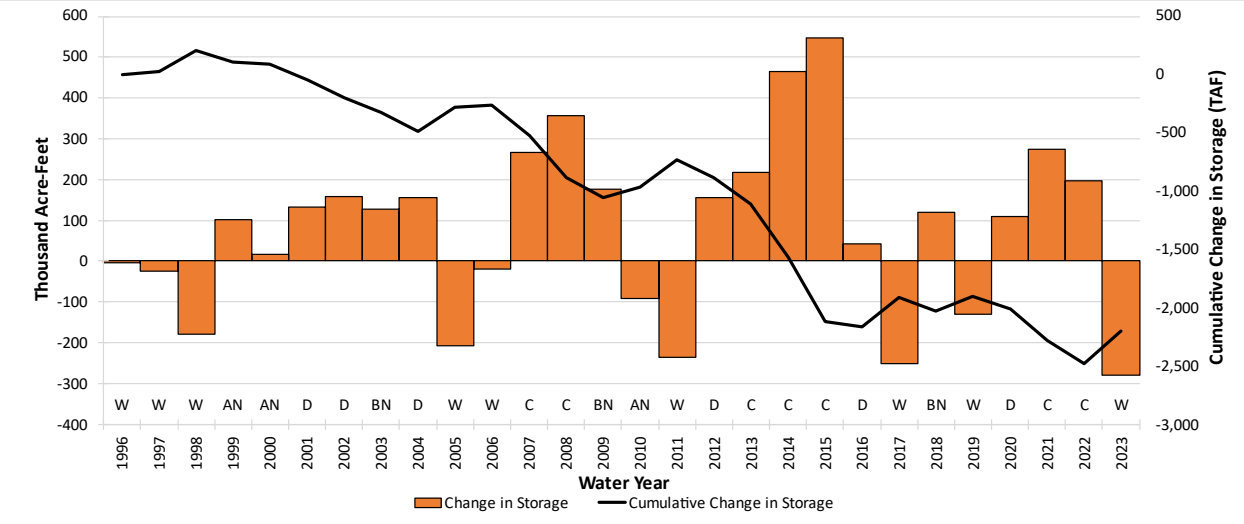
3.2.2 Recent Conditions

The MercedWRM was updated with recent hydrologic and Subbasin operation information from WY 2023 to estimate the historical change in storage in the Merced Subbasin. The cumulative change in storage during water years 1996-2023 was estimated as -1.92 million acre-feet, or an

average reduction of 107 thousand acre-feet (TAF) per year. The average annual reduction of 192 TAF per year established in the 2022 GSP using the hydrologically balanced period of WYs 2006-2015 remains the current estimate of long-term overdraft in the Subbasin.

Figure 3-5 shows the cumulative change in storage developed in the water budget and water year type. The cumulative change in storage (WYs 1996-2023) is shown as a black line with values indicated on the right vertical axis and the annual change in storage are shown as bar charts with values indicated on the left vertical axis.

Figure 3-5: Cumulative Change in Groundwater Storage



Notes:
"Change in Storage" is placed on the chart to balance the water budget. For example, if annual outflows (-) are greater than inflows (+), there is a decrease in storage, and this is shown on the positive side of the bar chart to balance out the increased outflows on the negative side of the bar chart.
Source: Water year types based on San Joaquin Valley Water Year Index (DWR, 2024a).

3.2.3 Recommended Corrective Actions and Modifications to 2025 GSP

DWR's determination letter stated that, for a sustainability indicator to not be applicable, a GSA must demonstrate that an undesirable result for that sustainability indicator is not present and not likely to occur. The Department concluded that due to the critically overdrafted status of the Subbasin and the continued decline in groundwater levels, the reduction of groundwater storage is an applicable indicator and that sustainable management criteria should be established.

Per the Department's recommendation, the 2025 GSP was amended to include groundwater storage as an applicable sustainability indicator. Data and methodology used to establish using groundwater levels as a proxy for groundwater storage are presented below and discussed in Section 3.4 of the 2025 GSP.

3.3 Degraded Water Quality

3.3.1 Overview based on 2022 GSP

In the 2022 GSP, the GSAs established a minimum threshold of 1,000 mg/L of Total Dissolved Solids (TDS) at representative monitoring sites for the degraded water quality sustainability indicator. The measurable objective and all interim milestones were set at 500 mg/L TDS. Undesirable results are defined in the GSP as "during GSP implementation when at least 25% of representative monitoring wells (6 of 22 sites) exceed the minimum threshold for degraded water quality for two consecutive years" (MIUGSA, MSGSA, & TIWD GSA-1, 2022).

3.3.2 Recent Conditions

Figure 3-6 through **Figure 3-9** show the spatial distribution of TDS concentration measurements in the three principal aquifers and unknown aquifer based on TDS and electrical conductivity (EC) data reported in the Groundwater Ambient Monitoring and Assessment (GAMA) database from WYs 2020 through 2023 for wells in the Subbasin monitoring network (including more than the representative wells). EC measurements were converted to estimates of TDS only if TDS samples were not measured directly during the evaluation cycle. The monitoring network includes both designated representative wells as well as any PWS wells that report data to the Division of Drinking Water (DDW).

While elevated TDS (actual and/or estimated from EC) concentrations (greater than 1,000 mg/L) were observed in monitoring data during the evaluation cycle, they were confirmed to be at locations where samples were collected at environmental monitoring wells monitored by regulated facilities. During the evaluation cycle, TDS concentrations observed in the Subbasin's monitoring network did not exceed the MT. Additionally, sixteen monitoring locations consistently achieved the measurable objective (MO). **Table 3-2** presents the latest concentrations of TDS observed at these representative monitoring wells.

Figure 3-6: Average TDS Concentrations 2019-2023 in Above Corcoran Clay

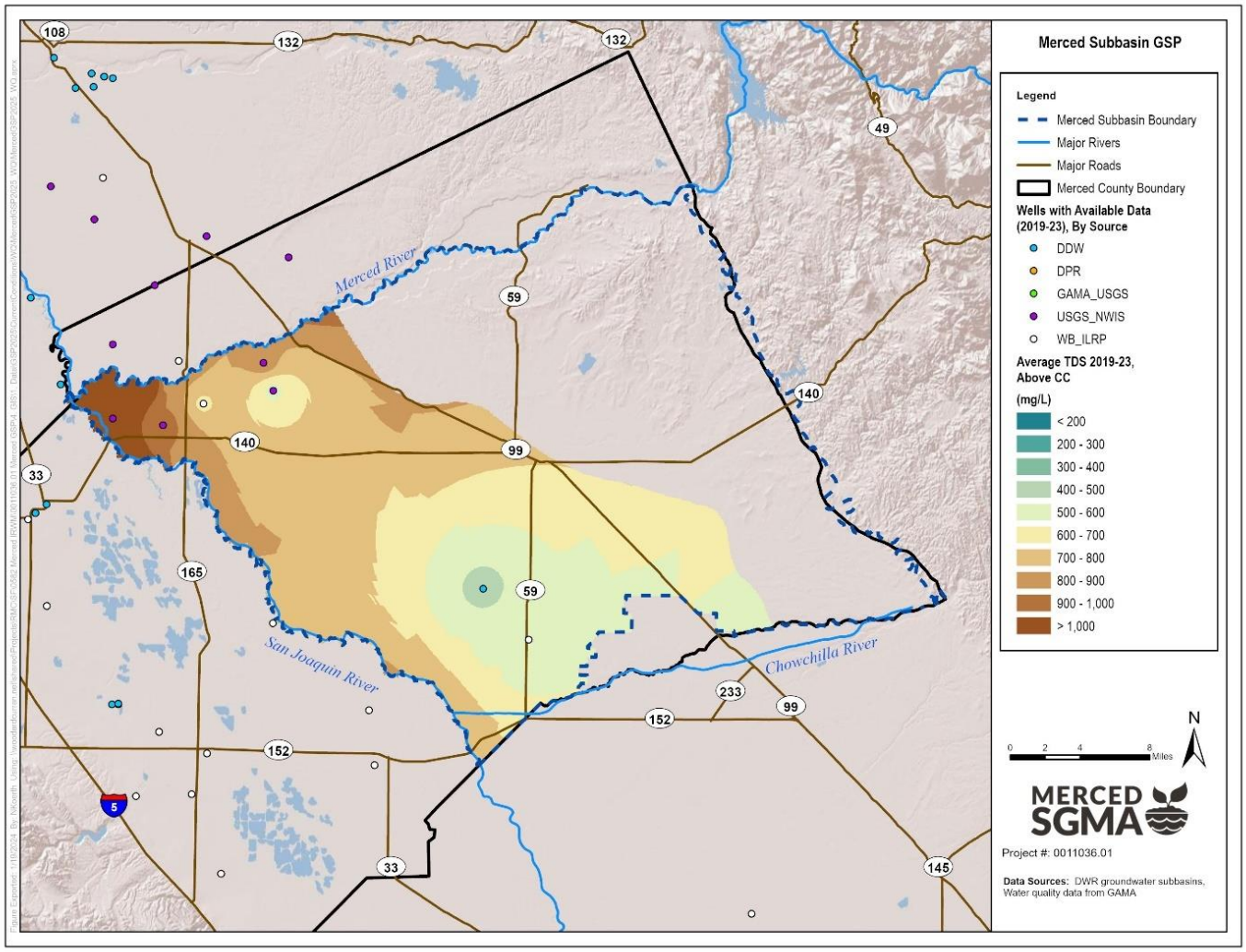


Figure 3-7: Average TDS Concentrations 2019-2023 in Below Corcoran Clay

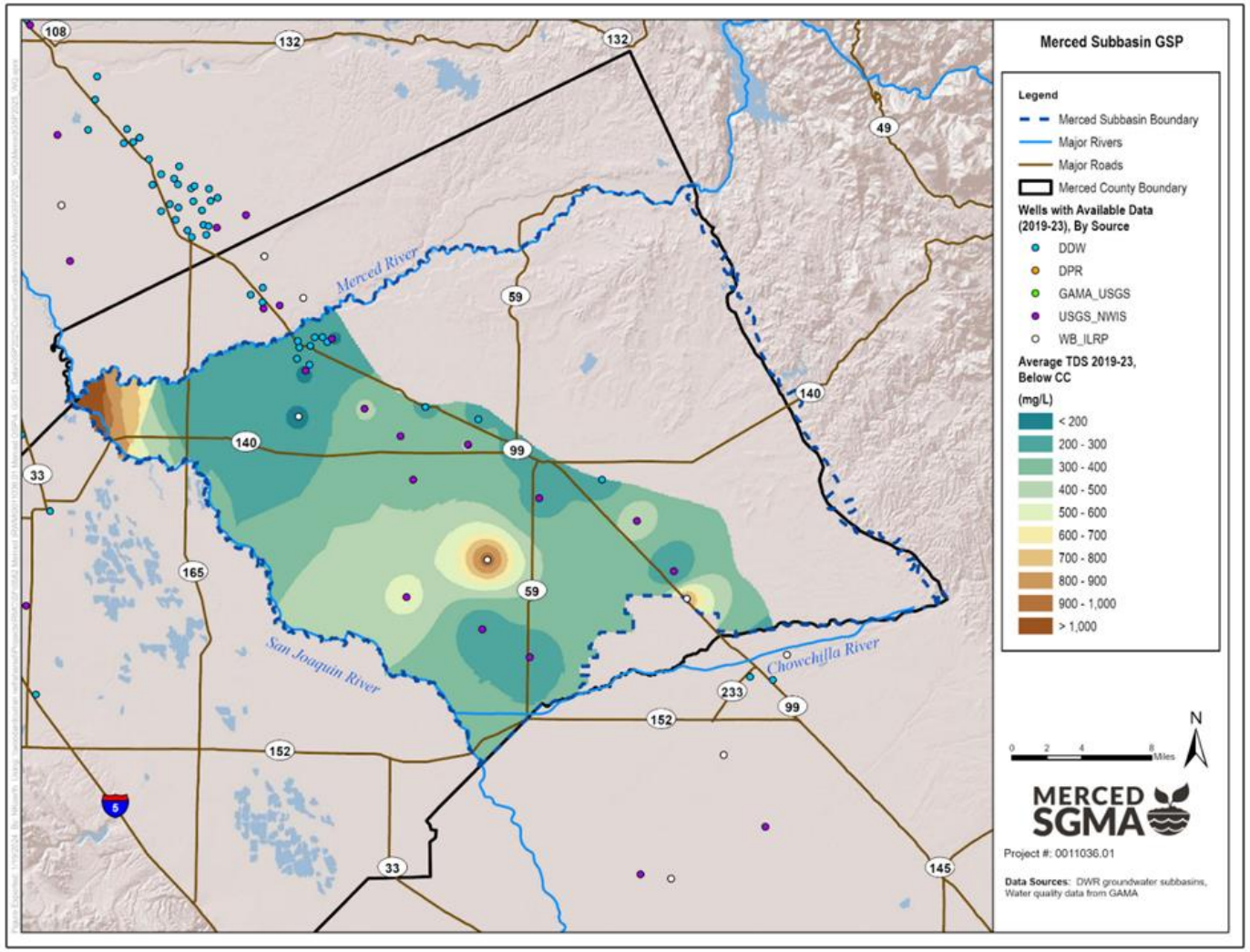


Figure 3-8: Average TDS Concentrations 2019-2023 in Outside Corcoran Clay

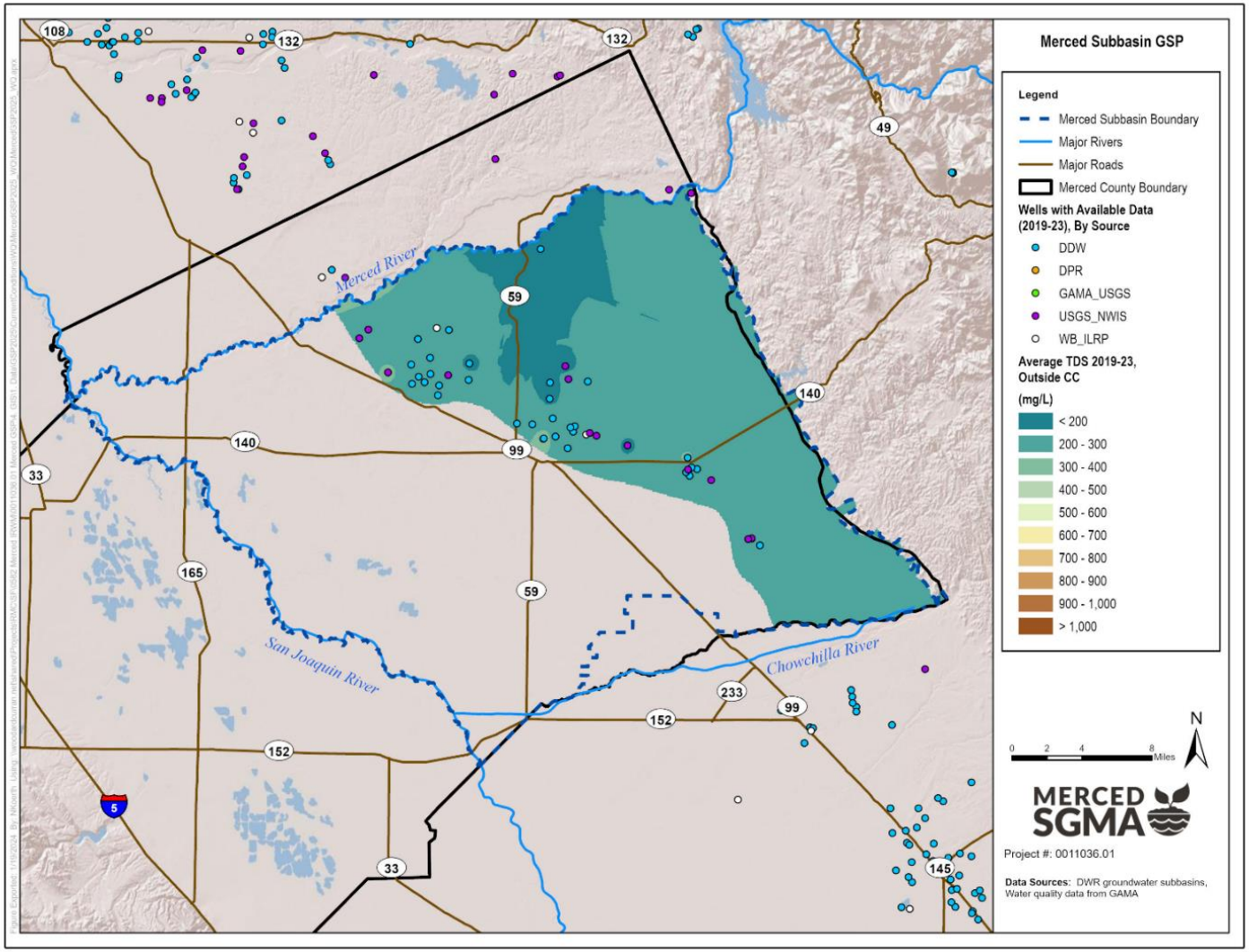


Figure 3-9: Average TDS Concentrations 2019-2023 in Unknown Aquifer

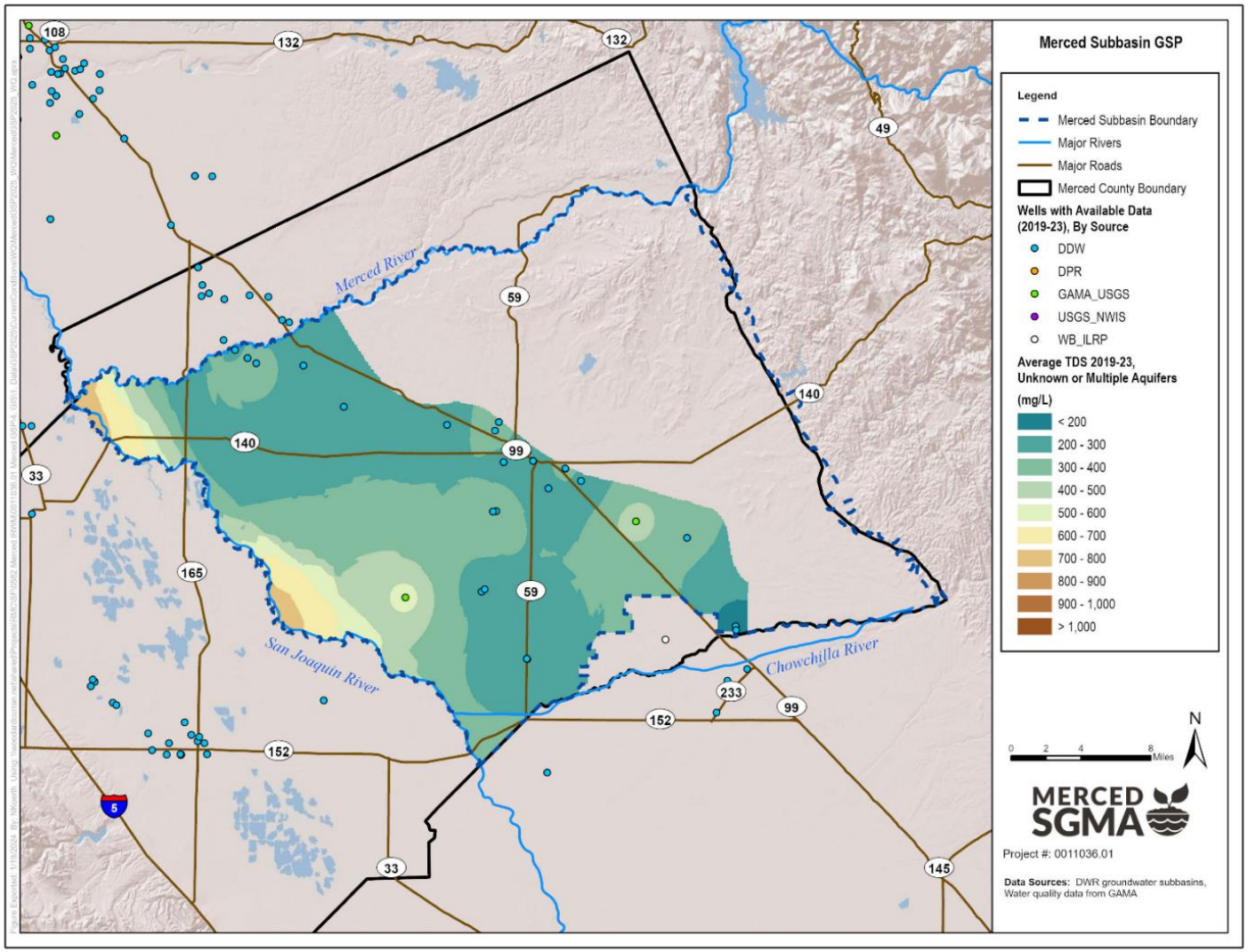


Table 3-2: Latest TDS Concentrations at Representative Monitoring Wells

GQTMP Well ID	GAMA Well ID	TDS (mg/L) WY 2020	TDS (mg/L) WY 2021	TDS (mg/L) WY 2022	TDS (mg/L) WY 2023	Latest Date of Measurement Date	Minimum Threshold (mg/L TDS)	Measurable Objective and Interim Milestones (mg/L TDS)	Principal Aquifer
P06	AGC100012331-ESJQC00006	196[2]	NA	NA	NA	8/5/2020	1,000	500	Outside Corcoran Clay
P07	AGC100012331-ESJQC00007	174[2]	195[2]	NA	190[2]	7/25/2023	1,000	500	Below Corcoran Clay
P08	AGC100012331-ESJQC00008	265[2]	297[2]	330	292[2]	7/24/2023	1,000	500	Outside Corcoran Clay
P09	AGC100012331-ESJQC00009	371[2]	420[2]	420	413[2]	7/25/2023	1,000	500	Below Corcoran Clay
P10	AGC100012331-ESJQC00010	764[2]	889[2]	970	840[2]	7/24/2023	1,000	500	Below Corcoran Clay
ESJQC00019	AGC100012331-ESJQC00019	706[2]	797	750	733	7/25/2023	1,000	500	Below Corcoran Clay
ESJQC00022	AGC100012331-ESJQC00022	550	534[2]	560	543[2]	7/24/2023	1,000	500	Above Corcoran Clay
ESJQC00030	AGC100012331-ESJQC00030	NA	492[2]	NA	NA	7/27/2021	1,000	500	Below Corcoran Clay
ESJQC00043	AGC100012331-ESJQC00043[1]	NA	NA	NA	333	7/25/2023	1,000	500	Outside Corcoran Clay
C42	CA2400046_002_002	NA	NA	320	NA	8/11/2022	1,000	500	Outside Corcoran Clay
C50	CA2400079_001_001	205	NA	NA	NA	11/2/2020	1,000	500	Unknown
C45	CA2400089_001_001	NA	NA	NA	NA	NA	1,000	500	Above Corcoran Clay
C39	CA2400119_001_001	NA	NA	NA	NA	NA	1,000	500	Outside Corcoran Clay
	CA2400134_003_003[1]	200	179[2]	NA	210	6/6/2023	1,000	500	Unknown
C35	CA2400172_001_001	NA	NA	NA	NA	11/6/2007 (362 mg/L)	1,000	500	Above Corcoran Clay

GQTMP Well ID	GAMA Well ID	TDS (mg/L) WY 2020	TDS (mg/L) WY 2021	TDS (mg/L) WY 2022	TDS (mg/L) WY 2023	Latest Date of Measurement Date	Minimum Threshold (mg/L TDS)	Measurable Objective and Interim Milestones (mg/L TDS)	Principal Aquifer
	CA2400172_002_002[1]	NA	450	NA	480	3/22/2023	1,000	500	Above Corcoran Clay
C49	CA2400172_012_012	NA	300	NA	NA	12/16/2020	1,000	500	Unknown
C47	CA2400194_001_001	NA	NA	NA	NA	NA	1,000	500	Outside Corcoran Clay
C44	CA2400218_001_001	NA	294	NA	NA	6/22/2021	1,000	500	Below Corcoran Clay
C41	CA2400220_001_001	NA	NA	NA	NA	5/5/2016 (456 mg/L)	1,000	500	Above Corcoran Clay
C40	CA2410001_006_006	NA	NA	NA	NA	3/16/2006 (290 mg/L)	1,000	500	Outside Corcoran Clay
	CA2410004_008_008[1]	NA	352[2]	350	258[2,3]	2/29/2024	1,000	500	Below Corcoran Clay
	CA2410004_009_009[1]	NA	237[2]	220	256[2,3]	2/29/2024	1,000	500	Below Corcoran Clay
C38	CA2410004_011_011	250	269[2]	NA	270	6/27/2023	1,000	500	Below Corcoran Clay
	CA2410004_012_012[1]	NA	275[2]	290	NA250[2,3]	2/29/2024	1,000	500	Below Corcoran Clay
	CA2410004_013_013[1]	NA	240	NA	NA250[2,3]	2/29/2024	1,000	500	Below Corcoran Clay
	CA2410004_025_025[1]	250	243[2]	NA	290	9/5/2023	1,000	500	Below Corcoran Clay
	CA2410004_028_028[1]	270	301[2]	NA	250	9/5/2023	1,000	500	Unknown
	CA2410007_001_001[1]	NA	NA	370	377[2,3]	10/31/2023	1,000	500	Outside Corcoran Clay
C46	CA2410007_002_002	NA	NA	NA	NA	1/31/1991 (209 mg/L)	1,000	500	Outside Corcoran Clay
	CA2410007_004_004[1]	220	NA	200	NA	7/25/2022	1,000	500	Outside Corcoran Clay

GQTMP Well ID	GAMA Well ID	TDS (mg/L) WY 2020	TDS (mg/L) WY 2021	TDS (mg/L) WY 2022	TDS (mg/L) WY 2023	Latest Date of Measurement Date	Minimum Threshold (mg/L TDS)	Measurable Objective and Interim Milestones (mg/L TDS)	Principal Aquifer
C43	CA2410007_005_005	NA	NA	290	269[2]	5/2/2023	1,000	500	Outside Corcoran Clay
	CA2410007_006_006[1]	NA	NA	300[2]	314[2]	7/18/2023	1,000	500	Outside Corcoran Clay
	CA2410007_007_007[1]	NA	NA	320	307[3]	1/9/2024	1,000	500	Outside Corcoran Clay
	CA2410007_014_014[1]	NA	NA	340	333[2]	5/23/2023	1,000	500	Outside Corcoran Clay
	CA2410008_004_004[1]	280	NA	NA	340	6/20/2023	1,000	500	Unknown
	CA2410008_005_005[1]	220	NA	NA	230	6/20/2023	1,000	500	Below Corcoran Clay
	CA2410008_010_010[1]	410	NA	NA	430	4/20/2023	1,000	500	Unknown
	CA2410009_057_057[1]	NA	186[2]	210	230[3]	10/31/2023	1,000	500	Unknown
	CA2410010_014_014[1]	210	NA	NA	220	5/11/2023	1,000	500	Outside Corcoran Clay
	CA2410010_019_019[1]	230	NA	NA	220	5/11/2023	1,000	500	Outside Corcoran Clay
C48	CA2410011_005_005	NA	NA	220	NA	10/18/2022	1,000	500	Outside Corcoran Clay
	CA5000433_008_008[1]	140	NA	102[2]	140[3]	11/13/2023	1,000	500	Outside Corcoran Clay

[1] *Monitoring sites added to representative monitoring network during the evaluation cycle.*
[2] *TDS concentration was estimated using the formula TDS (mg/L) ≈ EC (µS/cm) * 0.640.*
[3] *Latest data available is from Water Year 2024*

3.3.3 Recommended Corrective Actions and Modifications to 2025 GSP

The determination letter issued by the Department included recommended corrective actions related to the criteria established for TDS and raised questions on whether other constituents identified in the GSP should include sustainable management criteria.

3.3.3.1 Response to Recommended Corrective Action 1b and 6a

The Department requested that the GSP include additional justification and explanation for how water quality constituents, such as arsenic and nitrate, will be managed and monitored, and how impacts to beneficial uses and users will be addressed should there be degradation of water quality during plan implementation when lower groundwater elevations are expected. The Department also recommended that the GSAs consider developing sustainable management criteria for additional water quality constituents identified in the 2022 GSP.

Current conditions in the Subbasin are summarized in Sections 2.2.4.1 and 2.2.4.2 of the 2025 GSP. Monitoring of these constituents is included in ongoing monitoring efforts are described in Section 2.2.4 of the 2025 GSP and results from the latest available data are summarized below.

Nitrate

Nitrate (NO_3) occurs from both natural and anthropogenic sources and is widespread in groundwater in many parts of the San Joaquin Valley. High nitrate concentrations in groundwater are often associated with the use of fertilizers (commercial/animal waste) and onsite wastewater treatment systems or septic systems.

Nitrate concentrations observed during the evaluation cycle, by aquifer, are presented in **Figure 3-10** through **Figure 3-13**. These values are presented "as Nitrogen" which has a Maximum Contaminant Level (MCL) of 10 mg/L. Historically, nitrate concentrations were found to be higher, on average, in the Above Corcoran Clay Principal Aquifer than in the Below Corcoran Clay Principal Aquifer. Average concentrations of Nitrate observed across all aquifers during the evaluation cycle ranged from non-detect (<0.1 mg/L) to 160 mg/L. Elevated concentrations (above the MCL) of nitrate were localized throughout the Subbasin and are likely attributed to agricultural activities. These localized sources are situated south and southwest of Livingston, north and east of Merced, and the area south of Merced and north of El Nido. The GSAs will continue evaluating potential impacts of nitrate, specifically on beneficial uses and users situated in the aquifers with elevated nitrate concentrations, and identify measures to address these potential impacts.

Figure 3-10: Average Nitrate (as N) Concentrations 2019-2023 in Above Corcoran Clay

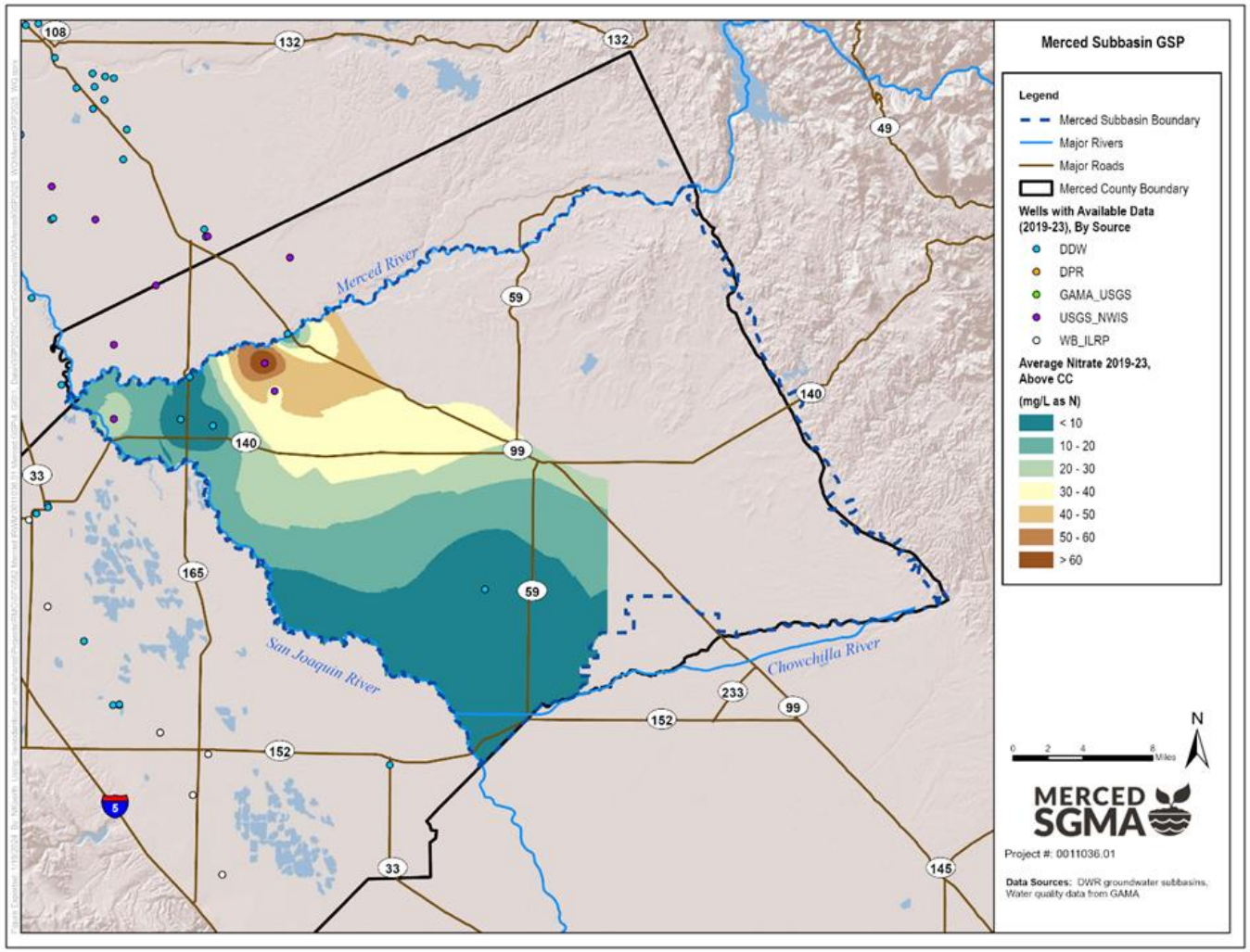


Figure 3-11: Average Nitrate (as N) Concentrations 2019-2023 in Below Corcoran Clay

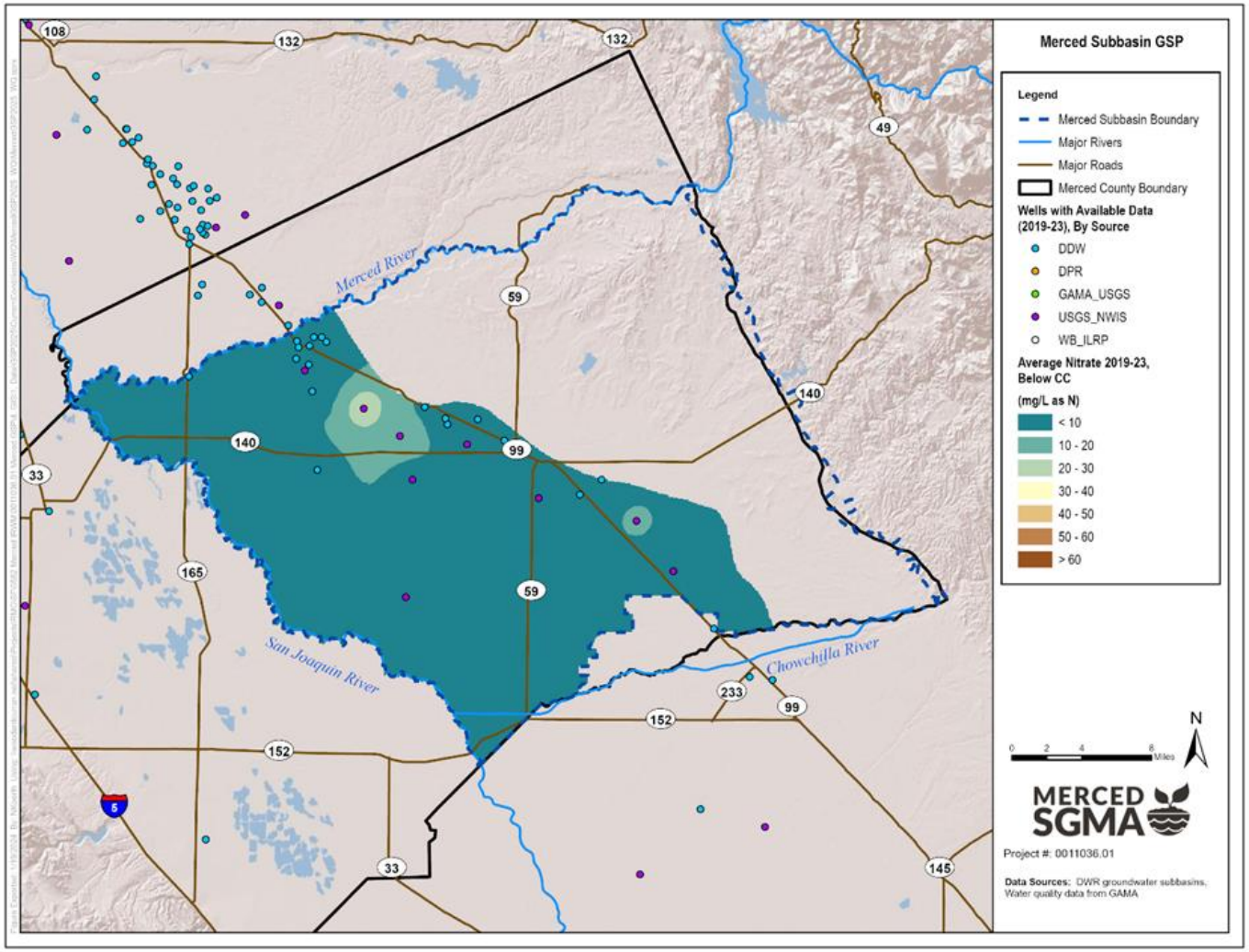


Figure 3-12: Average Nitrate (as N) Concentrations 2019-2023 in Outside Corcoran Clay

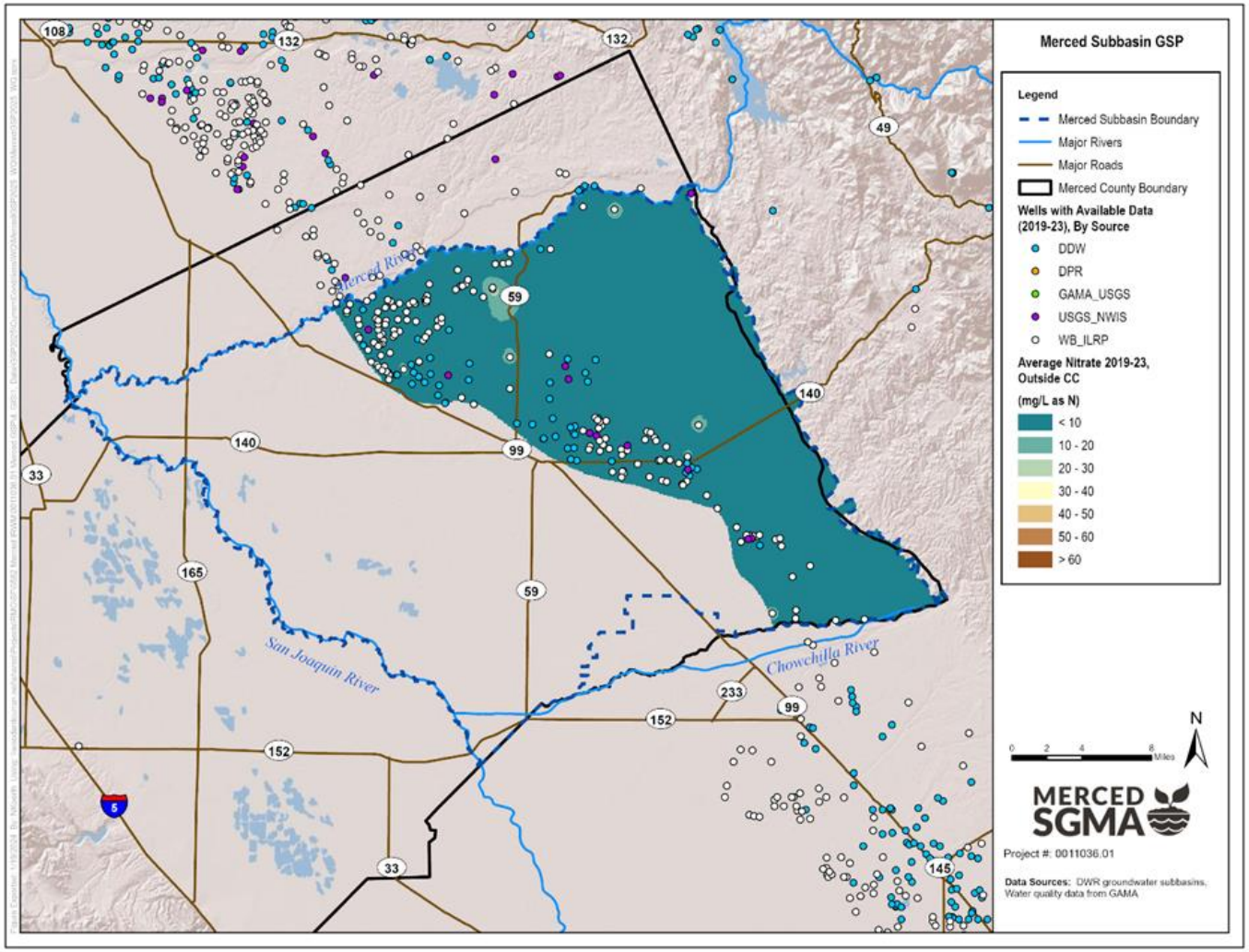
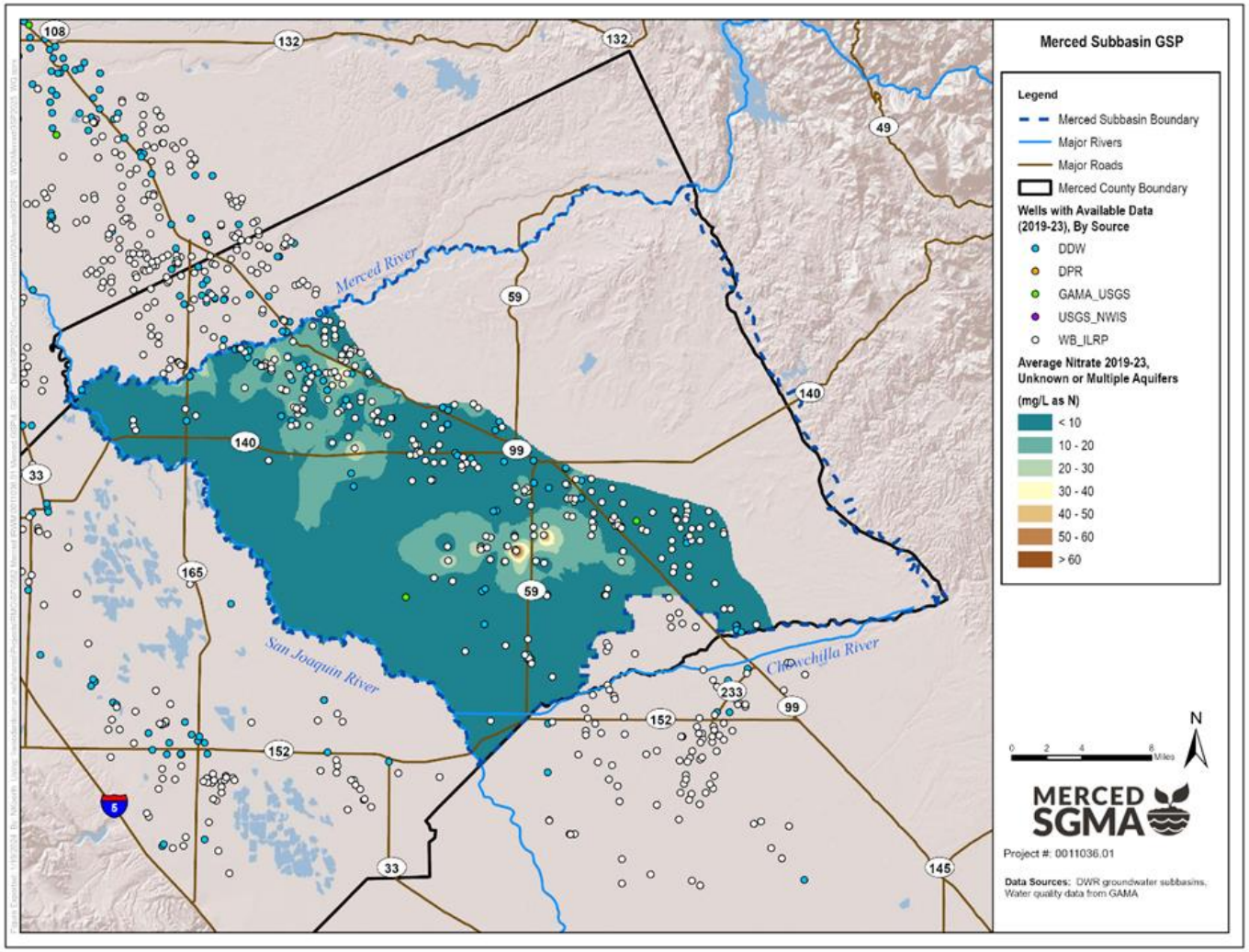


Figure 3-13: Average Nitrate (as N) Concentrations 2019-2023 in Unknown Aquifer



Arsenic

Arsenic is a dissolved metal found in many bedrock formations which can have human health impacts. Historically, within the Merced Subbasin area, arsenic concentrations ranged from non-detect (less than 1 microgram per liter [µg/L]) to as much as 800 µg/L. The primary MCL for arsenic is 10 µg/L (SWRCB, 2018). The average concentrations observed across all aquifers during the evaluation cycle ranged from non-detect (<1 µg/L) to 65.9 µg/L in the Subbasin. Elevated concentrations of arsenic (above the MCL) are highly localized, specifically in the El Nido area in the southwest portion of the Subbasin. These elevated concentrations are primarily in the Below Corcoran Clay and Unknown Aquifers; similar to the approach for nitrate, the GSAs will continue to evaluate potential impacts of arsenic on beneficial uses and users and identify measures to address these potential impacts in the future. Arsenic concentrations observed during the evaluation cycle, by aquifer, are presented in **Figure 3-14** through **Figure 3-17**.

Figure 3-14: Average Arsenic Concentrations 2019-2023, Above Corcoran Clay

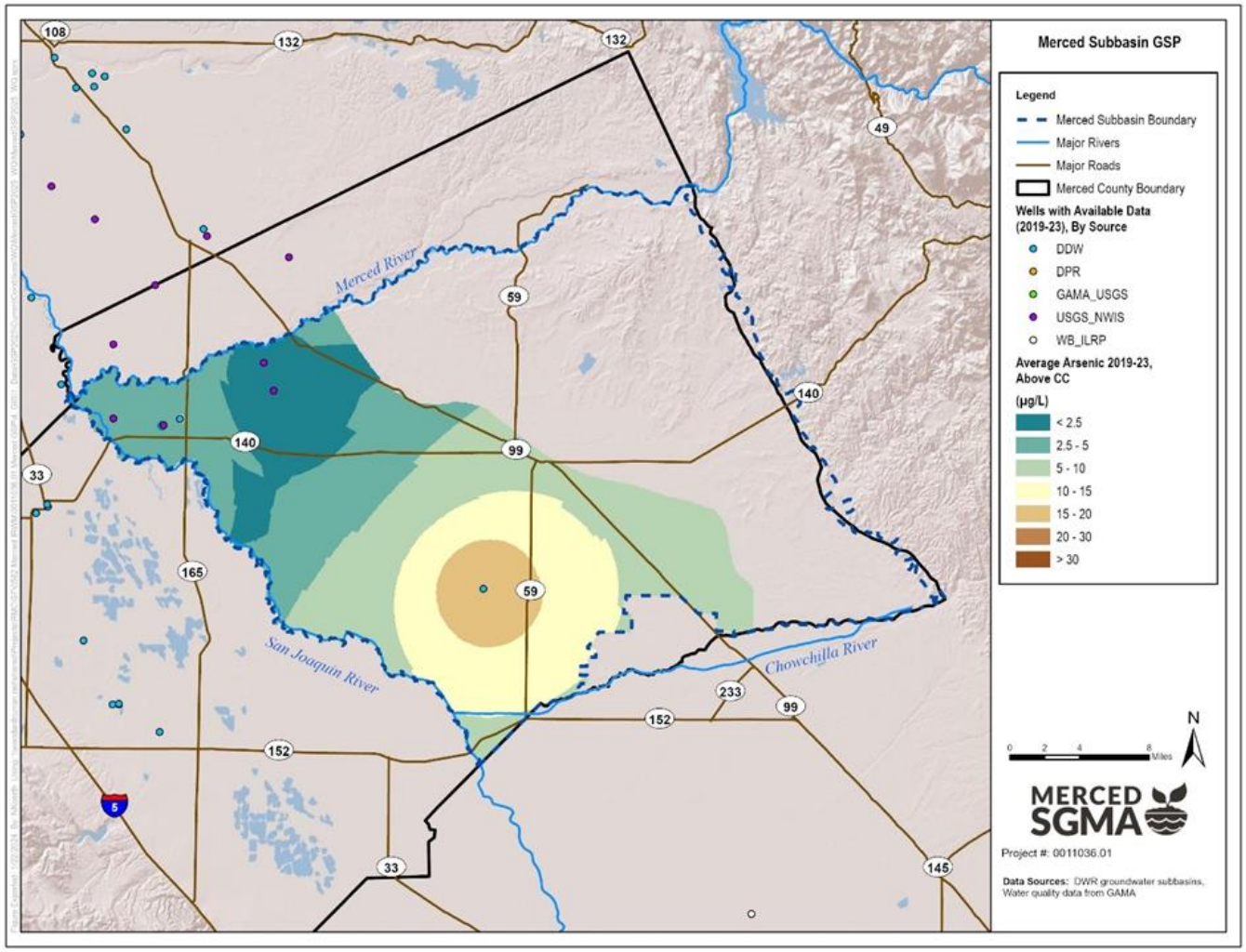


Figure 3-15: Average Arsenic Concentrations 2019-2023, Below Corcoran Clay

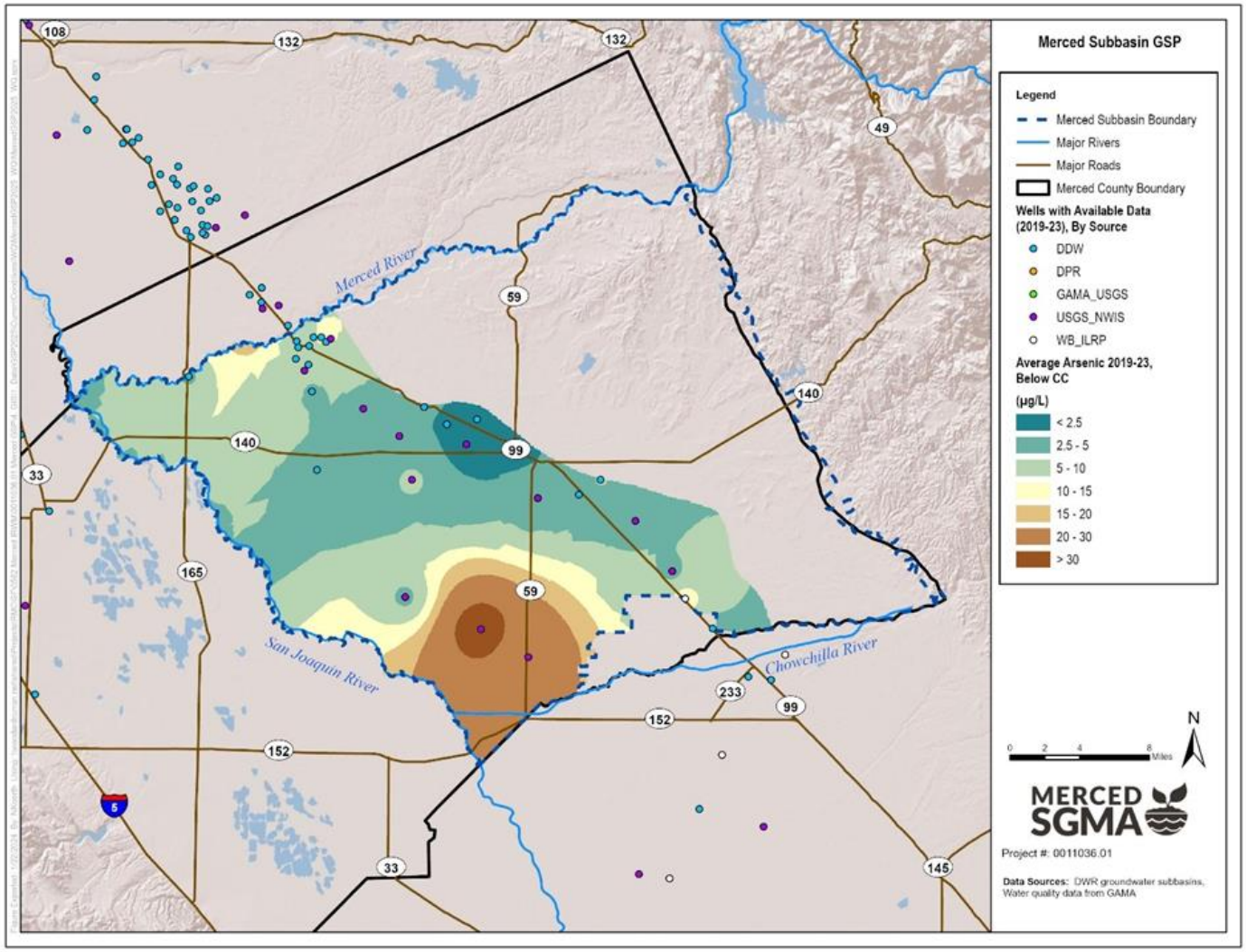


Figure 3-16: Average Arsenic Concentrations 2019-2023, Outside Corcoran Clay

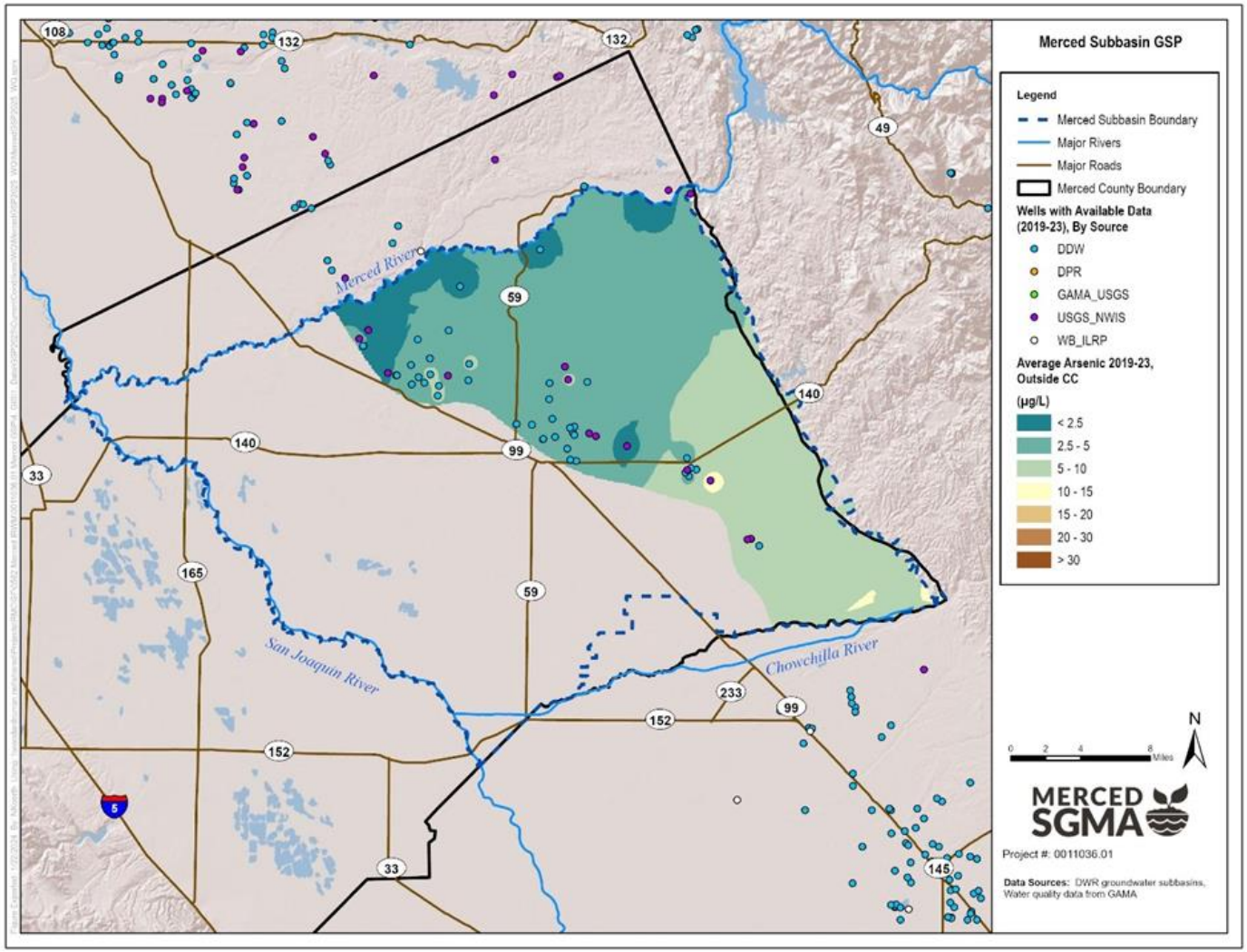
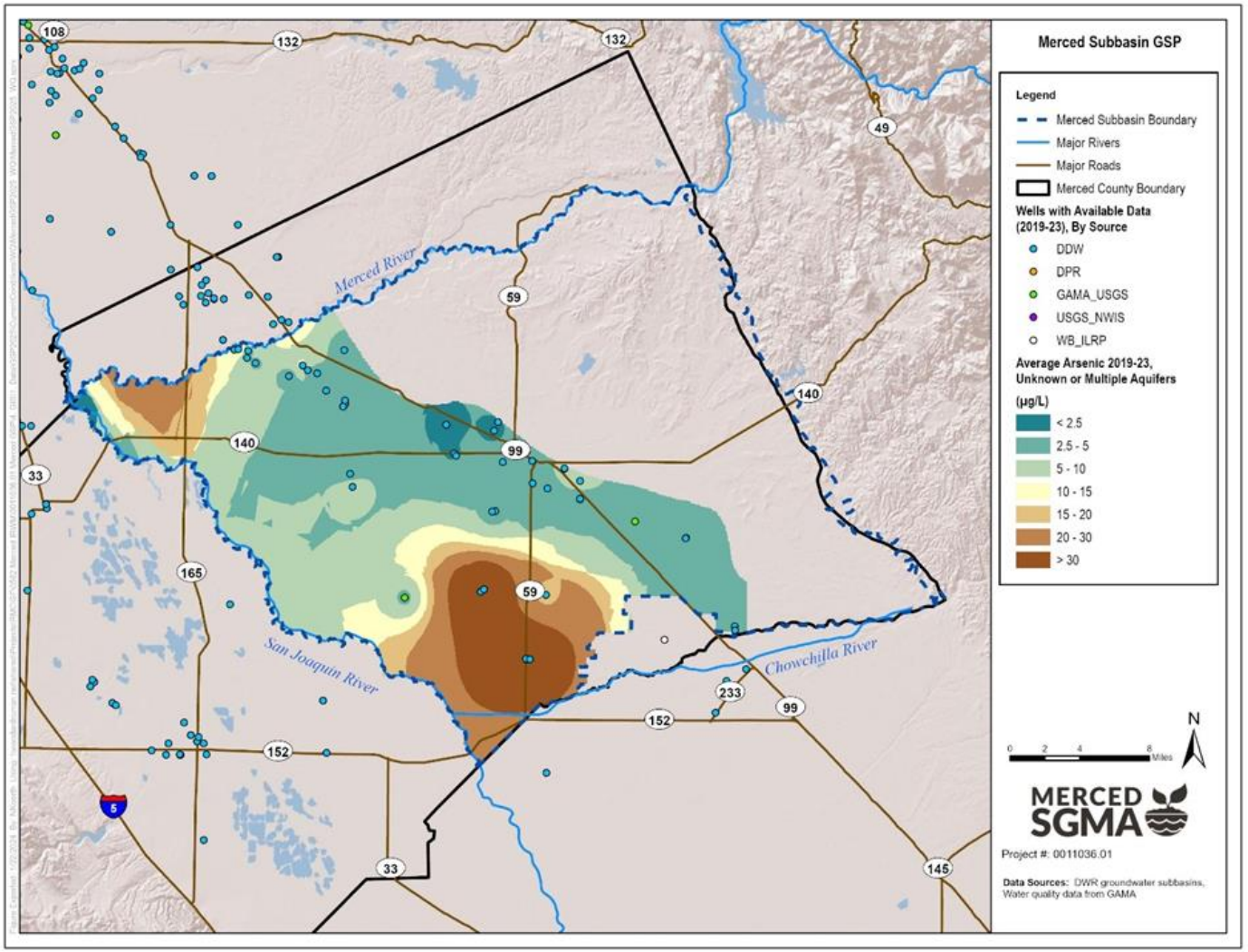


Figure 3-17: Average Arsenic Concentrations 2019-2023, Unknown Aquifer



Trends Across Multiple Constituents

In response to DWR's recommendation, the GSAs evaluated the relationship between groundwater elevation changes and the concentrations of nitrate and arsenic (as well as other constituents) to determine if declining groundwater levels, as a result of GSA activities, impacted the concentrations of the contaminant. The analysis was conducted in the following manner:

- All groundwater quality data were compiled from GAMA from wells throughout the Subbasin.
- Data were excluded at wells representing localized contamination sites under federal, state, and local regulatory oversight.
- Non-detect concentrations were considered a valid measurement with a value at the detection limit.
- Individual wells with less than eight measurements of the particular constituent to be analyzed were excluded. While the Mann-Mendall Trend Test requires a minimum of four samples per well, a more commonly used range for greater confidence in the results is 8-10 samples per well.

The Mann-Kendall test is a statistical test that determines if a set of data values is increasing or decreasing over time, and if the trend is statistically significant. The analysis was conducted for water quality concentrations measured in two separate time periods:

1. Period where groundwaters levels were consistently declining (2012-2016)
2. Period where more stable groundwater levels were observed (2016-2020)

The resulting output from the analysis included a percentage of wells that showed a trend compared to groundwater elevation changes. For example, during periods of groundwater elevation decline (2012-2016), the well evaluated for specific conductivity showed increases in concentrations as water levels decreased, as shown in **Table 3-3**.

Nitrate and groundwater elevation data were compared in 35 wells between 2012 and 2016. The results of this analysis showed the vast majority (94%) of wells indicating no trend. Data compared from 40 wells between 2016 and 2020 showed a larger percentage of wells (98%) with "no trend" between nitrate concentrations and groundwater elevations. Overall, the data evaluated did not demonstrate any trends between groundwater elevation changes and changes in nitrate concentrations.

Arsenic and groundwater elevation data were compared in 13 wells from 2012 to 2016 and 2016 to 2020. The results for this analysis did not indicate a trend between groundwater elevations change and arsenic concentrations. The results of this analysis are presented in **Table 3-3**.

Table 3-3: Mann-Kendall Results for Groundwater Levels and Common Contaminants

Constituent	2012-2016				2016-2020			
	Increasing	Decreasing	No Trend	Count of Wells	Increasing	Decreasing	No Trend	Count of Wells
Nitrate	2.9%	2.9%	94.3%	35	2.5%	0.0%	97.5%	40
Total Dissolved Solids				0				0
Chlorine				0				0
Arsenic	0.0%	0.0%	100.0%	13	0.0%	0.0%	100.0%	13
Iron				0	0.0%	0.0%	100.0%	1
Manganese	0.0%	0.0%	100.0%	1	0.0%	0.0%	100.0%	2
Chromium-6				0				0
Benzene	0.0%	0.0%	100.0%	12	0.0%	0.0%	100.0%	11
123 TCP	7.7%	15.4%	76.9%	13	0.0%	2.0%	98.0%	50
DBCP	0.0%	0.0%	100.0%	10	0.0%	7.1%	92.9%	14
MTBE	0.0%	0.0%	100.0%	12	0.0%	0.0%	100.0%	12
111 TCA	0.0%	0.0%	100.0%	12	0.0%	0.0%	100.0%	11
PCE	8.3%	0.0%	91.7%	12	0.0%	0.0%	100.0%	11
TCE	0.0%	0.0%	100.0%	12	0.0%	0.0%	100.0%	11
Boron				0				0
Sodium				0				0
Specific Conductivity	100.0%	0.0%	0.0%	1				0
EDB	0.0%	0.0%	100.0%	2	0.0%	0.0%	100.0%	3

Overall, the results from the analysis concluded that no significant trend exists between groundwater elevation changes and changes in concentrations of nitrate, arsenic, or other common constituents within the Subbasin. Groundwater elevation and constituent data used in this analysis are included in Appendix E of the 2025 GSP.

3.3.3.2 Response to Recommended Corrective Action 6b

DWR recommended the 2022 GSP provide further rationale for establishing minimum thresholds for TDS above the recommended secondary maximum contaminant level for drinking water standard.

The minimum threshold for salinity was established based on the potential impact of salinity on drinking water and agricultural beneficial uses, as aligned with state and federal regulations and historical conditions. The recommended drinking water secondary MCL for TDS is 500 mg/L with an upper limit for the secondary MCL of 1,000 mg/L and a short-term limit for the secondary MCL of 1,500 mg/L (SWRCB, 2006). The secondary MCL is established for aesthetic reasons such as taste, odor, and color and is not based on public health concerns. Concentrations of TDS have historically exceeded the secondary Maximum Contaminant Level (SMCL) at certain depths and locations in the Subbasin, however, undesirable results or adverse impacts to beneficial users have not been reported to the GSAs.

For agricultural uses, salt tolerance varies by crop, with common crops in the Merced Subbasin (alfalfa, almonds, corn, grapes, sweet potatoes, and tomatoes (Merced County Department of Agriculture, 2017)) tolerant of irrigated water with TDS of 900 to 1,500 mg/L at a 90% crop yield potential (Ayers & Westcot, 1985). **Table 3-4** summarizes the salinity tolerances for major crops within the Subbasin.

Table 3-4: Salinity Tolerances of Major Subbasins Crops

Crop Type	Salinity Tolerance (mg/L as TDS)
Alfalfa	1,400
Almonds	900
Corn	1,100
Grapes	1,100
Sweet Potatoes	1,000
Tomatoes	1,500

The 2025 GSP identifies areas of the Subbasin known to have elevated TDS concentrations, and water use has historically adjusted to accommodate these concentrations. For example, agriculture has focused on more salt-tolerant crops, and more saline water supplies are avoided or blended with less saline water supplies. As a result, TDS concentrations more than 1,000 mg/L where currently experienced are not unexpected. Additionally, Subbasin stakeholders plan to limit increases in salinity, to the extent feasible under SGMA, to prevent undesirable results such as requirements to change cropping, blending supplies, etc.

3.4 Inelastic Land Subsidence

3.4.1 Overview based on 2022 GSP

This section discusses land subsidence conditions observed during the evaluation cycle including maps of the most recent subsidence measurements taken in and around the Subbasin and compares them to the GSP's sustainable management criteria.

In the 2022 GSP, the GSAs established a minimum threshold of 0 ft/year (subject to uncertainty of ±0.16 ft/year) at four representative monitoring stations. The measurable objective is also 0 ft/year, with interim milestones of -0.75 ft/year (2025), -0.50 ft/year (2030), and -0.25 ft/year (2035) of subsidence. The GSP identifies undesirable results for subsidence as "exceedances of minimum threshold rates of land subsidence at three or more monitoring sites out of four for two consecutive years" (MIUGSA, MSGSA, & TIWD GSA-1, 2022).

3.4.2 Recent Conditions

Subsidence is measured at static global positioning system (GPS) control points throughout a portion of the San Joaquin Valley monitored by the US Bureau of Reclamation (USBR) as part of the San Joaquin River Restoration Program. Measurements have been recorded semiannually in July and December of each year to monitor ongoing subsidence since 2011. During the evaluation cycle, average subsidence rates ranged from -0.52 to 0.16 feet per year and the cumulative subsidence across the Subbasin averaged approximately -0.5 feet. **Figure 3-18** shows the total (cumulative) subsidence from December 2019 to December 2023. **Figure 3-19** shows the average subsidence rate occurring from December 2019 through December 2023.

Figure 3-18: Total Subsidence December 2019 to December 2023

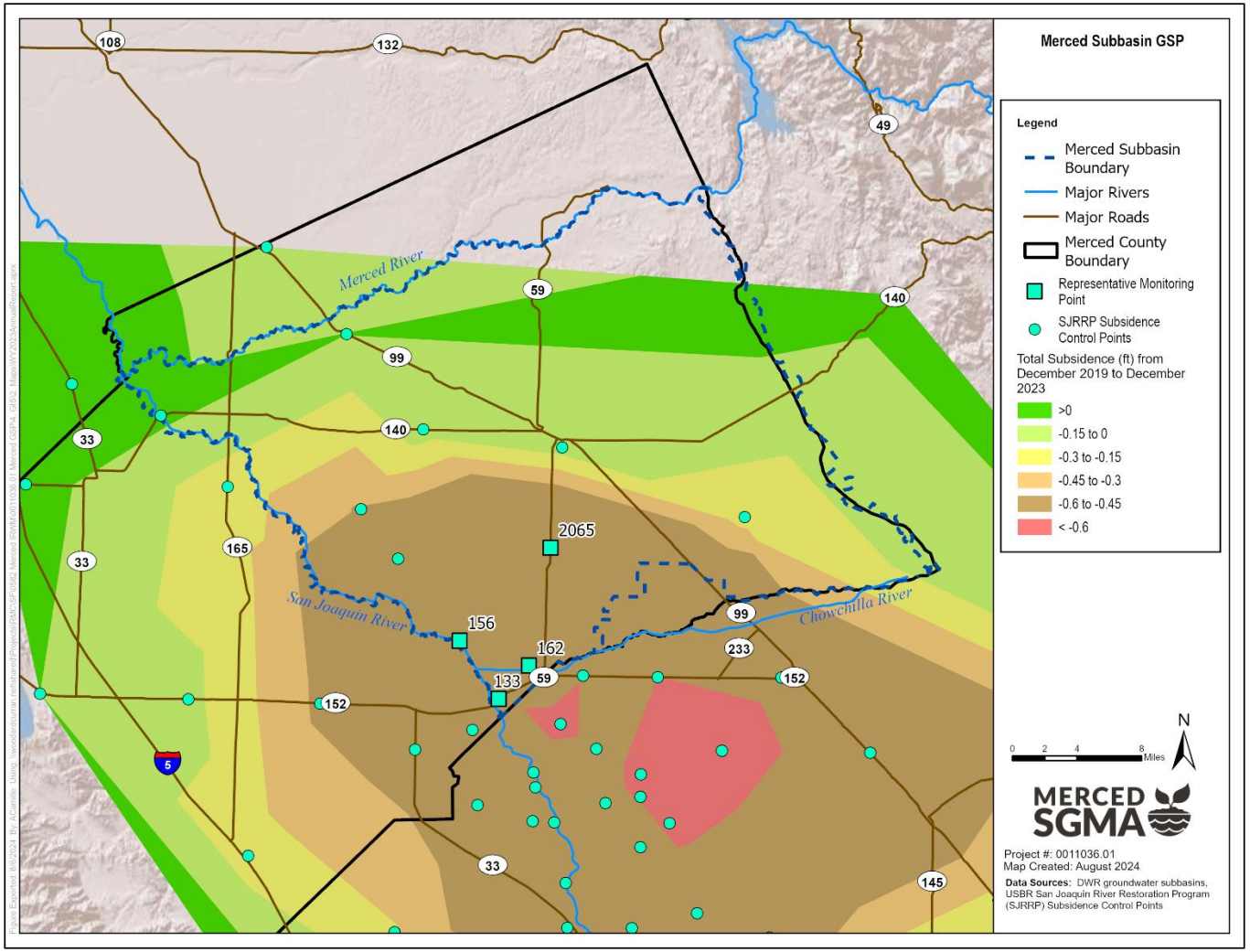
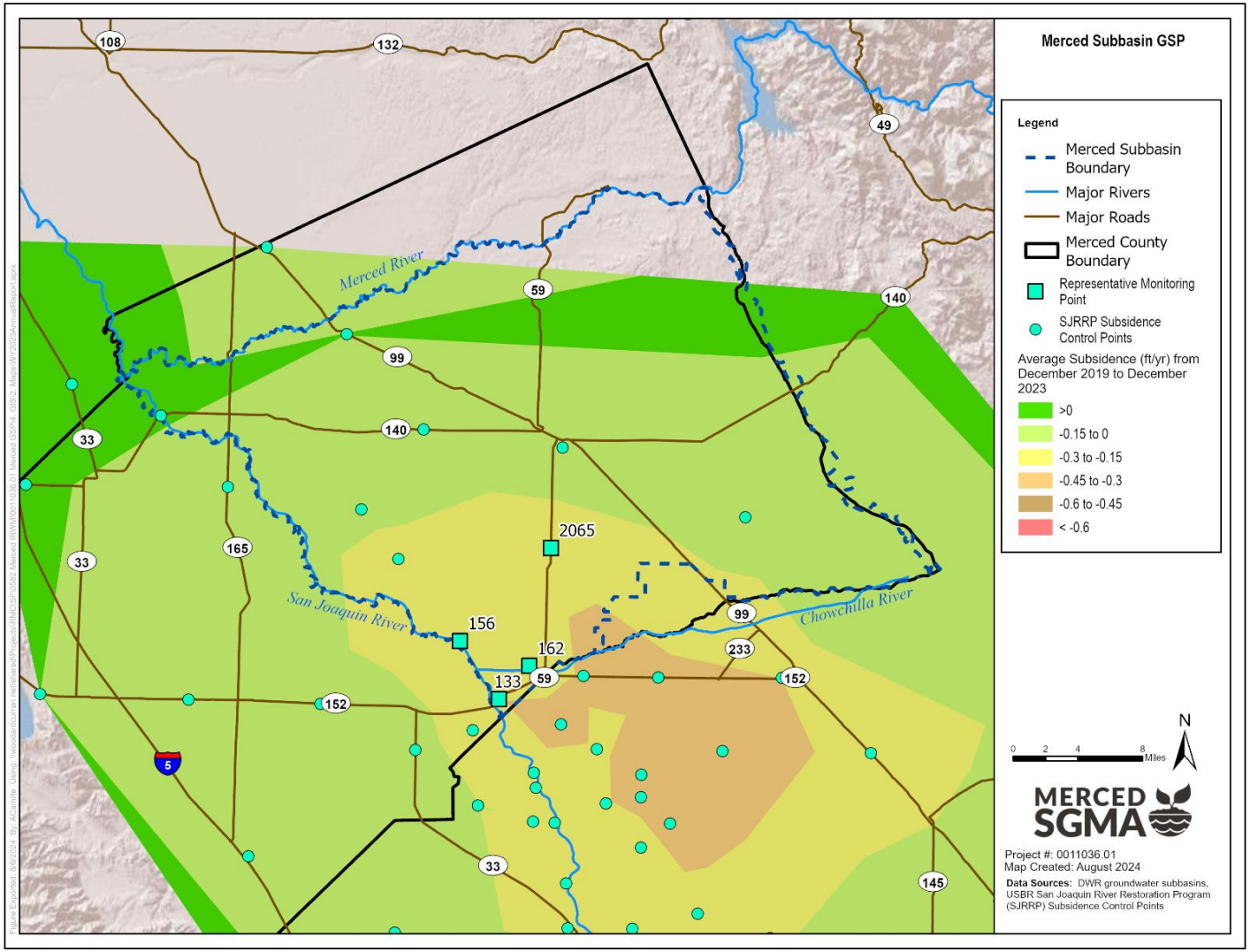


Figure 3-19: Average Subsidence Rate December 2019 to December 2023



As shown in **Table 3-5**, subsidence has consistently been observed (greater magnitude than the MT and MO of 0 ft/yr) at the representative monitoring sites from 2019 to 2023. However, the rate of subsidence has consistently been less than the 2025 IM of -0.75 ft/yr with the latest rate of subsidence demonstrating an increase in land surface elevation (positive value). Further analyses are still underway to better understand how to stabilize subsidence in the Subbasin. Subsidence, as a result of groundwater extraction, is a gradual process that takes time to develop and time to halt. As a result, some level of future subsidence, likely at rates similar to those experienced during the evaluation cycle, is likely to be underway already and will not be able to be prevented. The PMAs proposed by the GSAs are intended to raise groundwater levels and avoid unreasonable impacts as a result of inelastic land subsidence.

Table 3-5: Subsidence at Representative Monitoring Stations

	Point ID	133	162	2065	156
	Station Name	H 1235 RESET	RBF 1057	W 938 RESET	W 990 CADWR
Subsidence (ft)	Dec 2019-Dec 2020	-0.39	-0.26	-0.30	-0.28
	Dec 2020-Dec 2021	-0.33	-0.19	-0.35	-0.23
	Dec 2021-Dec 2022	-0.46	-0.34	-0.52	-0.35
	Dec 2022-Dec 2023	+0.02	+0.13	+0.02	+0.16
Minimum Threshold (ft/yr)		0 ± 0.16	0 ± 0.16	0 ± 0.16	0 ± 0.16
Measurable Objective (ft/yr)		0	0	0	0
2025 Interim Milestone (ft/yr)		-0.75	-0.75	-0.75	-0.75

3.4.3 Recommended Corrective Actions and Modifications to 2025 GSP

3.4.3.1 Response to Recommended Corrective Action 3a

DWR provided recommendations on the land subsidence sustainable management criteria stating that total cumulative subsidence tolerable by critical infrastructure should be identified and that additional details describing current and potential lasting impacts of subsidence on land uses and groundwater beneficial uses and users should be included in the GSP. Per DWR's recommendation, the GSAs have identified the Eastside Bypass as critical infrastructure within the Subbasin. The 2022 GSP included information on an analysis conducted by USBR on impacts to flow capacity related to historical subsidence on the Middle Eastside Bypass. The analysis concluded that by 2031 three reaches will near or exceed the maximum allowable water surface elevation when flows reach 2,500 cubic feet per second (cfs). The San Joaquin River Restoration Program (Reclamation) published the *2022 Channel Capacity Report* which concluded capacities in the Middle Eastside Bypass are equal to or greater than 2,600 cfs, but the capacity will be reduced as subsidence continues in the area. On June 11, 2024, and July 8, 2024, the GSAs contacted Reclamation to understand if additional information was available or impacts were

observed to the Middle Eastside Bypass. Reclamation did not provide any response to the GSAs correspondence. The GSAs conclude that the land subsidence impacts, and Middle Eastside Bypass's susceptibility to inelastic subsidence, remain consistent with the conclusions in the *2022 Channel Capacity Report*. The GSAs remain confident that, based on recent conditions and the sustainable management criteria established, critical infrastructure within the Subbasin will continue to avoid unreasonable impacts and undesirable results as a result of GSA activities.

3.4.3.2 Response to Recommended Corrective Action 3b

DWR also provided recommendations on the land subsidence sustainable management criteria stating that the level of uncertainty related to subsidence measurements should be revised according to professional practice standards. The 2022 GSP states that survey measurements collected by the USBR showed a vertical accuracy of ±2.5 centimeters, or approximately ±0.08 feet. The USBR conducted a survey on GPS stations included in the subsidence monitoring network between November and December 2011. The purpose of the survey was to evaluate multiple control stations in the San Joaquin River valley and establish confidence in the vertical accuracy measurements within this area. The survey concluded the vertical accuracy measurement of ±2.5 centimeters for GPS stations in the San Joaquin valley, which exceeded USBR's vertical accuracy goal of ± 3 centimeters. USBR's equipment used, methodology, and control point data are discussed in the *San Joaquin River Restoration Project – Geodetic Network, GPS Survey Report* (Reclamation 2011).

With two measurements, consistent with the monitoring schedule in the 2025 GSP, the total uncertainty in the subsidence value is ±5 centimeters, or approximately ±0.16 feet per year. Subsidence of less than -0.16 feet per year (values that are less negative) are within the uncertainty of the measurement and would be considered compliant with the minimum threshold of 0 feet per year as shown in **Figure 3-20**.

An example of land surface elevation changes and subsidence sustainable management criteria with the uncertainty error is shown in **Figure 3-21**; the land surface elevation measurements from station SJRPP 133 are presented with error bars demonstrating the ±0.08 uncertainty per measurement. Additionally, the uncertainty error bars are also incorporated for the sustainable management criteria, allowing the GSAs to evaluate whether there is a potential for minimum threshold and interim milestone exceedances.

Figure 3-20: Schematic of Uncertainty due to Measurement Error in Subsidence Quantification

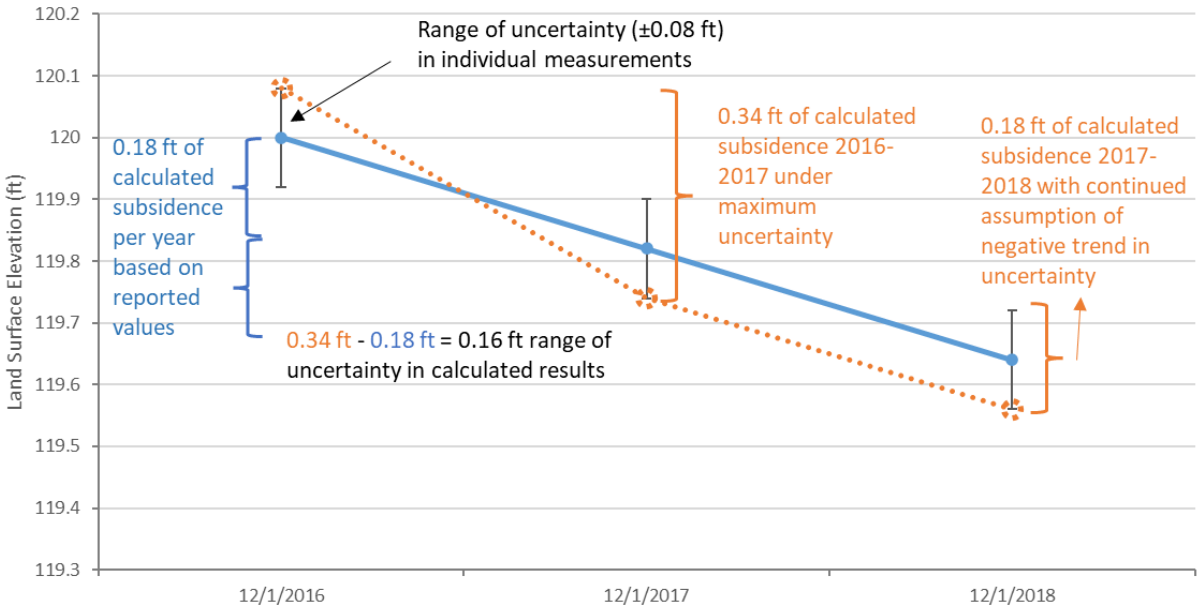
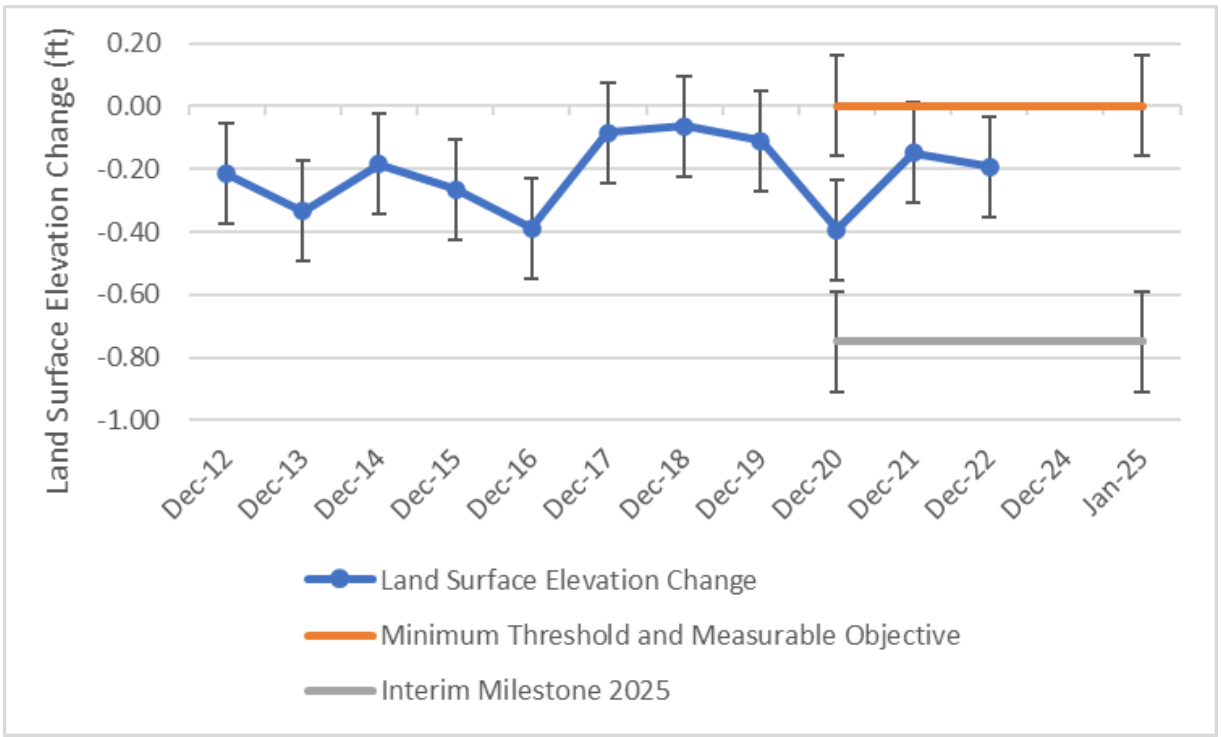


Figure 3-21: Example Land Surface Elevation Change with Uncertainty Measurement Range at SJRPP 133



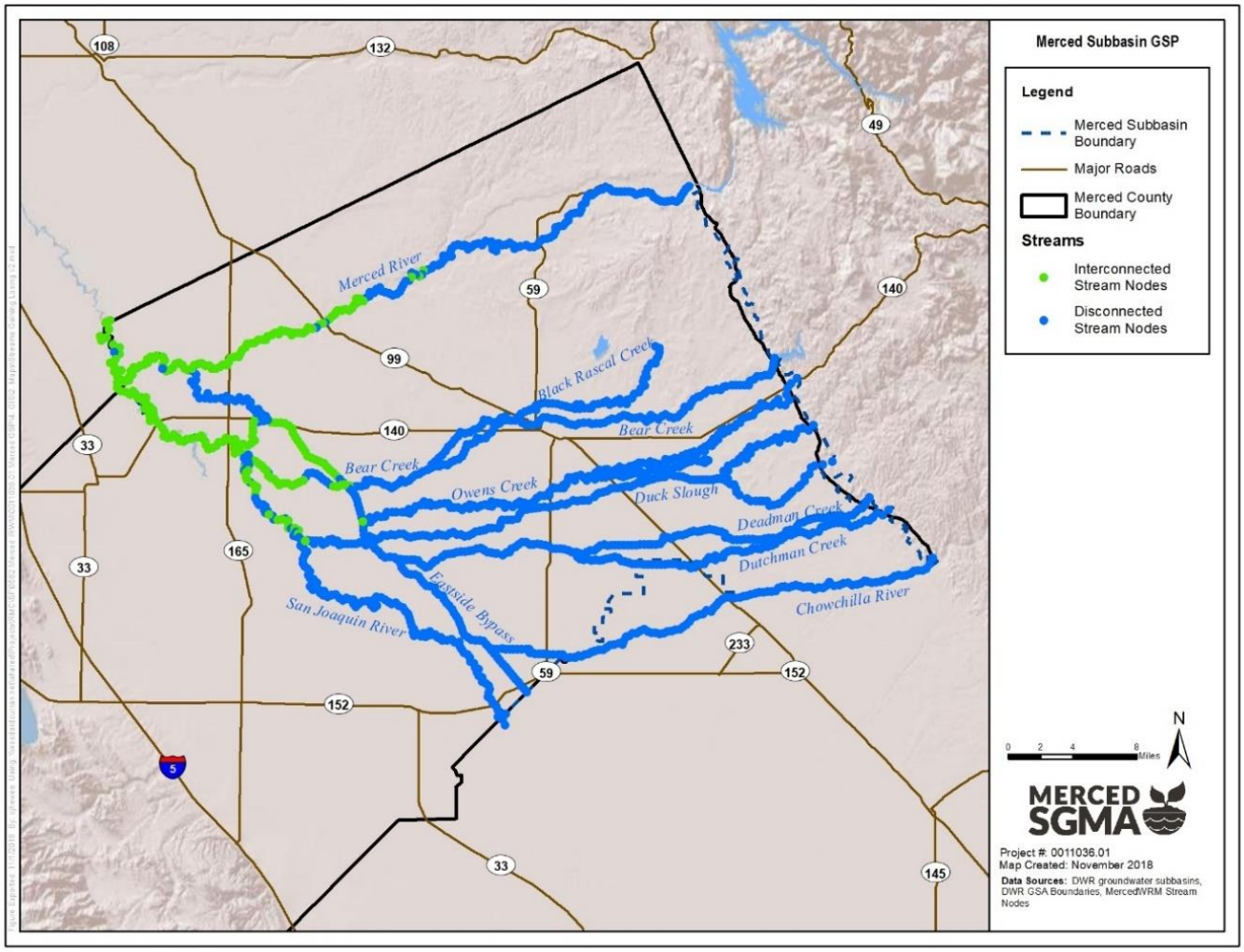
The sustainable management criteria for land subsidence were modified in the 2022 GSP to clarify integration of measurement uncertainty with the intention of preventing or minimizing inelastic land subsidence in perpetuity. The measurement uncertainty is defined according to standard professional practice and provides the GSAs with the best available data to monitor subsidence in the Subbasin. The minimum threshold of -0.16 ft/yr is associated with the uncertainty inherent within the monitoring devices and may periodically show a rate of land surface elevation decline during the implementation period. However, preventing land subsidence will still be demonstrated through the total land surface elevation changes as these uncertainties will remain consistent. The sustainable management criteria have not been changed since the 2022 GSP: exceedances of minimum threshold rates at three or more monitoring sites for two consecutive years would constitute an undesirable result with minimum thresholds and measurable objectives set at 0 feet per year. Additionally, the minimum threshold will also be compared to land surface elevation changes over a five-year period, with the same 0 ft/year threshold and the same uncertainty driven compliance point of -0.16 feet, which is equivalent to -0.032 ft/year, or approximately a third of an inch per year. Section 3.7 of the 2025 GSP includes a discussion regarding the measurement uncertainty, current subsidence conditions in the Subbasin, and potential impacts of these conditions on beneficial uses and users.

3.5 Depletions of Interconnected Surface Water

3.5.1 Overview Based on 2022 GSP

Interconnected surface waters are surface water features that are hydraulically connected by a saturated zone to the groundwater system. In other words, where groundwater table elevations and surface water features intersect at the same elevations and locations. Interconnected surface waters may be either gaining or losing, wherein the surface water feature is either gaining water from the aquifer system or losing water to the aquifer system. Interconnected surface water bodies are presented in **Figure 3-22**.

Figure 3-22: Interconnected and Disconnected Streams



As discussed in Section 2.2.7 of the 2025 GSP, an analysis utilizing MercedWRM was conducted to compare historical conditions and no-pumping scenario that could inform the impact of pumping on interconnected surface water bodies. Stream depletion was calculated by obtaining the difference in the stream-groundwater flow with and without groundwater pumping over a 30-year simulation period, from WYs 1994 to 2023. The no-pumping simulation assumed the following:

- All pumping for urban and agricultural use within the Merced Subbasin were set to zero.
- Agricultural and urban land use remain unchanged. Groundwater supply became zero, but associated land use properties, such as runoff characteristics, remain unchanged.
- Areas within the model domain outside the Merced Subbasin were also set to zero-pumping. However, the boundary conditions were kept equal to the historical simulation,

with specific head boundary conditions that represent historical groundwater elevations. This assumption implicitly states that areas outside the model boundary continue to operate groundwater pumping at historical levels.

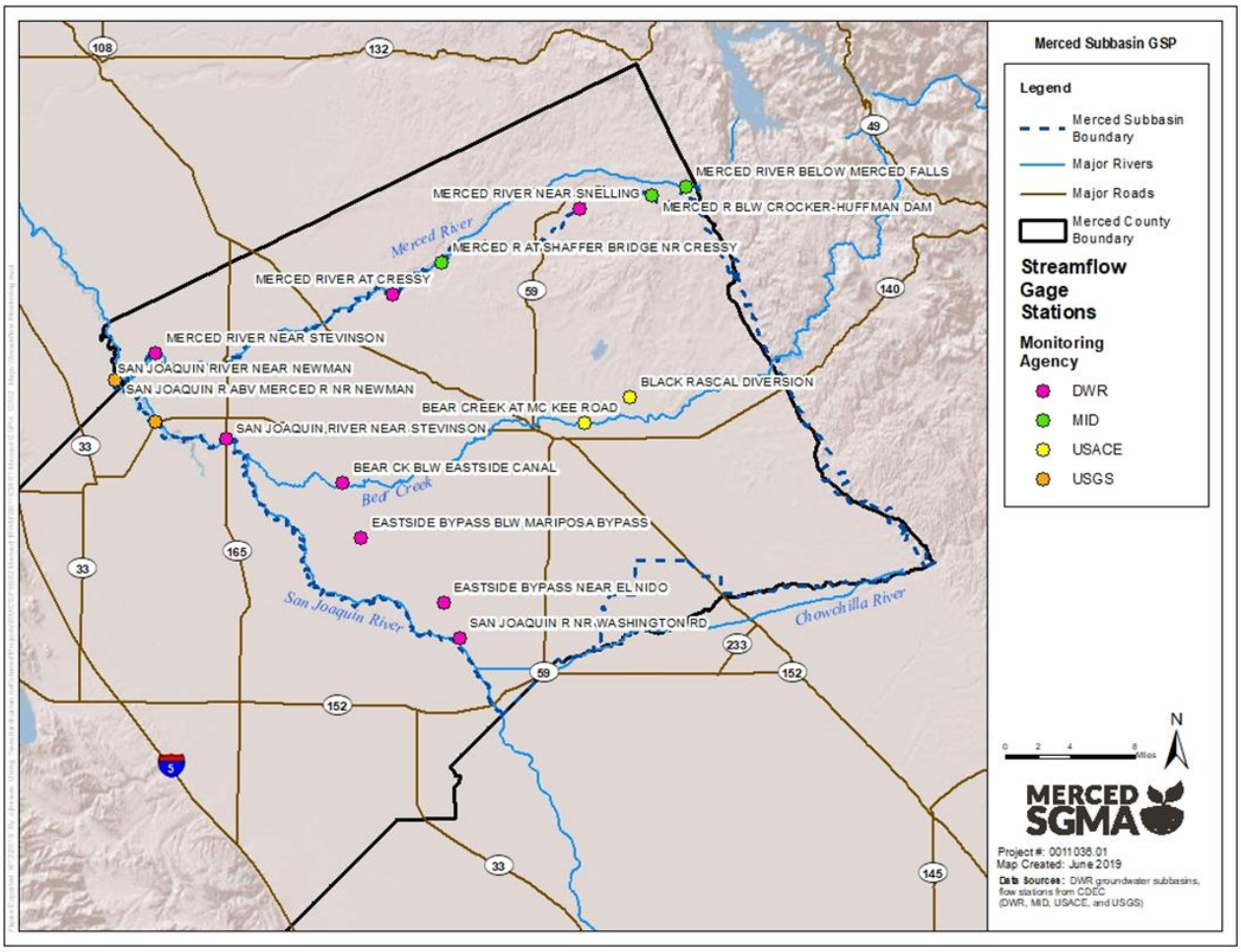
An estimate from MercedWRM indicates that about 50% of the pumped volume results in depletions or changes in out-of-basin subsurface flows in the 10 years following pumping, and about 70% happen within the 30-year simulation period. As not all pumping results in depletions (some pumping returns to the aquifer through deep percolation), the 70% value likely includes a substantial majority of depletions that will occur. As such, most of the impact of pumping from WYs 1994 through 2023 occurring as depletions in the latter years of the simulation period were captured in this analysis.

The analysis concluded that, based on an average of WYs 2018 to 2023 conditions, there are an estimated 504,400 AFY of depletions and 141,800 AFY of increase in subsurface groundwater inflow (eventually out-of-Subbasin depletions). These conclusions are based on WYs 2018 to 2023 to avoid simulation years that may not quantify depletions, such as groundwater pumping occurring in pre-1994 WYs.

Undesirable results established in the 2022 GSP for depletions of interconnected surface water in the Merced Subbasin could include depletions that result in reductions in flow or levels of major rivers and streams that are hydrologically connected to the Subbasin such that the reduced surface water flow or levels have a significant and unreasonable adverse impact on beneficial uses of the surface water within the Subbasin over the planning and implementation horizon of this GSP.

The chronic lowering of groundwater levels sustainability indicator was established as a proxy for depletions of interconnected surface water. Thus, an undesirable result would occur for both sustainability indicators when November groundwater levels at 25% or more representative monitoring wells exceed their respective minimum thresholds for two consecutive years. Because groundwater levels are used as a proxy for interconnected surface water, minimum thresholds, measurable objectives, and interim milestones are equivalent between both sustainability indicators at their respective locations. The representative monitoring sites for interconnected surface water are presented in **Figure 3-1**. Additional monitoring sites, comprised of stream gauges monitored under DWR, United States Geological Survey (USGS), MID, and United States Army Corps of Engineers (USACE) monitoring programs, are provided in **Figure 3-23** below.

Figure 3-23: Depletions of Interconnected Surface Water Monitoring Sites



3.5.2 Recent Conditions

Data collected within the supplemental stream gauge monitoring network is provided in **Table 3-6**.

Table 3-6: Stream Gauge Elevation Data

Steam Gauge Station ID	Fall 2020	Fall 2021	Fall 2022	Fall 2023
Bear Ck BLW Eastside Canal (BSD)	85.94	86.34	86.63	89.04
Bear Creek at Mc Kee Road (MCK)	5.10	4.88	4.94	5.61
Black Rascal Diversion (BDV)	5.47	5.68	5.85	5.56
Eastside Bypass BLW Mariposa Bypass (EBM)	82.16	80.49	80.26	82.37
Eastside Bypass Near El Nido (ELN)	10.47	8.71	8.99	9.29
Merced R at Shaffer Bridge NR Cressy (MBN)	1.66	1.53	1.21	1.69
Merced R BLW Crocker-Huffman Dam (MBH)	1.79	2.0	1.85	1.88

Steam Gauge Station ID	Fall 2020	Fall 2021	Fall 2022	Fall 2023
Merced River at Cressy (CRS)	11.23	10.85	10.76	11.13
Merced River Below Merced Falls (MMF)	5.16	3.99	3.71	7.50
Merced River Near Snelling (MSN)	6.26	7.83	5.33	6.92
Merced River Near Stevinson (MST)	56.70	57.46	56.84	60.76
San Joaquin R Abv Merced R NR Newman (SMN)	49.21	48.90	49.24	50.70
San Joaquin R At Fremont Ford Bridge (FFB)	58.86	57.83	58.90	60.45
San Joaquin R Nr Washington Rd (SWA)	99.51	97.41	96.16	100.14
San Joaquin River Near Newman (NEW)	49.12	48.73	49.06	51.80
San Joaquin River Near Stevinson (SIS)	61.23	59.93	60.35	64.53

1. *All elevations reported in feet above sea level, datum NGVD29.*
2. *Reported data were collected in October of each year, consistent with the monitoring frequencies of the groundwater level monitoring programs.*

Conditions observed during the evaluation cycle show a general decline in stream stage elevation from fall 2020 through fall 2022, which correlates to dry hydrologic conditions observed during this period. As a result of wet hydrologic conditions experienced during the winter months of 2022, stream stage elevations rebounded across all gauge stations in Fall 2023. Additionally, Fall 2023 stage elevations in 14 of 16 monitoring locations were the highest observed during the evaluation cycle.

3.5.3 Recommended Corrective Actions and Modifications to the 2025 GSP

The determination letter issued by the Department included recommended corrective actions related to the establishing sustainable management criteria, addressing data gaps, and engaging local, state, and federal regulatory agencies for the depletions of interconnected surface water sustainability indicator. Responses to each component of this corrective action are described in the subsections below.

3.5.3.1 Response to Recommended Corrective Action 7a

The Department requested that the GSAs work to establish undesirable results, minimum thresholds, and measurable objectives consistent with the GSP Regulations. While additional analyses have been completed to further the understanding of interconnected surface waters (see **Section 3.5.3.2**), no changes have been made to the sustainable management criteria from the 2022 GSP.

3.5.3.2 Response to Recommended Corrective Action 7b

The Department recommended the GSAs continue to fill data gaps, collect additional monitoring data, and implement the current strategy to manage depletions of interconnected surface water and define segments of interconnectivity and timing.

As previously discussed in the Periodic Evaluation and Section 2.2.7 of the 2025 GSP, the GSAs conducted an analysis to quantify the volumes, location, and timing of interconnected surface water depletions.

The MercedWRM was updated to isolate the impacts of pumping on interconnected surface waters. The historical conditions simulation of the MercedWRM was used together with a newly developed simulation that removed pumping from the Merced Subbasin. This allowed for a comparison between historical conditions and a no-pumping simulation that could inform the impact of pumping on surface water bodies. Stream depletion was calculated by obtaining the difference in the stream-groundwater flow with and without groundwater pumping. The analysis estimated approximately 504,400 AFY of depletions and 141,800 AFY of increase in subsurface groundwater inflow (eventually out-of-Subbasin depletions) conditions.

The locations of depletions were also estimated during the evaluation cycle. Approximately half of the depletions are present within three reaches: Merced River (120,000 AFY of depletions), Eastside Bypass (91,000 AFY of depletions), and San Joaquin River (72,000 AFY of depletions). The remaining interconnected surface water depletions are encompassed in several smaller sloughs, canals, and creeks throughout the Subbasin. The average annual depletion, by surface water body reach simulated in the MercedWRM, is shown in Table 2-11 of the 2025 GSP.

The timing of depletions includes the monthly distribution of depletions and the distribution of depletions among different water year types. A summary of the monthly distribution for depletions and change in subsurface flow is shown in Table 2-13 of the 2025 GSP. Based on MercedWRM results for WYs 2018 to 2023 conditions, there is not a clear trend in depletions in the monthly distribution. It appears to have relatively similar conditions across the months, but with higher depletions in January and July, and lower depletions during April and November. Conversely, subsurface flows are higher during irrigation season and lowest in the winter and early spring. Depletions were shown to be highly dependent on water year type, where depletions were the lowest in critically dry years and highest in wet years, as shown in Table 2-14 of the 2025 GSP.

As a result of pumping changing subsurface groundwater flow from neighboring basins, the GSAs evaluated these potential impacts on interconnected surface water depletions within the Subbasin. These impacts will eventually result in depletions; however, they occur outside of the Subbasin and are accounted for separately. Change in subsurface groundwater flow due to out-of-Subbasin pumping is an increased inflow or decreased outflow of 141,800 AFY, on average, based on simulated WYs 2018 to 2023 conditions. A breakdown of the change in subsurface flow due to pumping is shown, by basin, in Table 2-12 of the 2025 GSP.

3.5.3.3 Response to Recommended Corrective Action 7c

Following modeling analysis and refining sustainable management criteria, the GSAs engaged local and state agencies and interested parties to discuss the updates to depletions of interconnected surface water. Across September 2024, the GSAs held meetings with numerous agencies (listed below) to discuss locations of interconnected surface water bodies, methods for

quantifying depletions, sustainable management criteria for interconnected surface water, and the GSAs' plan for addressing data gaps. The meetings included:

September 12: The California Department of Fish and Wildlife,

September 12: The Nature Conservancy, Point Blue, and Audubon California.

September 23: The US Fish and Wildlife Service and the National Marine Fisheries Service

The GSAs requested input from these stakeholders on what beneficial uses and users that they work with and what potential impacts they may experience due to depletions of interconnected surface waters. Input from those meetings are summarized below:

- Concern about impacts on wetland habitats, especially those that make use of surface waters.
    - For example, the lower Merced River is a critical habitat for federally listed Steelhead fish.
- Concern about in-stream impacts to habitat for native freshwater species, particularly Endangered Species Act listed species (e.g., salmon and steelhead)

3.6 Recommended Corrective Actions

The California Department of Water Resources (DWR) provided nine recommended corrective actions in the *GSP Assessment Staff Report, San Joaquin Valley – Merced Subbasin (No. 5-022.04)* dated August 4, 2023 (DWR 2023). Detailed responses to individual corrective actions are located throughout this Periodic Evaluation but are summarized in **Table 3-7.** The determination letter is located in **Appendix A**.

Table 3-7: Recommended Corrective Actions

Recommended Corrective Action #	Recommended Corrective Action Summary	Periodic Evaluation Section(s)	Periodic Evaluation Summary
1a	The GSAs should initiate the Domestic Well Mitigation Program prior to impacts being observed in domestic wells given that groundwater level interim milestones are below minimum thresholds and historical lows. The program should be monitored by the GSAs and the funding mechanism should be assessed should mitigation exceed the proposed budget.	Section 4.4	The GSAs have worked collaboratively to define the various roles and responsibilities of a Domestic Well Mitigation Program and are in process of expanding existing services, conducting additional analyses, and finalizing the program for adoption by September 2025.
1b	The GSAs are aware that the lowering of groundwater levels can cause degradation of groundwater water. DWR staff recommend the GSAs describe how potential impacts to degradation of groundwater quality will be managed, including how coordination with groundwater users, including water, environmental, and irrigation users will be conducted and how such coordination will be utilized to address groundwater quality degradation, should it occur during Plan implementation.	Section 3.3.3.1	The GSAs evaluated the potential impacts of water quality contaminants due to lowering of groundwater levels, specifically on beneficial uses and users, and concluded that no significant trend exists within the Subbasin between groundwater elevation changes and changes in concentrations of common constituents.
2	The GSP should include additional assessments on the impacts to beneficial uses and users from continued overdraft anticipated from the potential decline of groundwater levels related to 2025 and 2030 interim milestones.	Section 3.1.3	A well impact analysis comparing well depths to sustainable management criteria, including interim milestones, was conducted to determine the number of wells potentially impacted if groundwater levels decline to those levels.

Recommended Corrective Action #	Recommended Corrective Action Summary	Periodic Evaluation Section(s)	Periodic Evaluation Summary
3a	The GSAs should identify the total cumulative subsidence tolerable by critical infrastructure. The Plan should also include additional details describing measures that consider and disclose the current and potentially lasting impacts of subsidence on land uses and groundwater beneficial uses and users	Section 3.4.3.1	On June 11, 2024, and July 8, 2024, the GSAs contacted Reclamation to understand if additional information was available or impacts were observed to critical infrastructure in the Subbasin, i.e., the Middle Eastside Bypass. Reclamation did not provide any response to the GSAs correspondence. The GSAs conclude that the land subsidence impacts, and Middle Eastside Bypass's susceptibility to inelastic subsidence, remain consistent with the conclusions in Reclamation's 2022 Channel Capacity Report, which continues to be described in the GSP.
3b	The GSAs should revise its application of the level of uncertainty as it relates to subsidence measurements according to standard professional practices.	Section 3.4.3.2	The minimum threshold of 0 ft/yr, with ±0.16ft/yr, is associated with the uncertainty inherent within the monitoring devices and may periodically show a rate of land surface elevation decline during the implementation period. Additional text has been added to the GSP to explain this in further detail. Additionally, the minimum threshold was modified to also be compared to subsidence over a five-year period, with the same 0 ft/year threshold and with the same uncertainty driven compliance point of -0.16 feet over the same period, which is equivalent to -0.032 ft/year, or approximately a third of an inch per year.

Recommended Corrective Action #	Recommended Corrective Action Summary	Periodic Evaluation Section(s)	Periodic Evaluation Summary
4	DWR recommends the GSAs further investigate the 56 wells which are said to be drilled below the bottom of the basin and confirm to what extent they are active. If these wells are active, then the GSAs should determine their groundwater extractions and account for that activity in the Plan.	Section 2	A well depth analysis was completed in August 2024 and concluded that 16 wells (approximately 0.34% of wells with data) extended below the bottom of the Subbasin. Based on their permit type, all 16 wells are irrigation wells (i.e., not domestic and not public water supply); monitoring and enforcement of groundwater extraction from these wells would not be different from other wells in the Subbasin. That is, the GSP assumes extraction based on the agricultural crop type. This extraction is assumed to come from the groundwater subbasin. Thus, all extraction is accounted for in the GSP.
5	DWR recommends sustainable management criteria for reduction of groundwater storage be established by the periodic evaluation.	Section 3.2.3	The 2025 GSP has been revised to include sustainable management criteria for the reduction of groundwater storage sustainability indicator. Groundwater levels were used as a proxy for the groundwater storage, thus the sustainable management criteria between both sustainability indicators are identical.
6a	The GSAs should evaluate how water quality constituents of concern other than TDS will be managed and monitored and how impacts to beneficial uses and users will be addressed. Consider developing sustainable management criteria for these constituents.	Section 3.3.3.1	Mann-Kendall Trend Tests were conducted to evaluate the relationship between groundwater elevation trends and the concentrations of various water quality constituents of concern. The test was conducted over a period of continued groundwater elevation decline and a period of stable groundwater elevations. The analysis concluded that no significant trend exists within the Subbasin between groundwater elevation changes and changes in concentrations of common water quality constituents. It was further concluded that, absent this trend, sustainable management criteria were not appropriate.

Recommended Corrective Action #	Recommended Corrective Action Summary	Periodic Evaluation Section(s)	Periodic Evaluation Summary
6b	The GSAs should provide additional details supporting the selection of TDS criteria and justify why TDS concentrations exceed the secondary maximum contaminant level.	Section 3.3.3.2	The SMCL is a secondary drinking water standard established for aesthetic reasons such as taste, odor, and color and is not based on public health concerns. For agricultural users, the majority of crop tolerances are above TDS concentrations observed in the Subbasin. Concentrations of TDS have historically exceeded the SMCL in certain depths and portions of the Subbasin. Undesirable results or adverse impacts to beneficial users have not been reported to the GSAs.
7a	The GSAs should establish sustainable management criteria for depletions of interconnected surface water while incorporating the location, quantity, and timing of depletions. Consider utilizing the interconnected surface water guidance when issued by the DWR.	Section 3.5.3.1	The GSAs completed additional analyses to quantify the volume, timing, and location of depletions of interconnected surface waters. Guidance on interconnected surface waters from DWR was not available by the time the 2025 GSP and PE were completed. Future changes to the sustainable management criteria for depletions may be considered in the future based on the guidance from DWR.
7b	The GSAs should continue to fill data gaps, collected additional monitoring data, and implement the current strategy to manage interconnected surface water depletions and define segments of interconnectivity and timing.	Section 3.5.3.2 and Section 5.2	The GSAs conducted an analysis through the MercedWRM to compare historical conditions to a no-pumping scenario to isolate the impacts of pumping on interconnected surface water bodies. The results of the analysis allowed the GSAs to better quantify the volume, locations, and timing of depletions along with adjacent basin impacts to the Subbasin. The GSAs have continued to monitor conditions and have added monitoring wells to support further analyses.

Recommended Corrective Action #	Recommended Corrective Action Summary	Periodic Evaluation Section(s)	Periodic Evaluation Summary
7c	Prioritize collaboration and coordination with local, state, and federal regulatory agencies and interested parties to understand impacts to beneficial uses and users that may be impacted by interconnected surface water depletions.	Section3.5.3.3 and Section 7	Following modeling analysis and refining sustainable management criteria, the GSAs engaged local and state agencies and interested parties to discuss the updates to depletions of interconnected surface water. The GSAs requested input from these stakeholders on what beneficial uses and users that they work with and what potential impacts they may experience due to depletions of interconnected surface waters. Input from those meetings is summarized in Section 3.5.3.3.
8	The GSAs should prioritize filling data gaps in the groundwater level monitoring network and describe how filling these data gaps will assist in the successful implementation of the Above Corcoran Sustainable Management Criteria Adjustment Consideration Management Action.	Section 6.1.1 and Section 6.2	The GSAs initiated the Data Gaps Plan during the evaluation cycle and added nineteen wells to monitor groundwater levels, eight of which are representative monitoring wells with newly established sustainable management criteria. The GSAs intend to work to fill remaining data gaps for groundwater levels and other sustainability indicators. The Above Corcoran Sustainable Management Criteria Adjustment Consideration Management Action will benefit from the additional data collected from above and below the Corcoran Clay to identify opportunities to sustainably increase use of the underutilized Above Corcoran Clay Aquifer while reducing stresses on the Below Corcoran Clay Aquifer which is subject to subsidence.

Recommended Corrective Action #	Recommended Corrective Action Summary	Periodic Evaluation Section(s)	Periodic Evaluation Summary
9	The GSAs should provide a robust discussion explaining how the implementation of the projects and management actions will restore groundwater levels up to the measurable objective by 2040 and how certain management actions will avoid impacts to the sustainability indicators.	Section 4.5.2	The GSAs have completed several projects, two of which are currently active and expected to provide groundwater benefits in the form of in-lieu and direct recharge. The GSAs are also in process of implementing additional in-lieu, direct recharge, and demand reduction projects. The GSAs' demand reduction programs have been modeled in conjunction with projects, to show achievement of the sustainability goal.

4. STATUS OF PROJECTS AND MANAGEMENT ACTIONS

§356.4(b) *A description of the implementation of any projects or management actions, and the effect on groundwater conditions resulting from those projects or management actions.*

4.1 Summary

The 2022 GSP included several projects and management actions (PMAs) that were either implemented, planning to be implemented, in design, and/or undergoing initial planning and studies.

Full descriptions of these projects are included in the Merced Integrated Regional Water Management (MercedIRWM) Opti project tracker: https://opti.woodardcurran.com/irwm/merced/. Consistent with SGMA requirements, the project descriptions in the Opti project tracker contain information regarding:

- Project descriptions,
- Significant new information,
- Reported or expected benefits,
- Evaluation of project impacts or benefits,
- Permitting and regulatory processes,
- Public notice and engagement processes, and
- Estimated costs and funding source

4.2 Completed Projects

Since adoption of the 2022 GSP, nine projects have been completed and are actively implemented in the Subbasin. **Table 4-1** provides a summary of updates to the projects completed since adoption of the 2022 GSP.

The completed projects outlined below are a subset of projects shortlisted in the 2022 GSP.

- El Nido Conveyance System Improvements Project
- El Nido Monitoring Wells Installation
- Planada Groundwater Recharge Basin Pilot Project
- Meadowbrook Water System Intertie Feasibility Study
- Merced Groundwater Subbasin LiDAR
- Merced Irrigation District to Lone Tree Mutual Water Company Conveyance Canal
- Merced Subbasin GSP Development Project for Addressing Critical Data Gaps
- Mini-Big Conveyance Project Feasibility Study
- Streamlining Permitting for Replacing Sub-Corcoran Wells
- Study for Potential Water System Intertie Facilities from MID to LGAWD and CWD

The majority of these projects were feasibility studies, incorporation of new data sources into the MercedWRM, and local policy changes. As a result, quantified benefits were not able to be determined for all projects. However, these projects have allowed the GSAs to better understand groundwater conditions in the Subbasin and better implement future planned projects. Two projects, Merced Irrigation District to Lone Tree Mutual Water Company Conveyance Canal and El Nido Conveyance System Improvements Project, were completed during the evaluation cycle and are anticipated to provide direct groundwater benefits to the Subbasin. Both projects are expected to generate 3,300 AFY in the form of direct and in-lieu groundwater recharge during the implementation period.

Two projects were removed during the evaluation cycle: Merquin County Water District (MCWD) Recharge Basin and MCWD Sustainable Yield Management Plan and Plan Implementation. Both projects were withdrawn from the SGM Implementation Grant Round 1 grant agreement as MCWD decided to no longer pursue them.

Table 4-1: Project Updates for Merced Subbasin Groundwater Sustainability Plan

Project Name	Project Update	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
Project 1: Planada Groundwater Recharge Basin Pilot Project	Cone Penetration Tests did not show favorable geologic conditions for a recharge basin; a dry well recharge facility was installed as an alternative to a traditional recharge basin. Pre-filtration methods designed for the pilot were insufficient; alternative approaches to filtration are being considered and evaluated. A permanent monitoring well was installed in September 2020. This well has been added to the Subbasin's monitoring network.	• Chronic lowering of groundwater levels • Reduction of groundwater in storage	Completed	March 2024	Not Applicable	Not Applicable
Project 2: El Nido Groundwater Monitoring Wells	All planned well site installations have been completed. These wells have been added to the Subbasin's monitoring network.	• Chronic lowering of groundwater levels • Reduction of groundwater in storage • Degraded water quality • Land subsidence	Completed	December 2020	Not Applicable	Not Applicable

Project Name	Project Update	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
Project 3: Meadowbrook Water System Intertie Feasibility Study	The feasibility study was completed in January 2021 proposing the installation of a 12" water main and intertie to the City of Merced's Water System.	• Chronic lowering of groundwater levels • Reduction of groundwater in storage	Completed	January 2021	Not Applicable	Not Applicable
Project 4: Merquin County Water District Recharge Basin	Merquin County Water District is no longer pursuing this project.	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Project 5: Merced Irrigation District to Lone Tree Mutual Water Company Conveyance Canal	The conveyance canal was constructed in fall 2022 and is currently in operation.	• Chronic lowering of groundwater levels • Reduction of groundwater in storage • Land subsidence	Completed	Fall 2022	Under Evaluation	1,300 AFY
Project 8: Merced Groundwater Subbasin LiDAR	Funding for this project was awarded under the Proposition 1 Round 1 IRWM Implementation Grant in 2020. Light Detection and Ranging (LiDAR) data were collected in December 2020 and is used in conjunction with weather forecast data to predict local stormflows from rainfall events.	All	Completed, Activities ongoing	LiDAR data will continue to be used in the Subbasin to better predict climate conditions.	Not Applicable	Not Applicable

Project Name	Project Update	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
Project 9: Study for Potential Water System Intertie Facilities from MID to LGAWD and CWD	The study was completed in 2021. The GSAs received Proposition 68 Implementation Grant funding for the phase 1 portion of this work in 2021. An additional, separate phase 2 of work has been funded as part of the SGM Implementation Grant Round 1.	• Chronic lowering of groundwater levels • Reduction of groundwater in storage	Completed	2021	Not Applicable	Not Applicable
Project 11: Mini-Big Conveyance Project Feasibility Study	Combined with Project 9 Study for Potential Water System Intertie Facilities from MID to LeGrand-Athlone Water District (LGAWD) and Chowchilla Water District (CWD) due to substantial overlap in scope.	• Chronic lowering of groundwater levels • Reduction of groundwater in storage	Completed	2021	Not Applicable	Not Applicable
Project 12: Streamlining Permitting for Replacing Sub-Corcoran Wells	The study has been completed and has been used by Merced County to support well permitting from below to above the Corcoran Clay in the subsidence area.	• Chronic lowering of groundwater levels • Reduction of groundwater in storage	Completed	2021	Not Applicable	Not Applicable
Merced Subbasin GSP Development Project for Addressing Critical Data Gaps	Developed Remote Sensing Decision Support Tool for Subbasin. The tool was completed in spring 2023.	All	Completed	March 2023	Not Applicable	Not Applicable

Project Name	Project Update	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
El Nido Conveyance System Improvements Project	Provided conveyance improvements at four existing siphons/pipelines in MID's El Nido Conveyance System to allow more surface water to be diverted from the Mariposa Creek to the El Nido area, an Underrepresented Community suffering from declining groundwater levels and subsidence. Construction concluded in March 2022.	All	Completed	March 2022	Under Evaluation	2,300 AFY
Merquin County Water District Sustainable Yield Management Plan and Plan Implementation	MCWD has withdrawn this project from the SGM Implementation Grant Round 1 grant agreement and is no longer pursuing the project.	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Merced Subbasin GSP Development Project for Addressing Critical Data Gaps	The "Addressing GSP Gaps" component has multiple sub-components: - The Data Gaps Plan document was completed in July 2021 and provides tools to prioritize filling the data gaps and identifies implementation procedures necessary to fill such gaps. The Data Gaps Plan does not attempt to completely fill all identified gaps, but rather acts as a starting point and guidance framework for ongoing efforts to do so. - Upgrade and Incorporate Existing Wells into Monitoring Network – MIUGSA and MSGSA have identified existing candidate wells for potential incorporation into the monitoring network and instrumented several of those wells for monitoring. In early- to mid-2024, the GSAs are completing remaining work to investigate, through video logs, site visits, and well completion reports, then instrument and incorporate the appropriate wells. Install New Monitoring Well(s) in Critical Locations – new dual completion (2 casings) monitoring	• Chronic lowering of groundwater levels • Reduction of groundwater in storage • Land subsidence • Interconnected surface water	Completed	March 2023	Not Applicable	Not Applicable

Project Name	Project Update	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
	well was previously installed in the southwest corner of the Subbasin.					

4.3 Ongoing Projects

The GSAs have included nineteen additional projects, identified as part of developing an application for funding by the SGM Implementation Grant Fund (Round 1 and Round 2). These projects are summarized in **Table 4-2** and descriptions are provided below. Section 6.4 of the 2025 GSP provides additional information and progress on implementation activities for ongoing and planned projects.

Full descriptions of these projects are included in the MercedIRWM Opti project tracker: https://opti.woodardcurran.com/irwm/merced/.

While several projects are currently in the conceptual phase, seven are nearing implementation and have estimated groundwater benefits:

- Amsterdam Water District Surface Water Conveyance and Recharge Project
- Crocker Control Structure Rehabilitation
- G Ranch and La Paloma Mutual Water Company Groundwater Recharge, Habitat Enhancement, and Floodplain Expansion Projects
- LeGrand-Athlone Water District Intertie and Recharge Project (Phase 1 & 2)
- Turner Island Water District (TIWD) Water Conservation
- Vander Dussen Subsidence Priority Area Flood-MAR Project
- Vander Woude Storage Reservoir

Following implementation, these projects are anticipated to provide approximately 33,800 AFY of groundwater benefits in the form of direct recharge, in-lieu recharge, and conservation practices. The GSAs intend to track project benefits through the chronic lowering of groundwater levels monitoring network and through project-specific monitoring activities. The Buchanan Hollow Mutual Water Company Floodwater Recharge project is also expected to provide in-lieu and direct recharge benefits to the Subbasin; however, the project is still in the conceptual phase and the quantity and timing of these volumes are still under evaluation.

Table 4-2: Projects Ongoing During 2025 Evaluation Cycle

Project Name	Project Description	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
LeGrand-Athlone Water District Intertie and Recharge Project (Phase 1)	The LGAWD Intertie and Recharge Project involves building a 2.18-mile canal to connect Merced Irrigation District's Booster Lateral 3 to Dutchman Creek. The canal will carry 35 cubic feet per second (cfs) of floodwater for Flood Managed Recharge (Flood-MAR) on over 200,000 acres in the Merced Subbasin. Water will come from the Intertie Canal via Little Deadman Creek. Flood-MAR will take place within LGAWD, the Merced Subbasin, and other districts. In a typical winter, over 7,000 acre-feet of floodwater will be used. The 35 cfs will flow into Mariposa Creek, Little Deadman Creek, Deadman Creek, and Dutchman Creek, available for diversion by landowners using existing and temporary pumps. Points of Diversion are detailed in the Permanent Water Rights Application submitted to the State Water Resources Control Board on December 30, 2019 and May 28, 2020.	• Chronic lowering of groundwater levels • Reduction of groundwater in storage • Degraded water quality • Land subsidence	Ongoing	August 2025	Under Evaluation	4,400 AFY (Benefits are cumulative with Phase 2)

Project Name	Project Description	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
LeGrand-Athlone Water District Intertie Canal (Phase 2)	The proposed LGAWD Intertie and Recharge Project Component (Project Component) completes Phase 2 of the LGAWD Intertie Canal. The LGAWD Intertie Canal would capture and store floodwaters by constructing an approximately 2-mile canal to connect MID's Booster Lateral 3 to Dutchman Creek northeast of Santa Fe Road. The new Intertie Canal would be built to convey 125 cubic feet per second (cfs) of floodwater for Flood Managed Aquifer Recharge (Flood-MAR) on approximately 40,000 acres of productive farmland in the Merced Subbasin.	• Chronic lowering of groundwater levels • Reduction of groundwater in storage • Degraded water quality • Land subsidence	Ongoing	August 2025	Under Evaluation	4,400 AFY (Benefits are cumulative with Phase 1)

Project Name	Project Description	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
Merced Subbasin Integrated Managed Aquifer Recharge Evaluation Tool (MercedMAR)	MercedMAR is an extension and integration of existing Merced models, including the Merced WRM and Groundwater Recharge Assessment Tool, to support exploration of groundwater recharge in the Merced Subbasin. The goal of the tool is to provide a one-stop shop tool and resources for decision makers (including Groundwater Sustainability Agency representatives, surface water operators, growers, drinking water users, domestic well owners, and other stakeholders) to implement and optimize MAR to benefit disadvantaged communities (DACs), growers, the ecosystem, Groundwater Dependent Ecosystems (GDEs), and the Subbasin's groundwater health. Additionally, MercedMAR will be used to support benefits and impacts of recharge to the shallow domestic well owners. The integrated tool can also enable the GSAs to account for allocation of recharge credits appropriately and support a basin-wide Flood-MAR program.	All	Ongoing	September 2024	Not Applicable	Not Applicable

Project Name	Project Description	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
Vander Dussen Subsidence Priority Area Flood-MAR Project	The Vander Dussen Subsidence Priority Area Project (Project) will build a 1.25-mile earthen canal from Merced Irrigation District's El Nido Canal to and 685-acres of agricultural fields, of which approximately 325-acres are located within Sandy Mush Mutual Water Company and 333-acres in the Madera County GSA. With 90 days of flood flows, the 20 cubic feet per second (cfs) canal will yield ~3,600 acre-feet (AF) of recharge.	• Chronic lowering of groundwater levels • Reduction of groundwater in storage • Degraded water quality • Land subsidence	Ongoing	April 2025	Under Evaluation	2,200 AFY
Vander Woude Storage Reservoir	The project will build a 30-acre storage reservoir with a capacity of 250 acre-feet (AF). The project will divert flood water from Mariposa and Owens Creeks and store it or later use to meet crop demand. It's estimated the reservoir would be filled 3 times per year for an estimated yield of 750 AFY. In addition, the project would permanently fallow 30-acres of productive farmland that has a crop demand of 150 AFY. The total project yield is 900 AFY.	All	Ongoing	November 2024	Under Evaluation	800 AFY

Project Name	Project Description	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
Filling Data Gaps Identified in Data Gaps Plan	The 2022 GSP identifies areas of data gaps in the Merced Subbasin in regard to a lack of understanding of groundwater levels in poorly monitored portions of the subbasin, partially due to unequal spatial representation of monitoring wells and a lack of understanding of shallow groundwater conditions near groundwater dependent ecosystems and rivers, mainly due to a lack of monitoring wells near such areas. Filling these gaps will help to improve scientific understanding, support ongoing basin management and policy making and can be used in developing future updates to the GSP. This project will include geophysical logging of the wells. The Merced GSP Data Gaps Plan, completed in Summer 2021, developed a tool to address the lack of spatial representation of monitoring wells and to determine well locations with opportunities to address multiple needs. This project proposes using the Data Gaps Tool to identify the high priority areas where the GSAs can install monitoring wells to better understand the groundwater conditions and basin water use.	• Chronic lowering of groundwater levels • Reduction of groundwater in storage • Land subsidence • Interconnected surface water	Ongoing	November 2024	Not Applicable	Not Applicable

Project Name	Project Description	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
Amsterdam Water District Surface Water Conveyance and Recharge Project	This project is composed of five project components with an estimated benefit of 6,580 AFY. The Bert Crane Pipeline component would build approximately 1-mile of 21" PVC pipeline to convey surface water from Canal Creek to an existing 125-acre-foot irrigation reservoir. The project would also build three recharge ponds totaling approximately 53-acres - Mark Couchman 8-acre recharge pond, Bert Crane 25-acre recharge pond, and Craig Johnson 20-acre recharge pond.	All	Planning	To Be Determined	Not Applicable	6,580 AFY

Project Name	Project Description	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
Crocker Control Structure Rehabilitation (Formerly "GSP Project 31: Crocker Dam Modification")	This project encompasses the installation of automatic gates at MID's Crocker Dam, located just west of Merced at the bifurcation of Black Rascal Creek and Bear Creek. Crocker Dam is a fixed structure with removable plates that are installed every spring (sometimes multiple times depending on late rains) to raise the water level to allow irrigation diversions. The current configuration severely limits the operational flexibility and control over this facility as it is primarily either "up" or "down" with switching between the two a difficult task. It is proposed to replace these plates with automatic gates. The automatic gates would allow for MID to remotely operate the control structure and adaptively manage the flows in Bear Creek/Black Rascal Creek. This would provide improved flood control downstream, water storage, and be a supply for groundwater recharge from stormwater (Flood-MAR).	All	Ongoing	June 2030	Under Evaluation	15,700 AFY

Project Name	Project Description	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
G Ranch Groundwater Recharge, Habitat Enhancement & Floodplain Expansion Project – Planning & Implementation	La Paloma Mutual Water Company (LPMWC) proposes a planning study to eventually develop the G Ranch Groundwater Recharge & Ecosystem Enhancement Project. The planning Project would consist of the planning, design, and environmental permitting of the combination of groundwater recharge ponds and floodplain re-establishment. The ponds would be designed to enhance the Pacific Flyway wetland habitat. The project would be located on approximately 439 acres within the G-Ranch property. This project would enhance 270-acres of existing wetlands and re-establish the remaining 169 acres of double-cropped farmland to floodplains. The entire project would be utilized for habitat enhancement and groundwater recharge, providing additional wetland habitat for migrating waterfowl.	All	Ongoing	April 2026	Under Evaluation	2,300 AFY (Benefits are cumulative with La Paloma project)

Project Name	Project Description	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
Buchanan Hollow Mutual Water Company Floodwater Recharge Project	The Project is to complete a Groundwater Recharge and Recovery Suitability Study to determine the suitability of recharge within Buchanan Hollow Mutual Water Company (BHMWC). The Soil Agricultural Groundwater Banking Index indicates that four areas of the site warrant further investigation. This Grant would fund BHMWC to hire a consulting engineer to fulfill a scope of work describing the suitability to recharge groundwater within BHMWC for subsequent extraction. It is expected the engineer would have approximately 8 geotechnical borings drilled to approximately 50 feet below the ground surface and generate lithologic logs. Soil samples would be analyzed for groundwater recharge suitability, likely moisture content, dry unit weight, grain size distribution, plasticity index, expansion potential, hydraulic conductivity (permeability), direct shear, and corrosion potential.	• Chronic lowering of groundwater levels • Reduction of groundwater in storage • Degraded water quality • Land subsidence	Planning	To Be Determined	Not Applicable	Under Evaluation

Turner Island Water District (TIWD) Water Conservation	TIWD's water delivery system consists of a series of open ditches that are fed by wells and surface water pumps. It is inefficient in its delivery and TIWD's growers are constantly maneuvering water in creative ways to recover delivered and return flow water. This project would consist of the construction of a surface water reservoir and installation of pumps/piping to return water to the head of the TIWD system. This would reduce strain on our growers' operations and allow us to limit the pumping of wells. Furthermore, some surface water deliveries to the district are erratic and can be curtailed quite quickly. A reservoir as part of the return system will allow TIWD to store the surface water when available and delay the pumping of wells, thereby reducing strain on wells and thus, the groundwater resources from which these wells draw. Based on this limited pumping, it is believed that this storage/return system could save 1,500 AF or more per year in groundwater extractions. This number does not reflect the ability for this reservoir to capture wet year water and stored for later use, which could be incredibly beneficial in further reducing demand on TIWD wells, potentially to the tune of an additional 750-1,000 AF per year.	• Chronic lowering of groundwater levels • Reduction of groundwater in storage • Land subsidence	Ongoing	July 2026	Under Evaluation	1,800 AFY
TIWD Shallow Well Drilling	Many of TIWD's wells are screened below the Corcoran Clay. Pumping from this aquifer is more likely to result in land subsidence issues,	Land subsidence	Ongoing	January 2025	Not Applicable	Not Applicable

Project Name	Project Description	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
	compared to pumping from the aquifer above the Corcoran Clay. This project would entail the construction of wells, screened above the Corcoran Clay to minimize subsidence impacts. This would require the scoping of the locations of the wells to ensure good production, followed by the drilling and installation of new wells at those desired locations. These shallow wells would be intended to replace existing deeper wells. Additionally, the project would consider geophysical logging of the well.					

Project Name	Project Description	Targeted Sustainability Indicator	Project Status	Expected Schedule or Completion Date	Benefits Observed to Date or Anticipated Benefits	Estimated Accrued Benefits at Completion
La Paloma Mutual Water Company Bear Creek Ranch Groundwater Recharge, Habitat Enhancement, and Floodplain Expansion – Phase I & II (Planning & Construction)	This project involves the planning and design of dual-purpose groundwater recharge ponds to enhance Pacific Flyway wetland habitat. The goal of the Project is to plan and design the re-establishment of approximately 1,171-acres of irrigated farm ground to floodplains, providing habitat for migrating waterfowl. Through the fallowing of this farm ground, the Merced Subbasin would get a net benefit through decreased pumping of approximately 5,400 acre-feet per year. The project would include the installation of four lift pumps from Bear Creek and additional facilities from the Livingston Drain to convey approximately 2,200 AFY of floodwater through approximately 28,000 linear feet of new pipelines distributed across the 2,111-acre ranch. The five points of diversion are included in the Permanent Water Rights Application submitted to the State Water Resources Control Board on December 30, 2019 and May 28, 2020.	All	Ongoing	April 2026	Under Evaluation	2,300 AFY (Benefits are cumulative with and G Ranch project)

4.4 Management Actions

Four management actions were presented in the 2022 GSP, and progress has been made in developing them during the evaluation cycle. Currently, the management actions in development within the Subbasin are listed below and summarized in **Table 4-3**:

- Integrated Groundwater Allocation Framework
- Merced Subbasin GSA Groundwater Demand Reduction
- Merced Irrigation-Urban GSA Groundwater Allocation
- Domestic Well Mitigation Program
- Above Corcoran Sustainable Management Criteria Adjustment Consideration

The Merced Subbasin GSA Groundwater Demand Reduction management action includes two phases: Phase 1 focusing on achieving a reduction in consumptive use of groundwater by 15,000 AFY by WY 2025, providing GSA the time needed to develop Phase 2, which is a comprehensive demand reduction program to achieve the large necessary annual reduction. Phase 2, scheduled to begin in 2026, would enforce distinct sustainability zones where allocations are escalated over the course of the GSP implementation period. The allocations would be based on a sustainable yield of native ground at 13 inches per acre. An additional pumping allowance of 10 inches would be included for the first 10 years of the program to allow users to adapt to the allocations. The additional pumping allowance decreases by one inch each proceeding year unless groundwater levels achieve measurable objectives.

The Merced-Irrigation Urban GSA Groundwater Allocation management action currently assigns extraction allocations at 1.1 acre-feet per acre per year. These allocations are in place for the first three years of program implementation; the allocation program will be refined following the submittal of the 2025 GSP.

Additional details on both allocation programs are presented in Section 6.2 of the 2025 GSP.

The Domestic Well Mitigation Program is intended to provide the GSAs with the management structure and resources to respond to adverse impacts experienced by domestic well users as a result of groundwater level declines. The Domestic Well Mitigation Program is currently in development with the GSAs in process of expanding services within Merced County and conducting additional modeling analyses on interim milestone impacts on domestic well users. Following these actions the GSAs plan to finalize and adopt the program by September 2025. Additional information on the Domestic Well Mitigation Program is discussed in Section 6.2.4 of the 2025 GSP.

As described in Section 6.2.6 of the 2025 GSP, the Above Corcoran Sustainable Management Criteria Adjustment Consideration management action would consider an adjustment to the groundwater level sustainable management criteria for all or a portion of the Above Corcoran Clay Principal aquifer as a result of the aquifer not used as a primary source of water supply. The GSAs

are considering whether minimum thresholds should be lowered without impacting beneficial uses and users and other sustainability indicators.

Table 4-3: Management Actions Implemented by the Merced GSAs

Management Action	Management Action Update	Management Action Status	Expected Schedule or Completion Date
Integrated Groundwater Allocation Framework	The GSAs have identified a need to allocate the sustainable yield of native groundwater in the basin and establish groundwater extraction limits. Based on information in the original 2020 and revised 2022 GSPs, each GSA has individually developed programs and policies to manage groundwater within their jurisdiction. While these GSA driven programs are successfully moving towards meeting overall Basin goals, the GSAs recognize there may be a need for further refinement of the allocations at a basin scale. This Management Action describes the integrated framework that has been discussed by the GSAs.	Ongoing	Ongoing
Merced Irrigation-Urban GSA Groundwater Allocation	In 2023, MIUGSA adopted comprehensive Rules and Regulations that include an allocation program in addition to establishing a framework for measuring, monitoring, and enforcing the groundwater allocation through well registration and groundwater usage reporting systems. The MIUGSA Board set an initial groundwater allocation for agricultural users starting April 1, 2023, through December 31, 2025. The MIUGSA Board also adopted an allocation for non-agricultural users of 1.4 AF/ac per year through 2031, followed by an allocation of 1.1 AF/ac per year after 2031 through 2040. The adopted allocation values are considered consistent with the GSP's sustainable yield of native groundwater at the time.	Ongoing	Ongoing

Merced Subbasin GSA Groundwater Demand Reduction	Initiation of the demand reduction program began soon after adoption of the original GSP in 2019. Phase 1's Land Repurposing Program was designed and launched in WY 2022. Phase 2's demand reduction program was designed in WY 2024 and will be tested between September 12, 2024, and January 1, 2026. Full implementation of the program will begin on January 1, 2026, and continue beyond 2040.	Completed (Phase 1) In Development (Phase 2)	WYs 2022-2023 (Phase 1) January 1, 2026 (Phase 2)
Domestic Well Mitigation Program	Merced County received a technical assistance grant from DWR on March 5, 2024 to help prepare a drought resilience plan as required by SB 552. The GSAs are in the process of finalizing the Domestic Well Mitigation Program Implementation Roadmap which will detail the timeline of components needed to be completed to meet the September 2025 committed adoption date.	In Development	September 2025
Above Corcoran Sustainable Management Criteria Adjustment Consideration	The GSAs are currently assessing the scope of the proposed management action.	Under Evaluation	To be Determined

4.5 Recommended Corrective Actions and Modifications to the 2025 GSP

4.5.1 Response to Recommended Corrective Action 1a

DWR recommended the GSAs initiate the Domestic Well Mitigation Program prior to impacts being observed in domestic wells given that groundwater level interim milestones are below minimum thresholds and historical lows. As described in **Section 4.4**, the GSAs are actively working during 2024-2025 to develop the Domestic Well Mitigation Program, with scheduled plan to finalize and adopt the program by September 2025. Additional information on the Domestic Well Mitigation Program is discussed in Section 6.2.4 of the 2025 GSP.

4.5.2 Response to Recommended Corrective Action 9

DWR recommended the GSAs provide a robust discussion explaining how the implementation of the PMAs will restore groundwater levels up to the measurable objective by 2040 and how certain management actions will avoid impacts to the sustainability indicators. The subsections below describe in a stepwise fashion how the GSAs analyzed the impacts of PMAs, how sustainable yield was estimated to avoid undesirable results after the impacts of PMAs were included in the model, and the resulting measurable objectives achieved under sustainable conditions.

PMAs Modeling Scenario

The GSAs have nine completed or planned projects and two management actions that are expected to provide groundwater benefits to the Subbasin. The total estimated yield of the projects is approximately 34,000 AFY, while the management actions are expected to generate approximately 170,000 AFY. The largest magnitude of benefits are expected to occur through implementation of the MSGSA Groundwater Demand Reduction (allocation) program management action.

The MercedWRM was used to estimate the impacts of PMAs compared to the Projected Conditions Baseline. 2025 GSP Section 2.3.4.4 provides more detailed assumptions around the PMAs that were modeled. Including PMAs, the groundwater system of the Subbasin would experience an average of 702,000 AF of inflows each year, of which 306,000 AF is deep percolation, 323,000 AF of recharge from rivers, streams, and canals, and 72,000 AF of subsurface inflows from the Sierra Nevada foothills and the neighboring Delta-Mendota Subbasin. Subbasin outflows include groundwater production (519,000 AF), subsurface outflow to neighboring subbasins (136,000 AF), and stream gain from groundwater (35,000 AF), approximately 690,000 AFY in total.

The PMAs budget has greater inflows than outflows, resulting in an average annual increase in groundwater storage of 12,000 AF. While the PMAs scenario results in long-term stable groundwater levels and a slightly positive change in storage, model simulated drought periods still result in groundwater levels at some locations are still low enough that undesirable results are projected for one year out of the 33-year "sustainable conditions" period of 2040-2073 within the 50-year simulated hydrology (e.g. there is one year in which more than 25% of representative

monitoring wells experience groundwater levels below minimum thresholds for two consecutive years).

Sustainable Yield Modeling Scenario

Sustainable yield is defined for SGMA purposes 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." (CWC §10721(w)). Sustainable yield for the Merced Subbasin was calculated through development of a MercedWRM scenario in which:

- The long-term (50-year) change in Subbasin storage is zero or net positive.
- There are no undesirable results for the chronic lowering of groundwater levels sustainability indicator (e.g., avoids MT exceedances at 25% or more of the representative monitoring wells for two consecutive years) from 2040-2073 (the "sustainable conditions" period within the 50-year simulation running from 2023-2073).

The Sustainable Yield estimate is based on a modified version of the PMA scenario that lowers groundwater production through reduced agricultural demand across the model domain until undesirable results are no longer observed. Section 2.3.5 of the 2025 GSP provides more detail on the assumptions used in the sustainable yield estimate.

Under sustainable groundwater management conditions, the groundwater system maintains inflows of 694,000 AFY, which is greater than the outflow volume of 676,000 AF each year, and of which 306,000 AF of inflow is deep percolation. Inflows also include recharge from rivers, streams, and canals (318,000 AF), and subsurface inflows (70,000 AF) from the Sierra Nevada foothills and the neighboring subbasins of Turlock, Delta-Mendota, and Chowchilla.

The sustainable groundwater management scenario results in groundwater outflows that are slightly less than groundwater inflows, bringing the long term (50-year) average change in groundwater storage to a more positive value (+18,000 AFY). Further, this scenario avoids undesirable results related to groundwater levels.

It is recognized that the combined benefit of the PMAs is slightly lower than what is required for the Sustainable Yield scenario. However, these scenarios are highly dependent on the actions of neighboring subbasins and the difference between the PMA benefits and the Sustainable Yield estimate is considered with the range of uncertainty in the modeling simulations, actions of neighboring subbasins, and hydrologic variability. These values are anticipated to be revisited as part of the periodic evaluation process. The current difference between the PMA benefits and the Sustainable Yield estimate was considered too small to warrant modification to the PMAs, but this decision will be revisited as GSP implementation progresses. See Section 2.3.5 in the 2025 GSP for more details.

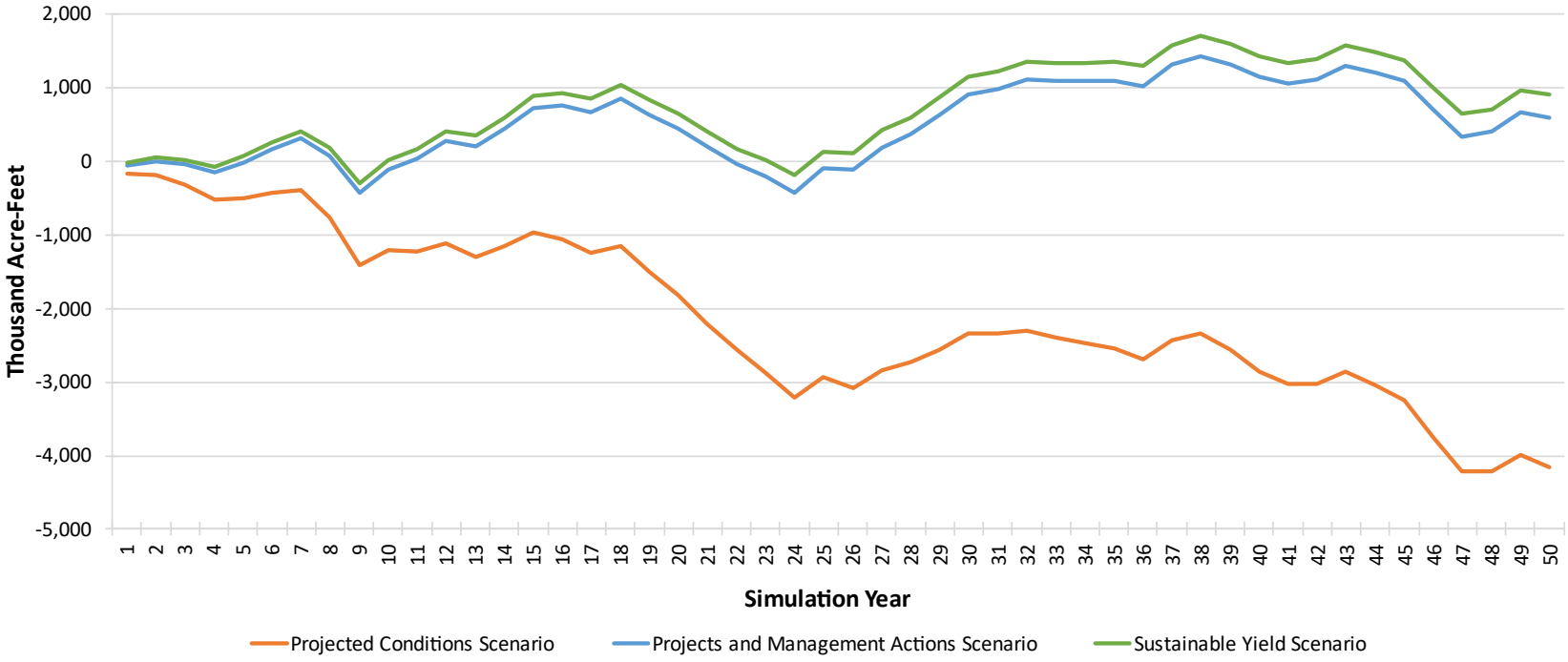
Measurable Objective Results

The MercedWRM estimates groundwater levels for each representative monitoring well across every year of the 50-year simulation period. Under sustainable conditions, groundwater levels at each representative monitoring well are anticipated to be within the margin of operational flexibility (the distance between the minimum threshold and measurable objective) according to hydrology or higher than the measurable objective. Across the sustainable yield scenario (years after 2040), 17% (5 of 29) representative monitoring wells are anticipated to operate exclusively within the margin of flexibility. The remaining 83% (24 of 29) of wells are anticipated to see groundwater levels above the measurable objective in 46% of years (on average), with the remainder of years showing groundwater levels within the margin of operational flexibility. While some wells do not achieve their defined measurable objective under the simulated conditions, they do achieve groundwater levels that are high enough to allow for declines during simulated drought conditions without triggering undesirable results, which is the intent of measurable objectives.

Figure 4-1 shows the cumulative change in groundwater in storage under the three scenarios over the simulation period (Projected Conditions, PMAs, and Sustainable Yield). Additional information on the modeling methods and results are presented in Section 2.3.5 of the 2025 GSP.

The Above Corcoran Sustainable Management Criteria Adjustment Consideration management action would consider an adjustment to the groundwater level sustainable management criteria for all or a portion of the Above Corcoran Clay Principal aquifer as a result of the aquifer not used as a major source of water supply. The GSAs are still considering whether minimum thresholds should be lowered without impacting beneficial uses and users and other sustainability indicators. The approach is based on successful implementation of projects elsewhere in the region where groundwater pumping is moved to above the Corcoran Clay and paired with recharge activities. This allows for more effective use of the shallow groundwater system while protecting other users but does require some level of flexibility in thresholds under what becomes more of a conjunctive use operation. Development of this management action will be performed in coordination with the stakeholder groups described in **Section 8.1**.

Figure 4-1: Cumulative Change in Storage Modeling Scenario Comparisons



5. BASIN SETTING BASED ON NEW INFORMATION OR CHANGES IN WATER USE

§356.4(d) *An evaluation of the basin setting in light of significant new information or changes in water use, and an explanation of any significant changes. If the Agency's evaluation shows that the basin is experiencing overdraft conditions, the Agency shall include an assessment of measures to mitigate that overdraft.*

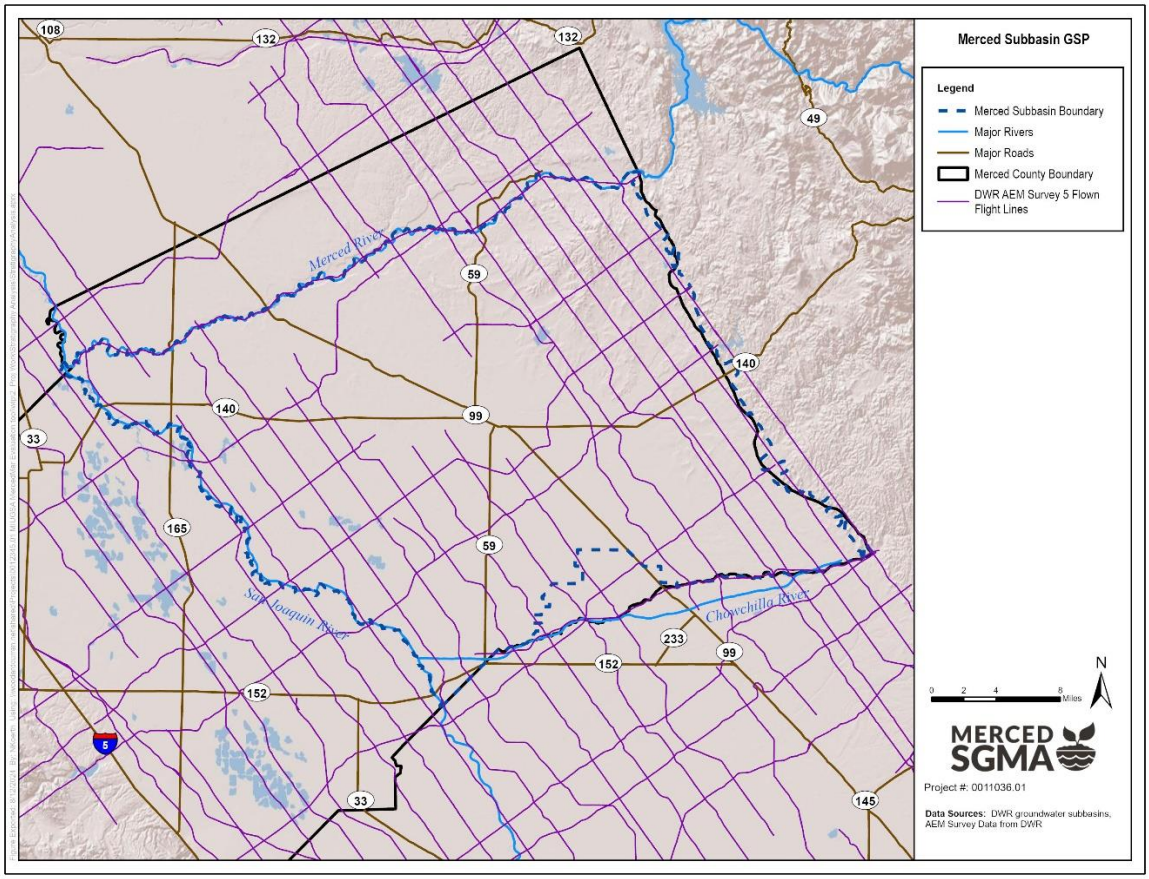
5.1 Hydrogeologic Conceptual Model

The hydrogeologic conceptual model (HCM) presented in the 2022 GSP discusses the physical setting, characteristics, and processes that govern groundwater within the Subbasin. This section discusses new information provided to the GSAs during the evaluation cycle that warranted updating the HCM and amending the GSP. New data and analyses conducted during this evaluation cycle are presented in **Section 2** of the Periodic Evaluation and described further below.

Airborne Electromagnetic Survey

On April 15, 2023, DWR published the *Data Report for Survey Area 5, Merced, Turlock and Modesto Groundwater Subbasins* which discussed the acquisition, processing, inversion and lithology transform for the AEM survey conducted in the Merced, Turlock and Modesto Subbasins. The survey included flight line planning, local coordination and public outreach, data collection and processing, and lithology modeling. Flight lines for the Merced Subbasin are shown in **Figure 5-1**. Additionally, the *Data Report for Survey Area 5, Merced, Turlock and Modesto Groundwater Subbasins* is included in **Appendix B**.

Figure 5-1: Merced Subbasin AEM Survey Flight Lines



AEM survey data were paired with lithology and geophysical data to better process and transform the survey data into the lithology and hydrostratigraphic models. The locations of the lithology and geophysical logs are shown in **Figure 5-2** and a summary of these logs is provided in **Table 5-1**.

Figure 5-2: Merced AEM Survey Flight Lines and Boring Logs

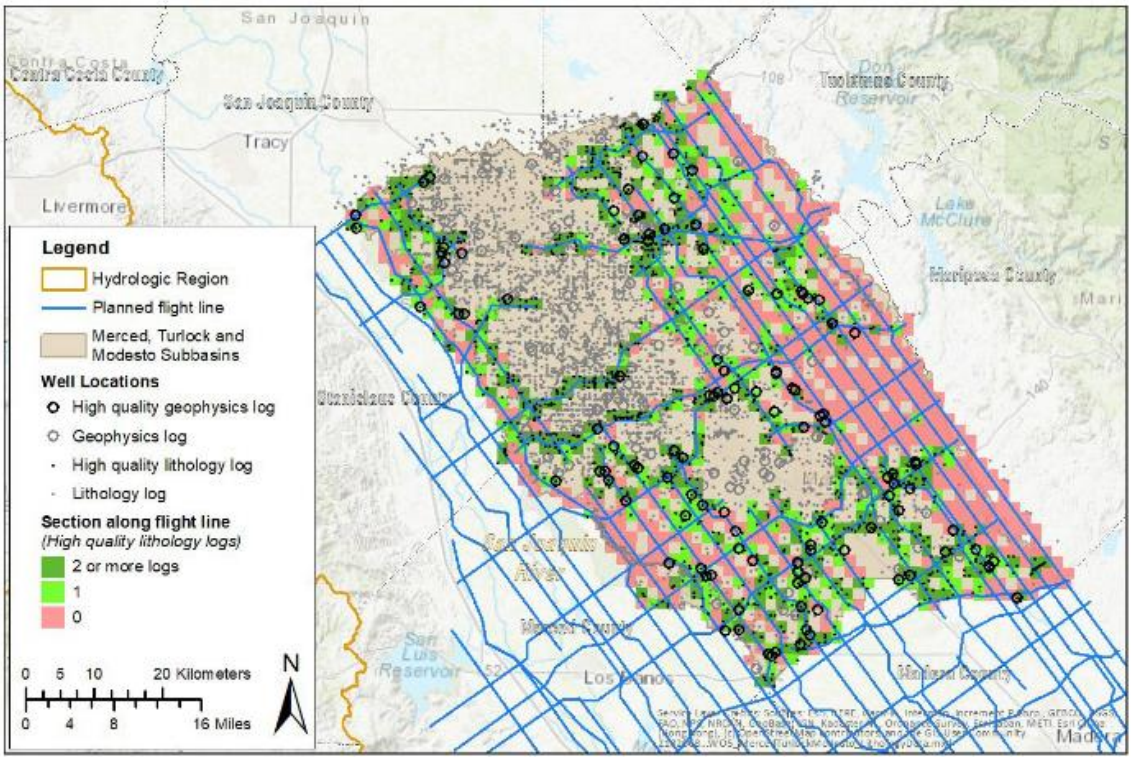


Table 5-1: Merced AEM Survey Lithology and Geophysical Logs

Lithology Logs		Geophysical Logs		Total
High Quality	Low Quality	Within Flight Line PLSS	Outside of Flight Line PLSS	
480	1,042	79	34	1,635

Results from the AEM survey data provided the GSAs with additional information to refine the HCM. AEM survey data shows a high percentage of coarse material at shallows depths throughout the Subbasin, specifically in the north, northwestern, and eastern areas, which aligns with the proximity of these areas to major surface water bodies and known alluvial deposits. Coarse percentages decrease with depth and a distinct layer with low percentages (0-10%) is observed across the Subbasin below the shallow coarse layers, which is consistent with the existing understanding of the extent of the Corcoran Clay. Beneath the Corcoran Clay, coarser material reappears also aligning with the Below Corcoran Clay Aquifer evaluated in the Subbasin's HCM. **Figure 5-3** presents the AEM survey coarse fraction data collected by DWR within the Subbasin.

As an example of the benefits of the AEM data, initially the MercedWRM characterized shallow clays extending along the northern border of the Subbasin (**Figure 5-4**). Analysis of the AEM data

showed that this shallow clay layer may not be present and the lithology in that area is likely coarser grained material. Several model updates such as this were made to reflect the improved understanding based on the AEM data (**Figure 5-5**).

Figure 5-3: AEM Survey Coarse Fraction Visualization

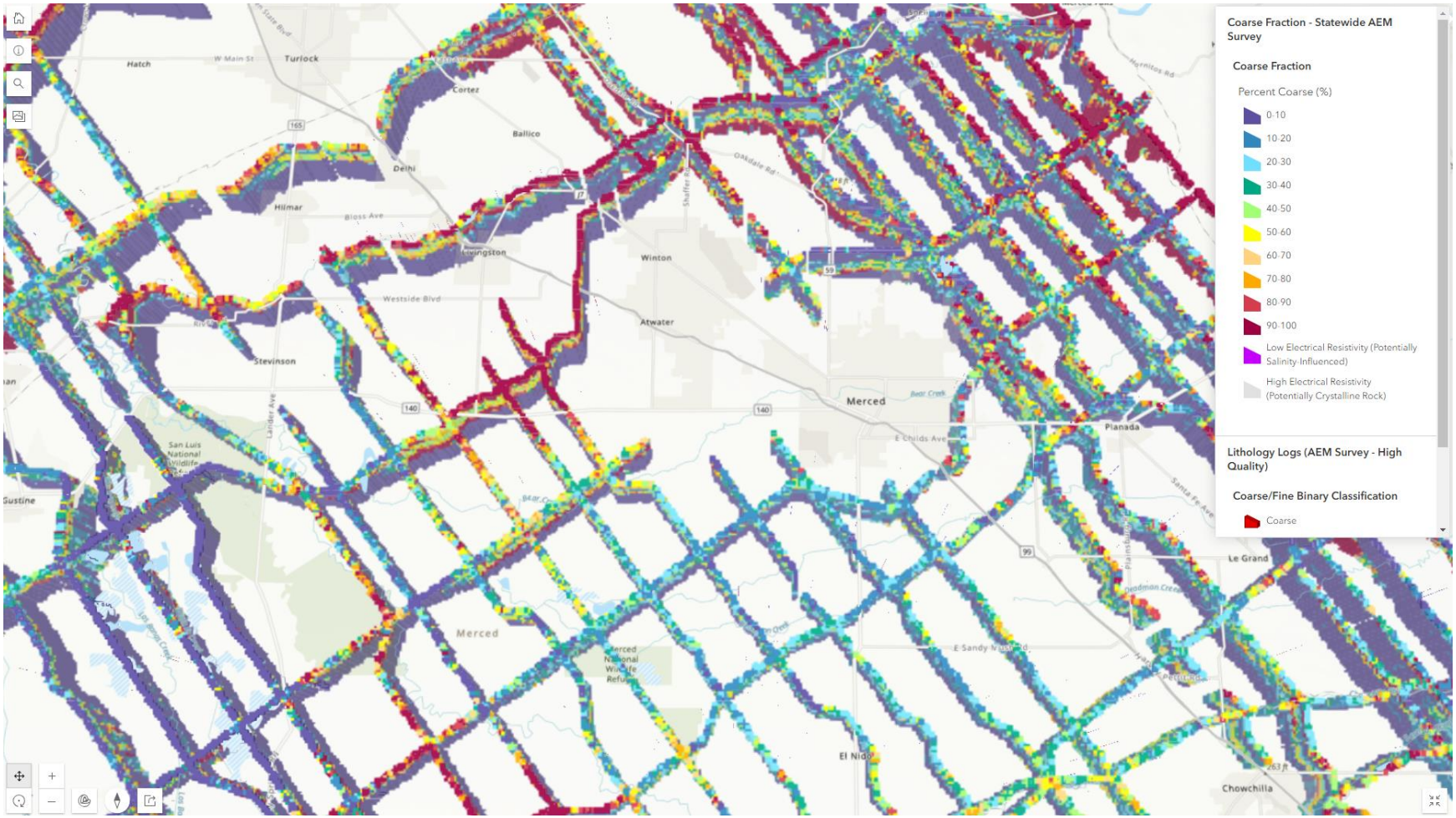


Figure 5-4: Initial MercedWRM Lithology Cross-Section, Northern Border

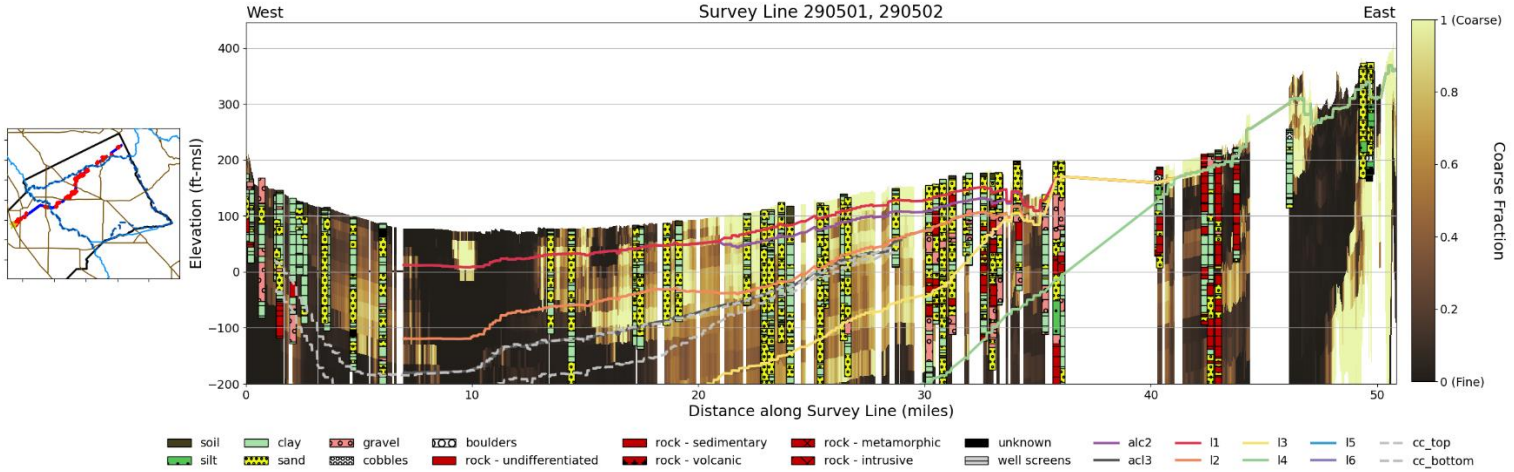
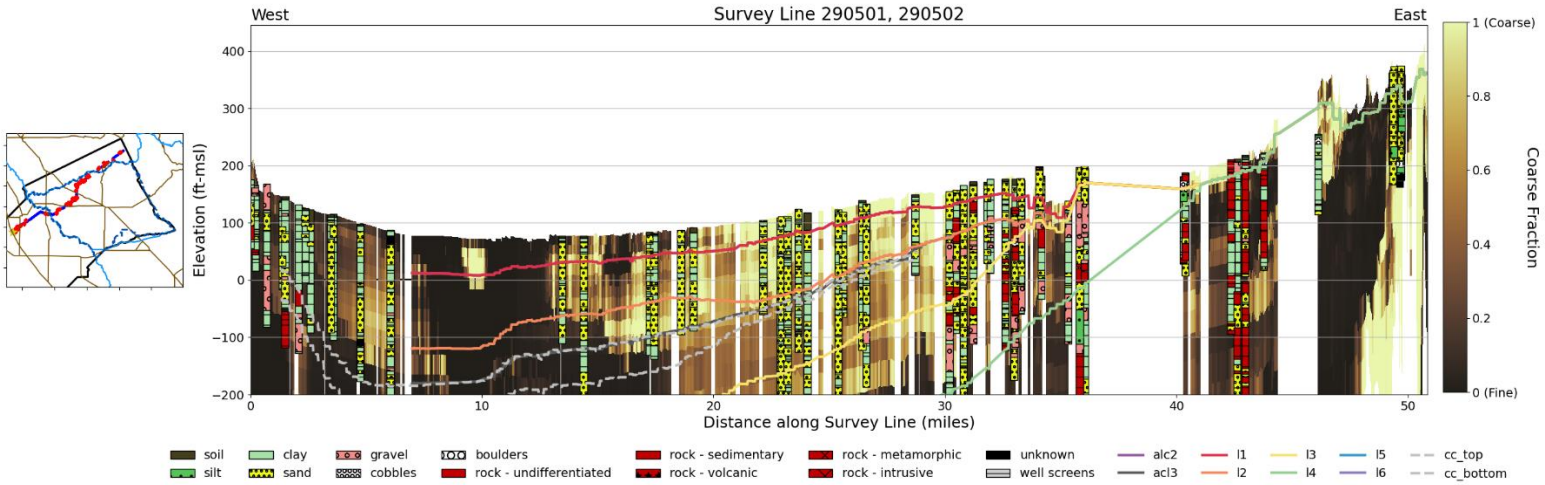


Figure 5-5: Current MercedWRM Lithology Cross-Section, Northern Border



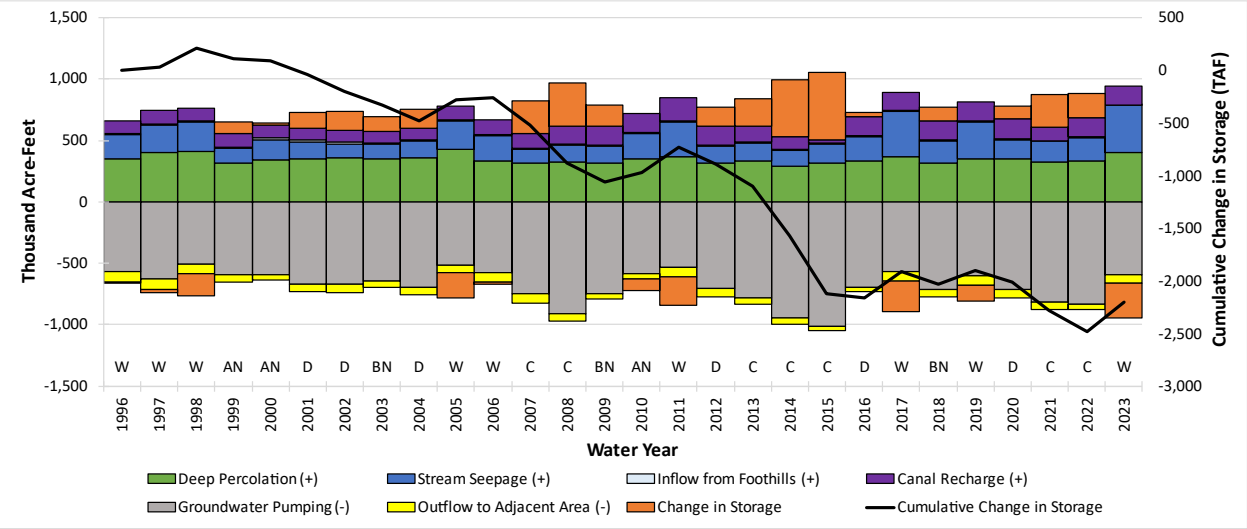
5.2 Groundwater Conditions

Outside of regular monitoring and efforts to fill data gaps, no new information related to regional groundwater conditions was collected during the evaluation cycle.

5.3 Water Use Changes and Associated Water Budget

As discussed in the 2022 GSP, the GSAs developed water budgets to provide a quantitative account of water entering and leaving the Subbasin. The values presented in the water budget provide information on historical, current, and projected conditions as they relate to hydrology, water demand, water supply, land use, population, climate change, groundwater and surface water interaction, and subsurface groundwater flow. This information can assist in the management of the Subbasin by identifying the scale of different uses, highlighting potential risks, and identifying potential opportunities to improve water supply conditions, among others. Water budgets were developed utilizing the MercedWRM (discussed further in **Section 5.4**) and are updated annually as new information and data is collected by the GSAs. **Figure 5-6** shows the estimated water budgets for water years 1996 through 2023, as well as the cumulative change in storage through that period.

Figure 5-6: Historical Annual Water Budget and Cumulative Change in storage (WYs 1996-2023)



Through the evaluation cycle, water use changed frequently each water year, summarized by component in **Table 5-2**.

Table 5-2: Estimated Water Budget by Water Year

Component	WY 2020 (AF)	WY 2021 (AF)	WY 2022 (AF)	WY 2023 (AF)	Average percentage change (WYs 2020-2023)
Deep Percolation	323,000	320,000	316,000	418,000	+10%
Inflow from Foothills	8,000	9,000	7,000	7,000	-3.7%
Groundwater pumping	-708,000	-620,000	-817,000	-713,000	+1.6%
Canal Recharge	155,000	123,000	156,000	152,000	-0.5%
Outflow to adjacent areas	0	-41,000	-7,000	-41,000	+168%
Stream Seepage	73,000	99,000	91,000	373,000	+109%
Outflow to Root Zone	-9,000	-13,000	-8,000	0	-36%

Most notably, outflow to adjacent areas and stream seepage remained stable from WYs 2020-2022 and increased significantly in WY 2023. The increase in stream seepage is attributed to the heavy precipitation events experienced in the winter months of 2022 and 2023, increasing the volume of water present in surface water bodies. While reported groundwater pumping in the Subbasin has also increased on average, the latest data (WY 2023) shows a significant decline from the previous water year.

5.4 Model Updates

The GSAs developed the Merced Water Resources Model (MercedWRM); a fully integrated surface and groundwater flow model covering approximately 1,500 square miles of the Merced Groundwater Region. The MercedWRM is a quasi-three-dimensional finite element model and was developed using the Integrated Water Flow Model 2015 software package to simulate the relevant hydrologic processes within the Subbasin. The model integrates groundwater aquifers with the surface hydrologic system, land surface processes, and water operations. The model is updated annually to incorporate the latest data available, including surface water diversions and deliveries, groundwater pumping, population, land use, precipitation, streamflow, boundary conditions, MID canal recharge, and interbasin flows.

Data for these components is procured annually from federal, state, and local entities and incorporated into the MercedWRM updates to generate an estimated water budget as part of the Annual Report process. **Table 5-3** lists the entities the GSAs regularly request data from each year. **Figure 5-6** shows the estimated groundwater budgets, by water year, following updates to the MercedWRM during the evaluation cycle.

Table 5-3: MercedWRM Data Sources

Entity Type	Entity Name(s)	Applicable MercedWRM Component
Agricultural and Environmental Water Purveyors	• Merced Irrigation District • Stevinson Water District • Merquin County Water District • Turner Island Water District • Lone Tree Mutual Water Company • Merced National Wildlife Refuge	• Surface Water Diversions and Deliveries • Groundwater Extractions • MID Canal Recharge
Municipal Water Purveyors	• City of Merced • City of Atwater • City of Livingston • Le Grand Community Services District • Planada Community Services District • Winton Water and Sanitary District • California American Water, Meadowbrook	• Groundwater Pumping
State of California	• DWR SGMA Data Viewer • DWR California Data Exchange Center • California Department of Finance	• Population • Streamflow • Boundary Conditions • Interbasin Flows
Federal	• United States Department of Agriculture, Natural Resources Conservation Service, National Agricultural Statistics Service: CropScape • United States Geological Survey National Water Information System • United States Census	• Population • Land Use • Streamflow
Other	• Precipitation-Elevation Regressions on Independent Slopes Model (PRISM) Climate Group, Oregon State University	• Precipitation

Significant refinements to the MercedWRM were made for the 2025 GSP Update, focusing on the Land Surface and Groundwater Systems, as described below:

- Land Surface System – Land Use

  Land Use Data was updated for the entire time period using DWR's Statewide Crop Mapping from 2014 through 2022. Data prior to 2014 was obtained from decadal County Land Use Surveys and interpolated between existing datasets.

- Land Surface System – Evapotranspiration

  Actual evapotranspiration data was obtained from OpenET in a raster format with a resolution of 30m x 30m. The data was processed by aggregating them by Land Use categories of MercedWRM and validated by the local California Irrigation Management Information System (CIMIS) station near Merced to obtain each crop potential evapotranspiration. At the time of the model update, OpenET had data available from 2016 through 2022, so data before 2016 was obtained by averaging evapotranspiration information by month and water year type and establishing a correlation with the historical reference evapotranspiration from the CIMIS station.

- Land Surface System – Soil Parameters

  Each element of the MercedWRM was mapped against the Soil Survey Geographic Database to obtain a soil classification for each element based on the major soil texture classifications defined by the United State Department of Agriculture (USDA). Using the soil classification for each element, the soil parameters needed in the MercedWRM (wilting point, field capacity, total porosity, pore size distribution index, and saturated hydraulic conductivity) were estimated using referenced ranges from published literature (Saxton & Rawls, 2006) and calibrated using the 2020 Merced Irrigation District Agricultural Water Management Plan.

  Additionally, using the soil classification and land use, the curve number for each element was estimated using the Technical Releasee 55 (TR-55) from the USDA which provides a range of curve number values based on cover type and hydrologic soil group.

- Groundwater System – Model Layering

  The lithological and stratigraphic information of the model was refined based on the latest Aerial Electromagnetic (AEM) survey from DWR, including shallow alluvial aquifer layer, to enable the model for assessment of GDEs, and facilitate future work that could model shallow recharge conditions within the model.

  The AEM survey was compared and validated with regional geologic maps and large-scale quadrangles, and complemented with well-specific elogs and local lithology information.

- Groundwater System – Aquifer Parameters

  New aquifer parameters were estimated by using the Texture data provided by the latest AEM survey and calibrated against groundwater level and streamflow observations between 1994 and 2023.

6. MONITORING NETWORKS

§356.4(e) *A description of the monitoring network within the basin, including whether data gaps exist, or any areas within the basin are represented by data that does not satisfy the requirements of Sections 352.4 and 354.34(c). The description shall include the following:*

(1) An assessment of monitoring network function with an analysis of data collected to date, identification of data gaps, and the actions necessary to improve the monitoring network, consistent with the requirements of Section 354.38.

(2) If the Agency identifies data gaps, the Plan shall describe a program for the acquisition of additional data sources, including an estimate of the timing of that acquisition, and for incorporation of newly obtained information into the Plan.

(3) The Plan shall prioritize the installation of new data collection facilities and analysis of new data based on the needs of the basin.

Section 6.1 discusses and assesses the monitoring networks established in the 2022 GSP and changes made to the monitoring network during the evaluation cycle. **Section 6.2** describes the current status of data gaps by sustainability indicator.

6.1 Summary of Changes to Monitoring Network

Modifications, such as the addition of new monitoring sites, were primarily made to the groundwater level and groundwater quality monitoring networks during this evaluation cycle. Information and timing of these changes are summarized below. Note that Section 4 of the 2025 GSP describes in greater detail the changes to the monitoring network for each applicable sustainability indicator and identifies data gaps.

6.1.1 Groundwater Levels

Nineteen monitoring wells were added to the groundwater level monitoring network during the evaluation cycle, as presented in **Table 6-1** below. Representative monitoring sites are denoted, and sustainable management criteria established for these locations are shown in **Table 6-2**.

Table 6-1: Monitoring Wells Added During Evaluation Cycle

Local Well Name	SGMA Station ID[2]	Principal Aquifer	Latitude	Longitude	Reference Point Elevation (ft. a-msl)	Well Depth (ft. bgs)	Top of Screen Interval (ft. bgs)	Bottom of Screen Interval (ft. bgs)	Representative Monitoring Well
MW-OA-3	To be Determined	Above	37.33028	-120.81444	To be Determined	55	40	50	Yes
Jefferson Road - Above Corcoran Shallow	60569	Above	37.09856	-120.48948	133.48	140	95	105	No
Jefferson Road - Above Corcoran Deep	60568	Above	37.09855	-120.48948	133.56	140	125	140	Yes
El Nido Firehouse - Above Corcoran Shallow	60566	Above	37.13473	-120.49286	140.35	90	70	90	No
El Nido Firehouse - Above Corcoran Deep	60565	Above	37.13473	-120.49286	140.31	130	110	125	Yes
Jefferson Road - Below Corcoran	60570	Below	37.09856	-120.48953	133.48	312	287	307	Yes
El Nido Firehouse - Below Corcoran	60567	Below	37.134731	-120.4928	141.49	345	320	340	Yes
Cardwell Ranch - Shallow	60564	Outside	37.25385	-120.31603	230.15	250	95	110	No
Cardwell Ranch - Intermediate	60563	Outside	37.25385	-120.31603	230.32	250	140	150	No
Cardwell Ranch - Deep	60562	Outside	37.25385	-120.31603	230.47	250	240	250	Yes
Michael Road	60571	Above	37.222162	-120.49354	139.9	104	94	104	No
HR1-S	60572	Above	37.0721827	-120.54256	113.76	184	164	174	No
DW7	To be Determined	Above	37.3304	-120.8447	To be Determined	172	To be Determined	To be Determined	No

Local Well Name	SGMA Station ID[2]	Principal Aquifer	Latitude	Longitude	Reference Point Elevation (ft. a-msl)	Well Depth (ft. bgs)	Top of Screen Interval (ft. bgs)	Bottom of Screen Interval (ft. bgs)	Representative Monitoring Well
DW9	To be Determined	Above	37.320231	-120.85914	To be Determined	158	30	150	No
DW16	To be Determined	Above	37.326273	-120.89207	To be Determined	205	60	200	No
DW17	To be Determined	Above	37.320796	-120.8919	To be Determined	127	20	120	No
DW18	To be Determined	Above	37.330651	-120.84336	To be Determined	190	80	165	No
Candidate Well ID C	To be Determined	Above	37.1927	-120.4252	To be Determined	100	To be Determined	To be Determined	No
Baker 3	To be Determined	Above	37.0874	-120.5372	To be Determined	77	To be Determined	To be Determined	No
Old DW 1	To be Determined	Below	37.2337	-120.4882	To be Determined	219	To be Determined	To be Determined	No
HR1-D	60573	Below	37.0721827	-120.54256	113.77	386	366	376	No
Dejager #3	To be Determined	Below	37.2292	-120.4837	To be Determined	202	To be Determined	To be Determined	No
Upper Bear Well 3	To be Determined	Outside	37.3518	-120.2522	To be Determined	331	To be Determined	To be Determined	No
Athwal MW MS	To be Determined	Outside	37.2169	-120.2269	To be Determined	400	To be Determined	To be Determined	No
17	To be Determined	Outside	37.3614109	-120.43016	To be Determined	500	To be Determined	To be Determined	No

Local Well Name	SGMA Station ID[2]	Principal Aquifer	Latitude	Longitude	Reference Point Elevation (ft. a-msl)	Well Depth (ft. bgs)	Top of Screen Interval (ft. bgs)	Bottom of Screen Interval (ft. bgs)	Representative Monitoring Well
21	To be Determined	Outside	37.36033	-120.46956	To be Determined	640	To be Determined	To be Determined	No

Notes

1. *El Nido Firehouse (Above Corcoran Shallow, Above Corcoran Deep, Below Corcoran), Jefferson Road (Above Corcoran Shallow, Above Corcoran Deep, Below Corcoran), Cardwell Ranch (Shallow, Intermediate, Deep), and HR1-S and HR1-D are nested monitoring wells.*
2. *Wells without SGMA Station IDs assigned have been added to the monitoring network in a provisional status. The GSAs intend to collect and review data for two full years before officially adding each well to the network which will be noted in an Annual Report.*

Table 6-2: Sustainable Management Criteria for New Representative Monitoring Wells

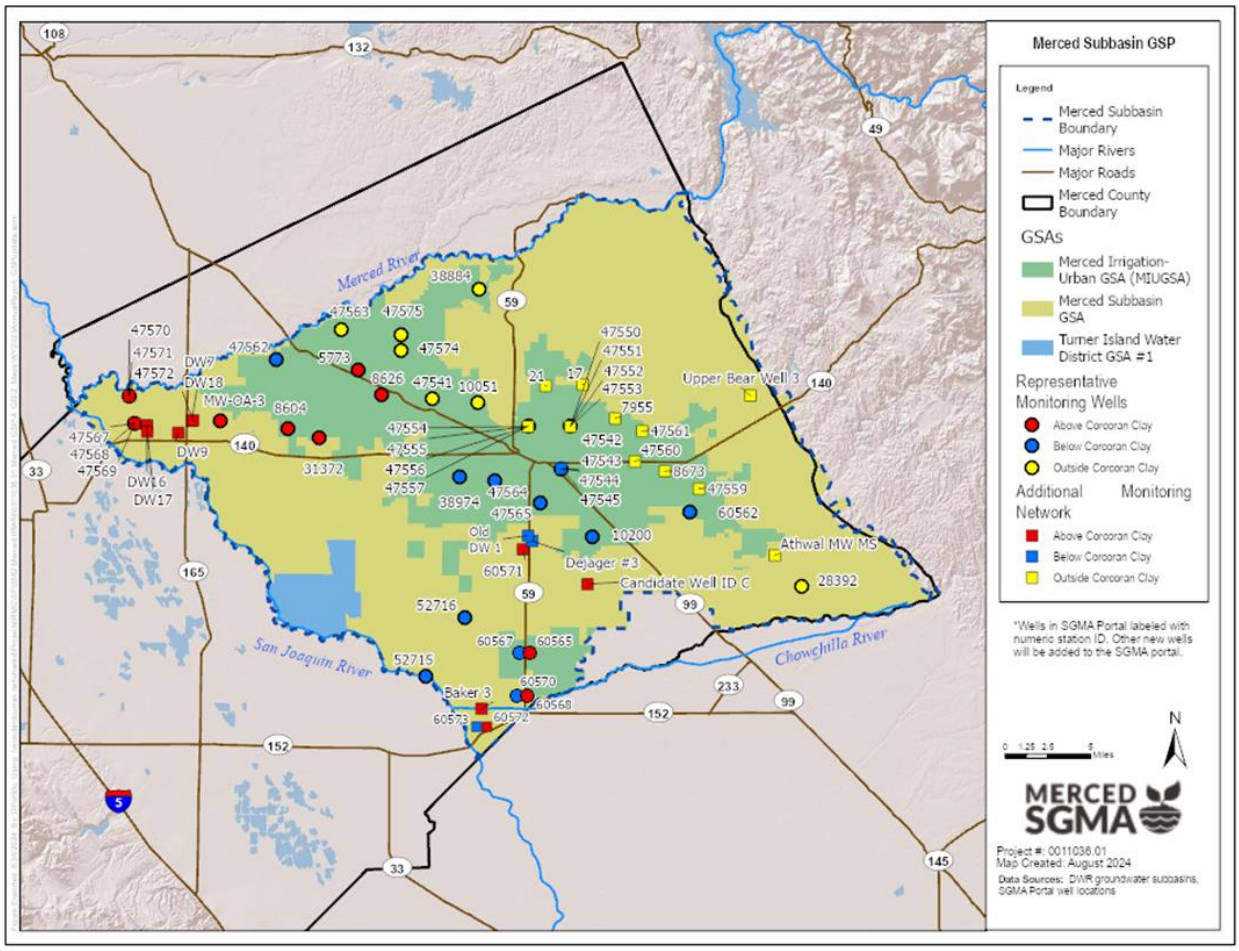
Local Well Name	SGMA Station ID	Principal Aquifer	Latitude	Longitude	Minimum Threshold[1]	Measurable Objective[1]	Interim Milestone 2025[1]	Interim Milestone 2030[1]	Interim Milestone 2035[1]
MW-OA-3	To be Determined	Above	37.33028	-120.81444	62.7	76.1	63.5	61.9	69.1
El Nido Firehouse - Above Corcoran Deep	60565	Above	37.13473	-120.49286	44.78	92.3	41.0	37.3	66.0
Jefferson Road - Above Corcoran Deep	60568	Above	37.09855	-120.48948	32.7	57.6	32.8	30.2	44.3
52715	52715	Below	37.11533	-120.59578	-142.7	1.5	-133.7	-151.7	-73.6
52716	52716	Below	37.16396	-120.55557	-79.6	-15.2	-75.6	-83.6	-48.7
El Nido Firehouse - Below Corcoran	60567	Below	37.134731	-120.4928	-47.0	17.7	-43.2	-51.2	-16.0
Jefferson Road - Below Corcoran	60570	Below	37.09856	-120.48953	-47.6	4.5	-44.3	-50.8	-22.6
Cardwell Ranch - Deep	60562	Outside	37.25385	-120.31603	28.3	71.4	1.7	2.2	36.7

Notes

1. *Sustainable management criteria values are presented in feet above mean sea level.*
2. *El Nido Firehouse – Above Corcoran (Shallow and Deep), Jefferson Road – Above Corcoran (Shallow and Deep), and Cardwell Ranch (Shallow, Intermediate, Deep) are nested monitoring wells.*

The objective of the addition of new groundwater monitoring wells was to fill data gaps previously identified in the 2022 GSP. The addition of new monitoring wells allows the GSAs to better monitor groundwater level changes relative to the established sustainable management criteria, impacts to beneficial uses and users, and better track annual changes in water budget components. Section 4.5 of the 2025 GSP provides further discussion and evaluation of these new additions to the groundwater level monitoring network. **Figure 6-1** presents the current groundwater monitoring network, by principal aquifer, for the Subbasin.

Figure 6-1: Groundwater Level Monitoring Network



Note - Wells without SGMA Station IDs assigned have been added to the monitoring network in a provisional status. The GSAs intend to collect and review data for two full years before officially adding each well to the network which will be noted in an Annual Report.

The monitoring wells installed during this evaluation cycle were selected based on their long-term viability to provide data relative to groundwater level sustainable management criteria. All newly added representative monitoring wells also include sustainable management criteria; the process

of establishing new sustainable management criteria at these wells is described in Section 3.3 of the 2025 GSP.

The following monitoring wells were removed from the monitoring network:

- Well 47558, located east of the City of Livingston, and completed within the Outside Corcoran Clay Principal Aquifer, has not been successfully measured since 2013. Fortunately, it is located in close proximity to other network wells that do have regular, successful measurements. Well 47588 was found to be redundant and the removal from the monitoring network did not require replacement with a new well.
- Wells 53315 and 53316, located in the southern end of the Outside Corcoran Clay Principal Aquifer have not been measured since 2019 due to various site challenges. The GSAs are actively evaluating other existing wells to replace Wells 53315 and 53316.

The addition of nineteen monitoring wells, eight of which include sustainable management criteria, provides the GSAs with additional sources of data to track changing groundwater conditions as they relate to sustainability indicators, progress of project and management implementation, and potential data gaps.

6.1.2 Other Sustainability Indicators

The 2022 GSP also established monitoring networks for the degraded water quality, inelastic land subsidence, and depletions of interconnected surface waters. The 2025 GSP now includes the monitoring network for reduction of groundwater in storage. As previously stated, groundwater levels are used as a proxy for storage and, as a result, the monitoring networks for both sustainability indicators are identical. The monitoring networks for all other sustainability indicators were assessed during this evaluation cycle and summarized below.

Reduction of Groundwater in Storage

Reduction of Groundwater in Storage was incorporated as a sustainability indicator, and as a result sustainable management criteria and a monitoring network were established during this evaluation cycle per DWR's recommendation for groundwater storage. Groundwater levels are used as a proxy for tracking groundwater in storage and the monitoring network is identical for both sustainability indicators. The assessment of the network is discussed in **Section 6.2** of the Periodic Evaluation.

Degraded Water Quality

The groundwater quality monitoring network includes a subset of wells under various active monitoring programs to meet the needs of GSP monitoring for the Subbasin. The selected wells (e.g., wells from which data are collected in the future for reporting) are those that continue to be monitored under the East San Joaquin Water Quality Coalition (ESJWQC) and DDW programs. Monitoring would not continue if wells were removed from the ESJWQC program or if wells were

not sampled for DDW compliance. Additionally, wells added to the ESJWQC program or wells newly sampled for DDW compliance will be added to the monitoring network as needed and reported in future Periodic Evaluations.

The groundwater quality monitoring network established in the 2022 GSP totals 287 wells, with 8 wells from the ESJWQC Groundwater Quality Trend Monitoring (GQTM) program and 279 wells sourced from Public Water System (PWS) wells that report data to the DDW. The current groundwater quality monitoring network is presented in **Figure 6-2**. During the evaluation cycle, 225 PWS wells were removed from the supplemental monitoring network as a result of being destroyed or discontinued from their respective programs (**Figure 6-3**). Additionally, 72 PWS wells were added for a total of 122 active monitoring wells in the network beyond representative monitoring wells. Finally, one principal well and 19 complementary monitoring wells were added to the ESJWQC/DDW programs and are now included in the Subbasin's representative monitoring network for a total of 44 representative monitoring wells.

Figure 6-2: Groundwater Quality Monitoring Network

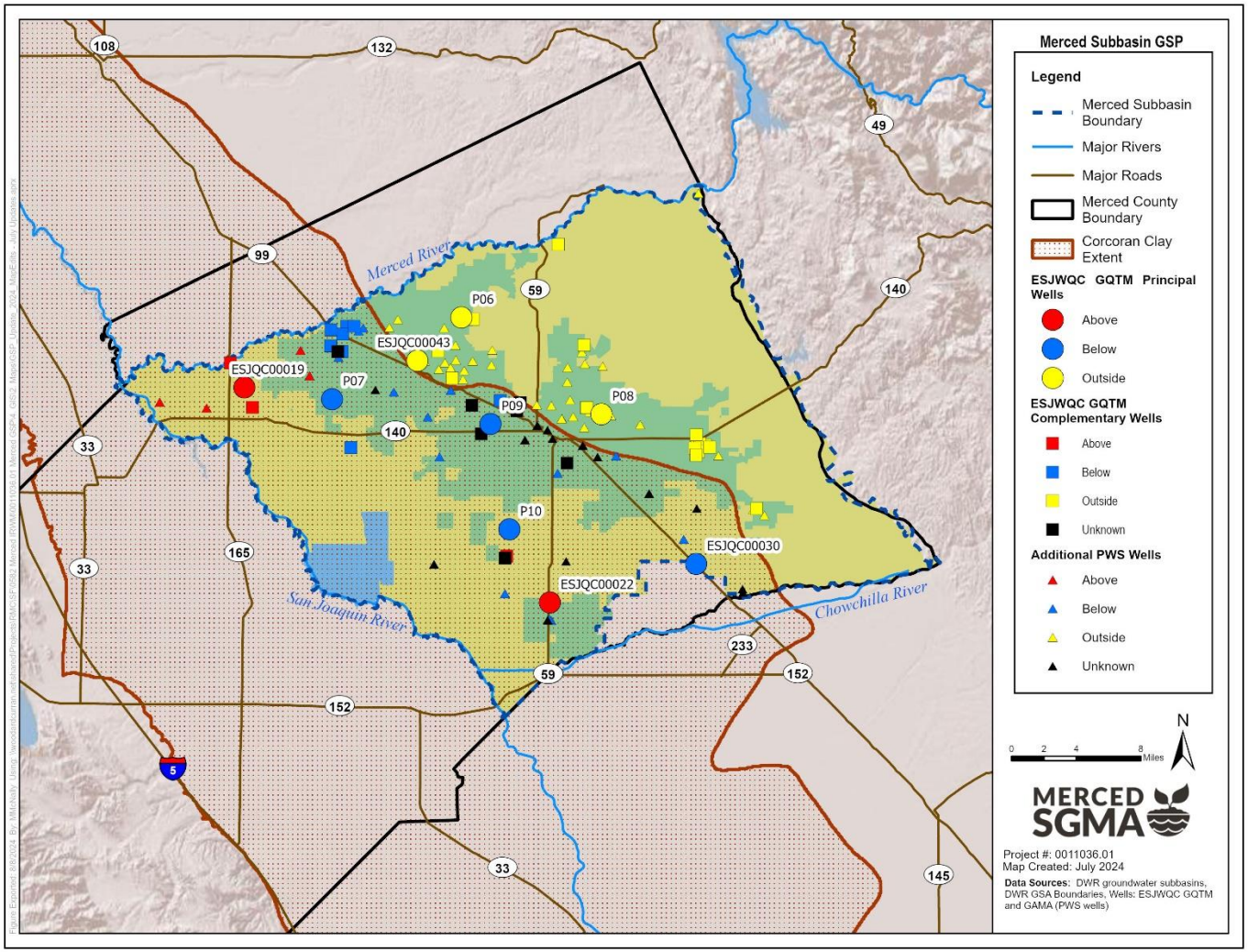
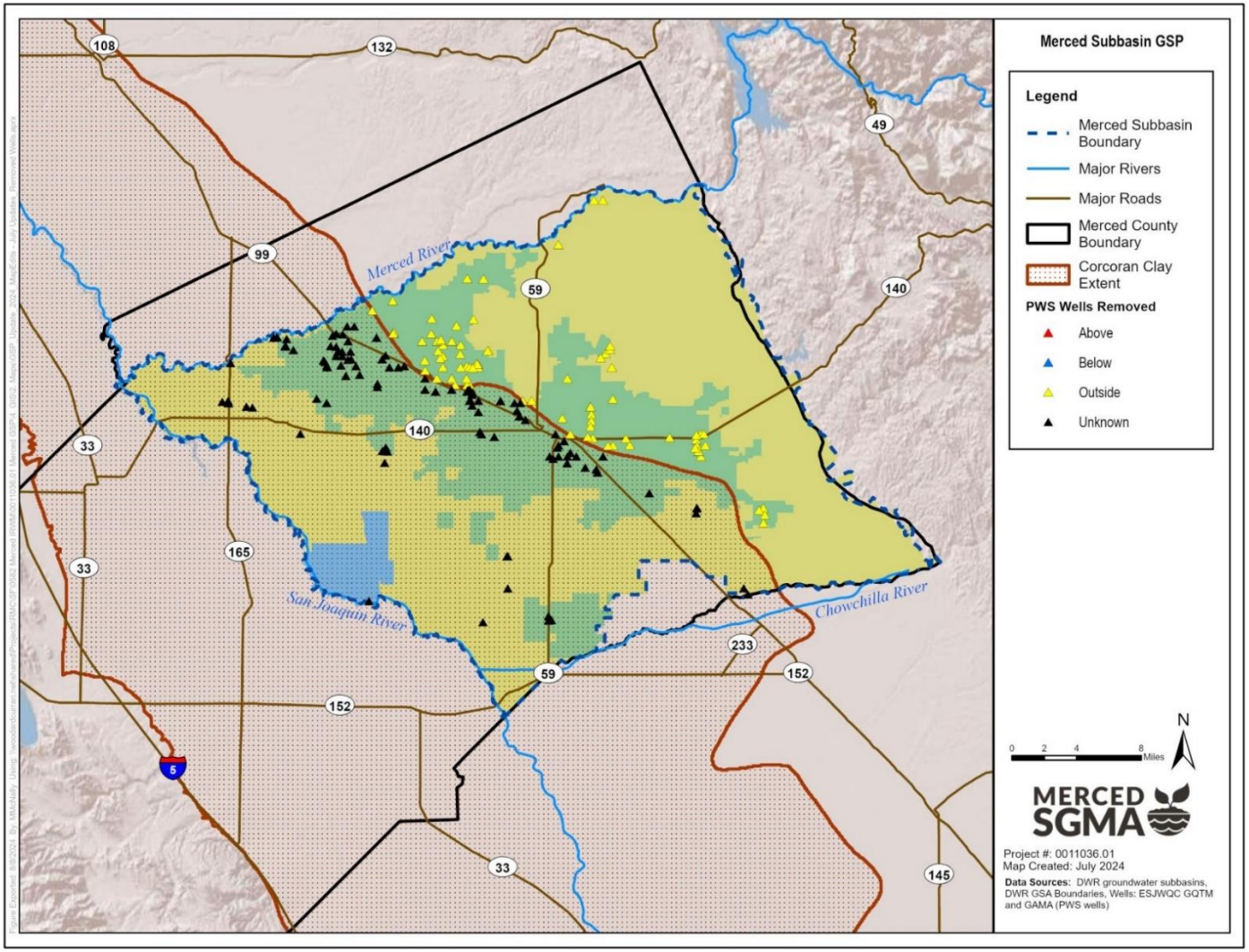


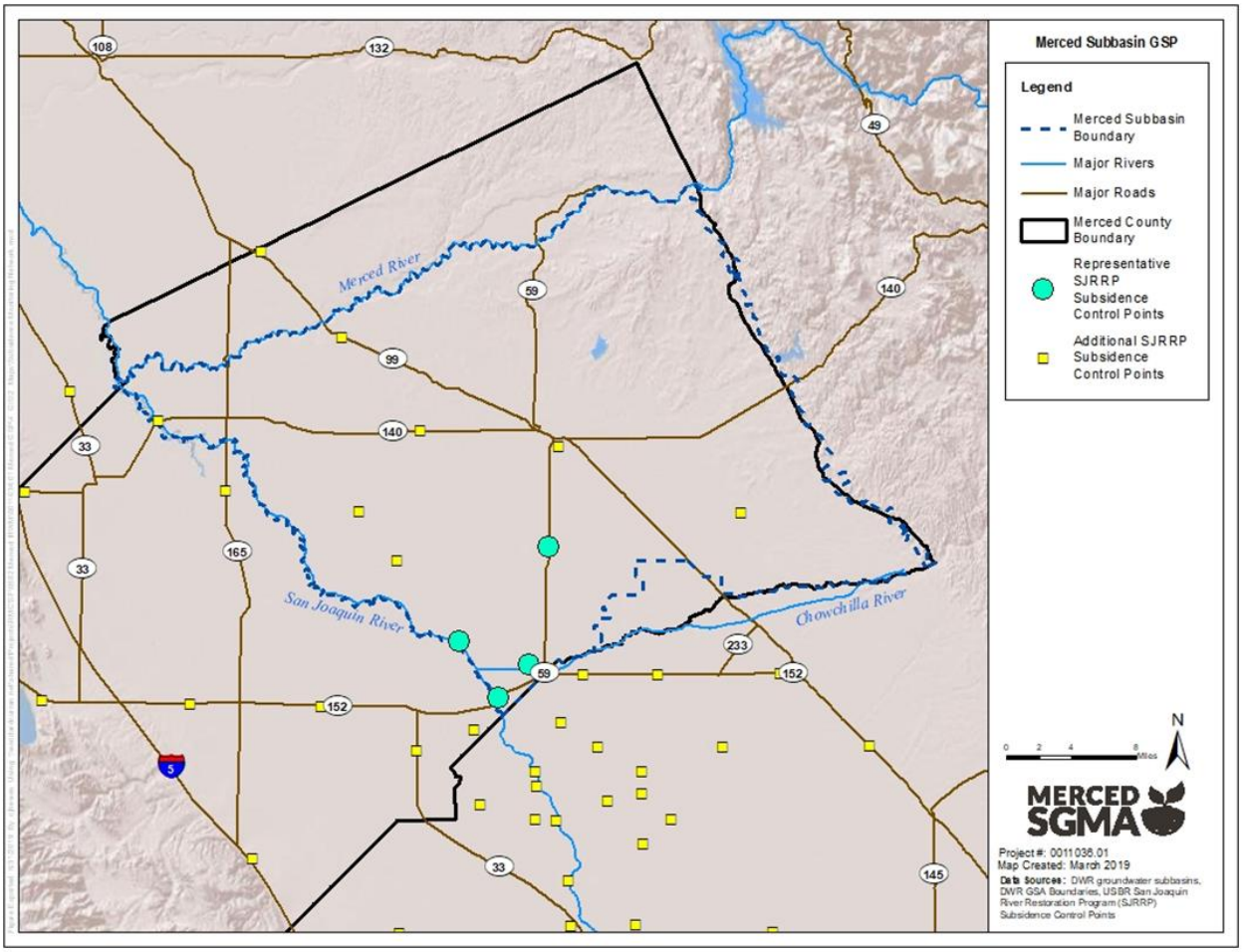
Figure 6-3: Wells Removed from Groundwater Quality Monitoring Network



Inelastic Land Subsidence

The subsidence monitoring network, shown in **Figure 6-4**, remains unchanged from the 2022 GSP.

Figure 6-4: Subsidence Monitoring Network

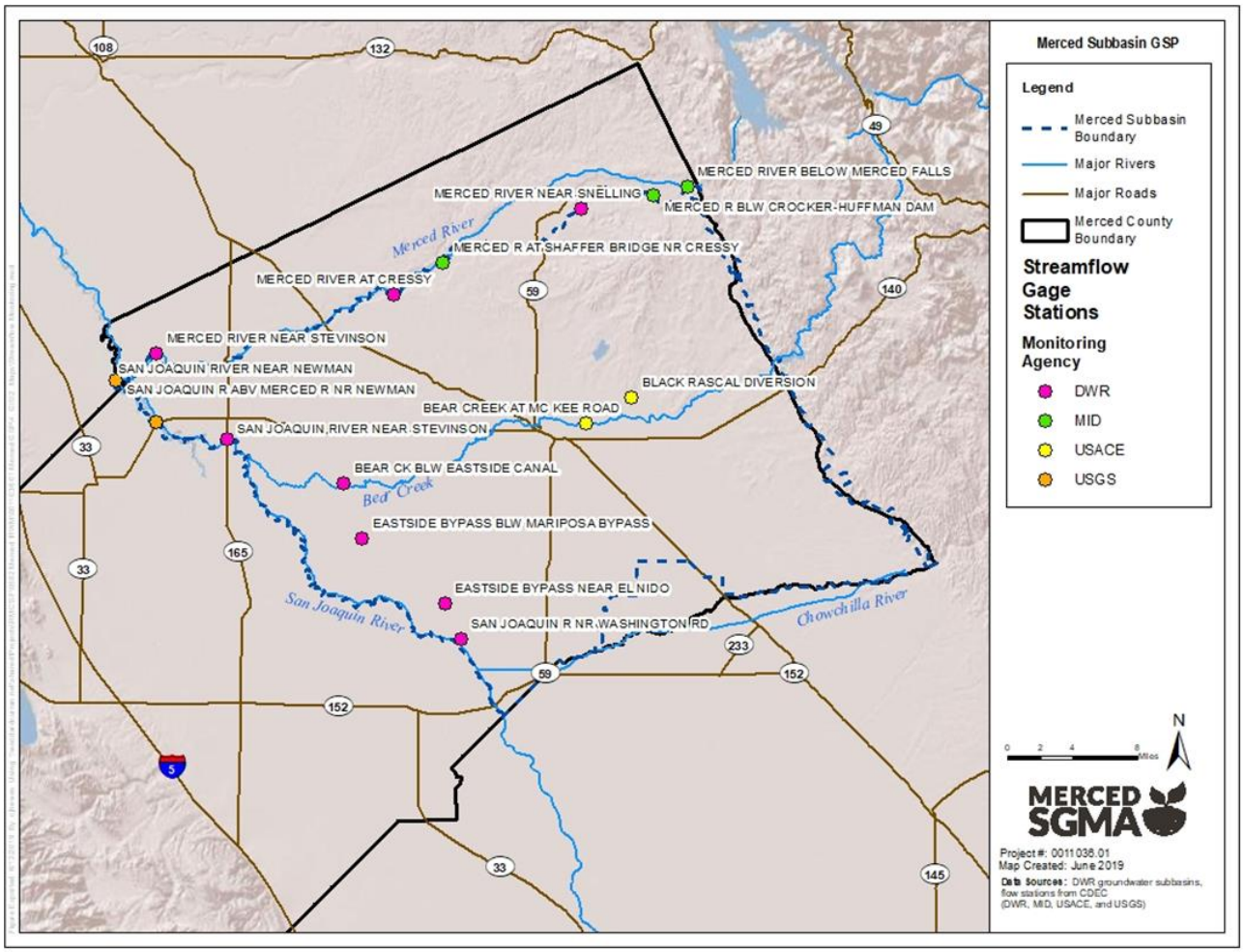


Depletions of Interconnected Surface Water

Sustainable management criteria for depletions of interconnected surface waters are monitored by proxy through the measurement of groundwater levels and the same representative monitoring network is used to support overall characterization of the Subbasin. Additionally, the monitoring network is intended to provide data to support characterization of the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate estimate depletions of surface water caused by groundwater extractions.

Monitoring sites include the groundwater wells and stream gage locations described in the 2022 GSP. The stream gage sites were selected as those being actively monitored for other purposes and to meet the needs of monitoring interconnected surface water sustainable management criteria. The selected sites are not necessarily these specific sites, but rather the sites that continue to be monitored under DWR, USGS, MID, and USACE monitoring programs. Thus, monitoring would not continue if sites were removed from one of these programs. Additionally, sites added to one of these agency programs would be added to the monitoring network. The monitoring network for interconnected surface water is shown in **Figure 6-5**.

Figure 6-5: Interconnected Surface Water Stream Gages



Changes to the monitoring network for interconnected surface water made during this evaluation cycle are consistent with those for groundwater levels (**Section 6.1.1**).

6.2 Data Gaps

Data gaps were identified in the 2022 GSP for all applicable sustainability indicators. The original 2020 GSP stated that the GSAs would develop a plan to address these data gaps with a timeline for implementation within two years of the approval of the GSP. A Data Gaps Plan was prepared by the GSAs and adopted in July 2021 (Woodard & Curran, 2021). The Data Gaps Plan included identifying data gaps presented in the Subbasin's monitoring network, prioritization of addressing data gaps for certain sustainability indicators, and the plan for implementing activities to fill data gaps.

Changes made to the monitoring networks to fill data gaps were described earlier in **Section 6.1**. Overall, data gaps have been partially addressed for the groundwater levels (and by proxy, groundwater storage and interconnected surface waters) and water quality monitoring networks.

Remaining and/or newly identified data gaps are summarized in **Table 6-3**. Details of the data gaps identified and actions planned to address them are discussed by sustainability indicator below.

Table 6-3: Monitoring Network Data Gaps

Data Gap #	Description	Applicable Sustainability Indicator(s)	Progress Update
1	Outside Corcoran Clay Principal Aquifer – northern corner of Subbasin	Groundwater Levels, Groundwater Storage, Interconnected Surface Water	Included for consideration of new monitoring wells in ongoing data gaps funding efforts for groundwater levels, though with a lower priority due to relatively limited beneficial uses of groundwater in this region.
2	Above Corcoran Clay Principal Aquifer (primarily in the center of the aquifer)	Groundwater Levels, Groundwater Storage, Interconnected Surface Water	Included for consideration of new monitoring wells in ongoing data gaps funding efforts for groundwater levels,
3	Below Corcoran Clay Principal Aquifer (northwestern and central portion of the aquifer)	Groundwater Levels, Groundwater Storage, Interconnected Surface Water	Included for consideration of new monitoring wells in ongoing data gaps funding efforts for groundwater levels,
4	There are relatively few monitoring wells closer to the San Joaquin River and closer to Mariposa County.	Water Quality	An additional PWS well was added to the supplemental monitoring network near the confluence of the Merced and San Joaquin River. The GSAs are evaluating additional monitoring wells within the western area of the Subbasin and western Mariposa County border.

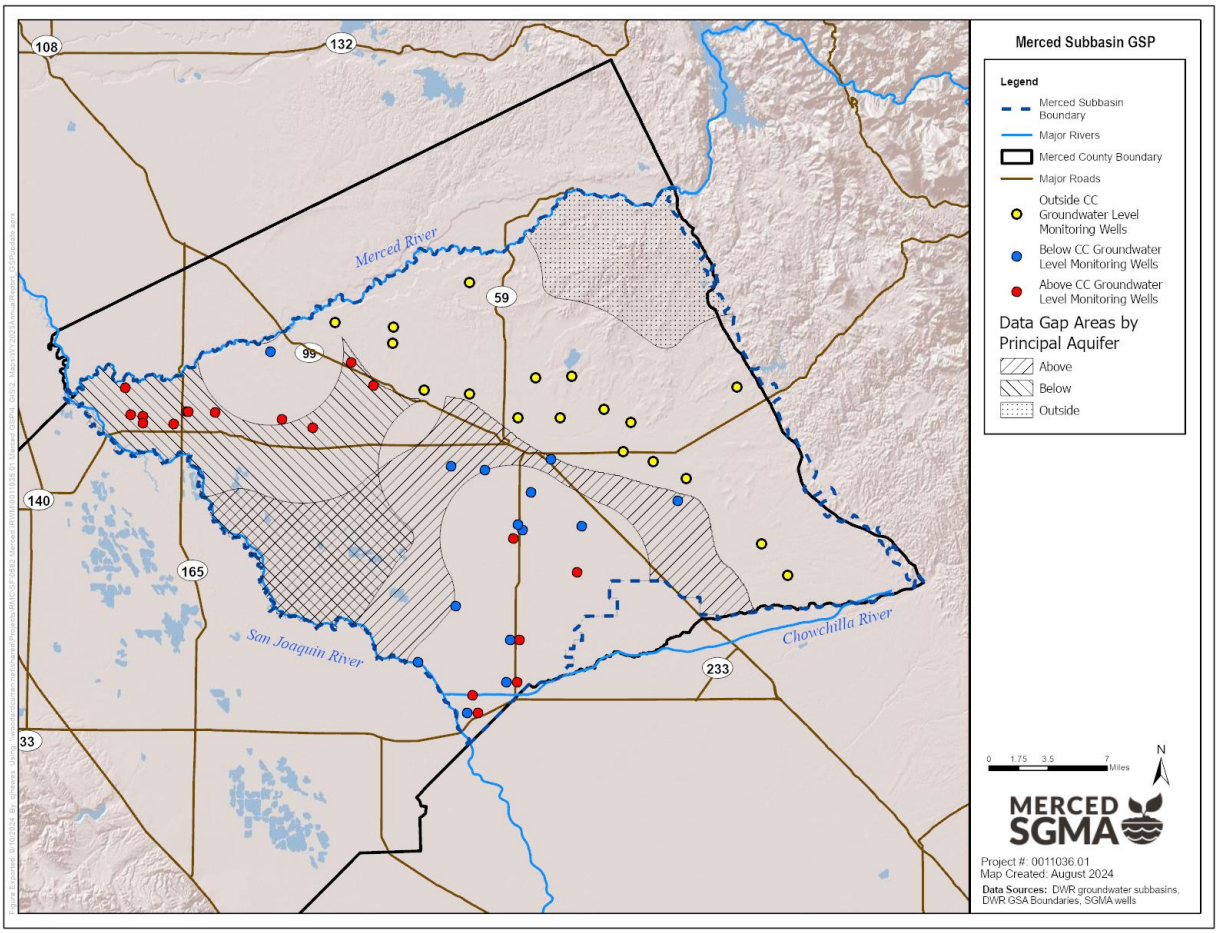
Data Gap #	Description	Applicable Sustainability Indicator(s)	Progress Update
5	Many wells used for monitoring do not have construction information, which notably limits the ability to distinguish whether wells are below or above the Corcoran Clay.	Water Quality	The GSAs are currently evaluating wells that lack construction information.
6	The depth at which subsidence is occurring and the level of compaction that occurs as data gaps and recommended the installation of one or more extensometers.	Land Subsidence	The GSAs continue to monitor for partnerships and/or funding options for the installation of an extensometer.
7	The understanding of depletions of interconnected surface water could be improved through additional depth-discrete groundwater elevation data within the vicinity of rivers and streams within the Subbasin.	Groundwater Levels, Interconnected Surface Water	The GSAs are evaluating two shallow monitoring wells: one on the Delta-Mendota-Merced border and one along Bear Creek. Following evaluation, these wells would provide the GSAs with additional shallow groundwater data to better understand interconnected surface water bodies within the Subbasin.

Chronic Lowering of Groundwater Levels

Figure 6-6 shows remaining data gap regions for groundwater levels by principal aquifer from the 2025 GSP which is based on areas with a low density of monitoring wells. At the time of publishing, the GSAs have funding remaining from grant applications specific to monitoring networks and will continue implementation to fill additional data gaps according to the Data Gaps Plan.

No wells are officially part of the monitoring network within TIWD GSA-#1 which occupies a large portion of the hatched area where data gaps in the Above and Below Corcoran Clay Principal Aquifers overlap in **Figure 6-6**. However, at least three wells located within TIWD GSA-#1 are in the process of being confirmed by the GSA for official addition to the monitoring network. Monitoring data has been collected and used to update groundwater contour maps since at least 2016 and continues to be collected.

Figure 6-6: Groundwater Level Monitoring Network Data Gaps



Reduction of Groundwater in Storage

As groundwater levels are now used as a proxy for groundwater storage, the previously discussed data gaps are the same for both sustainability indicators.

Degraded Water Quality

Two data gaps were identified in the 2022 GSP that partially remain today:

1. There are relatively few monitoring wells closer to the San Joaquin River and closer to Mariposa County.

2. Many wells used for monitoring do not have construction information, which notably limits the ability to distinguish whether wells are below or above the Corcoran Clay.

The ESJWQC GQTM program includes an approach to add additional principal wells, stating that "[t]he spatial representation and statistical validity of the GQTM well network will be evaluated on an annual basis with respect to the objectives of the program" (ESJWQC, 2018). The Phase III Workplan design approach recognizes the importance for the monitoring program to adapt based on consideration of data derived through continuous evaluation of program implementation. Some additional goals discussed in the GQTM plan's network refinement section included:

- Verification of construction information for complementary wells.
- Locating wells in the Chowchilla region where domestic and public supply wells are less common or most often deeper than expected for Upper Zone wells (this region overlaps with the very southern corner of the Merced Subbasin).
- Identification of network wells in "lower vulnerability agricultural areas, especially in the more eastern portions of the Coalition region" (ESJWQC, 2018) through focused outreach efforts to Coalition members, which includes the eastern portion of the Merced Subbasin.

20 monitoring wells were added to the ESJWQC monitoring network (and thus also the GSP monitoring network) which are regularly sampled for specific conductivity and/or total dissolved solids. These new locations reflect recent and consistently sampled wells to provide the GSAs with the most accurate data available as they continue to track changes in salinity as it relates to sustainable management criteria.

The GSAs planned to obtain additional construction information for additional PWS wells located throughout the Subbasin to determine the completion information for these wells so they can be assigned to Above or Below Corcoran Clay for the purpose of analyzing salinity. Currently, the GSAs are still in progress of obtaining and evaluating well information for addition to the monitoring network and plan to do so during the next evaluation cycle.

Inelastic Land Subsidence

The 2022 GSP identified the depth at which subsidence is occurring and the level of compaction that occurs as data gaps and recommended the installation of one or more extensometers. The GSAs continue to monitor for available funding for the addition of an extensometer in the Subbasin.

Depletions of Interconnected Surface Water

The 2022 GSP states that the understanding of depletions of interconnected surface water could be improved through additional depth-discrete groundwater elevation data within the vicinity of rivers and streams within the Subbasin. The addition of multi-level monitoring wells would assist

with the characterization of the hydrologic connection between these surface water bodies and the principal aquifers within the Subbasin.

Data gaps related to the hydrologic connection between adjacent basins were also identified during the evaluation cycle. These data gaps included:

- There was no readily available data to calibrate the model regarding projected conditions from the neighboring subbasins.
- Since the neighboring subbasins have either completed their GSP or are in the process of completing their GSP by January 31, 2022, it is expected that additional data and/or assumptions on the groundwater operations would be available from the neighboring subbasins for future updates of the model and assessments of the Merced Subbasin sustainability conditions.
- Lack of groundwater level monitoring wells along the western edge of the Subbasin.

The GSAs were able to use data outside of and along the Subbasin boundary as part of the calibration objectives for groundwater levels during the MercedWRM update that was performed for the 2025 GSP (see **Section 5.4**). This informed modeling scenarios to project future conditions for depletions of interconnected surface water (see **Section 3.5.3**). The updated model results are presented in Section 2.2.6 of the 2025 GSP.

The GSAs are currently evaluating one shallow monitoring well along the western border of the Subbasin adjacent to the San Joaquin River and another along the interconnected portion of Bear Creek. Following evaluation, the GSAs intend to incorporate monitoring data into its analysis of interconnected surface water depletions and include these wells into the representative monitoring network.

7. GSA AUTHORITIES AND ENFORCEMENT ACTIONS

§356.4(g) *A description of relevant actions taken by the Agency, including a summary of regulations or ordinances related to the Plan.*
§356.4(h) *Information describing any enforcement or legal actions taken by the Agency in furtherance of the sustainability goal for the basin.*

7.1 Relevant Enforcement, Legal, or Other Actions

The GSAs have taken several actions during the evaluation cycle related to the 2023 California Water Code (CWC). Applicable CWC sections and related actions taken by the GSAs are presented in **Table 7-1** .

Table 7-1: Applicable Authorities and Actions

Legal Authority	Description	Update for the Evaluation Cycle
CWC § 10725.2	(a) A groundwater sustainability agency may exercise any of the powers described in this chapter in implementing this part, in addition to, and not as a limitation on, any existing authority, if the groundwater sustainability agency adopts and submits to the department a groundwater sustainability plan or prescribed alternative documentation in accordance with Section 10733.6. (b) A groundwater sustainability agency has and may use the powers in this chapter to provide the maximum degree of local control and flexibility consistent with the sustainability goals of this part.	The GSAs adopted the revised GSP in July 2022.
CWC § 10725.4	(a) A groundwater sustainability agency may conduct an investigation for the purposes of this part, including, but not limited to, investigations for the following: (1) To determine the need for groundwater management. (2) To prepare and adopt a groundwater sustainability plan and implementing rules and regulations. (3) To propose and update fees. (4) To monitor compliance and enforcement. (b) An investigation may include surface waters and surface water rights as well as groundwater and groundwater rights. (c) In connection with an investigation, a groundwater sustainability agency may inspect the property or facilities of a person or entity to ascertain whether the purposes of this part are being met and compliance with this part. The local agency may conduct an inspection pursuant to this section upon obtaining any necessary consent or obtaining an inspection warrant pursuant to the procedure set forth in Title 13 (commencing with Section 1822.50) of Part 3 of the Code of Civil Procedure.	No enforcement actions or other legal actions have been taken with respective to this section of the CWC.

Legal Authority	Description	Update for the Evaluation Cycle
CWC § 10725.6	A groundwater sustainability agency may require registration of a groundwater extraction facility within the management area of the groundwater sustainability agency.	MIUGSA exercised this authority to implement a well registration program (see more details in Section 4.4)
CWC § 10725.8	(a) A groundwater sustainability agency may require through its groundwater sustainability plan that the use of every groundwater extraction facility within the management area of the groundwater sustainability agency be measured by a water-measuring device satisfactory to the groundwater sustainability agency. (b) All costs associated with the purchase and installation of the water-measuring device shall be borne by the owner or operator of each groundwater extraction facility. The water-measuring devices shall be installed by the groundwater sustainability agency or, at the groundwater sustainability agency's option, by the owner or operator of the groundwater extraction facility. Water-measuring devices shall be calibrated on a reasonable schedule as may be determined by the groundwater sustainability agency. (c) A groundwater sustainability agency may require, through its groundwater sustainability plan, that the owner or operator of a groundwater extraction facility within the groundwater sustainability agency file an annual statement with the groundwater sustainability agency setting forth the total extraction in acre-feet of groundwater from the facility during the previous water year. (d) In addition to the measurement of groundwater extractions pursuant to subdivision (a), a groundwater sustainability agency may use any other reasonable method to determine groundwater extraction. (e) This section does not apply to de minimis extractors.	Both MSGSA and MIUGSA began implementation of allocation programs to measure and/or limit groundwater extraction (see more details in Section 4.4)

Legal Authority	Description	Update for the Evaluation Cycle
CWC § 10731(a)	Following an investigation pursuant to Section 10725.4, the governing body may make a determination fixing the amount of groundwater production from the groundwater extraction facility at an amount not to exceed the maximum production capacity of the facility for purposes of levying a groundwater charge. If a water-measuring device is permanently attached to the groundwater extraction facility, the record of production as disclosed by the water-measuring device shall be presumed to be accurate unless the contrary is established by the groundwater sustainability agency after investigation.	Both MIUGSA and MSGSA established allocation programs during the evaluation cycle. Details of the Subbasin's allocation programs are discussed in Section 4.1.3 of the Periodic Evaluation.
CWC § 10732	(a)(1) A person who extracts groundwater in excess of the amount that person is authorized to extract under a rule, regulation, ordinance, or resolution adopted pursuant to Section 10725.2, shall be subject to a civil penalty not to exceed five hundred dollars ($500) per acre-foot extracted in excess of the amount that person is authorized to extract. Liability under this subdivision is in addition to any liability imposed under paragraph (2) and any fee imposed for the extraction. (2) A person who violates any rule, regulation, ordinance, or resolution adopted pursuant to Section 10725.2 shall be liable for a civil penalty not to exceed one thousand dollars ($1,000) plus one hundred dollars ($100) for each additional day on which the violation continues if the person fails to comply within 30 days after the local agency has notified the person of the violation. (b)(1) A groundwater sustainability agency may bring an action in the superior court to determine whether a violation occurred and to impose a civil penalty described in subdivision (a).	MIUGSA established Rules & Regulations that include a requirement to register all wells within its management area. MIUGSA also established penalties for not registering wells which have been levied against a small number of non-responsive well owners who have not yet registered their well(s) with MIUGSA.

8. OUTREACH, ENGAGEMENT, AND COORDINATION WITH OTHER AGENCIES

§356.4(k) *Where appropriate, a summary of coordination that occurred between multiple Agencies in a single basin, Agencies in hydrologically connected basins, and land use agencies.*

8.1 Outreach and Engagement

During GSP development, the Merced GSP used multiple forms of outreach to communicate SGMA-related information and solicit input. The GSAs continued public outreach and provided opportunities for engagement during GSP implementation. This included providing opportunities for public participation, especially from beneficial users, at public meetings, providing access to GSP information online, and continued coordination with entities conducting outreach to DAC communities in the Subbasin. Announcements were distributed via email prior to public meetings (e.g., Stakeholder Advisory Committee meetings, Coordination Committee meetings, public workshops, and GSA Board meetings). Emails were also distributed as specific deliverables were finalized, when opportunities were available for stakeholder input and when this input was requested, or when items of interest to the stakeholder group arose, such as relevant funding opportunities. The Merced SGMA website, managed as part of GSP Administration, has and will continue to be updated regularly and will house meeting agendas and materials, reports, and other program information. The website may be updated to add new pages as the program continues and additional activities are implemented. Additionally, public workshops are typically held semi-annually, or more frequently if necessary, to provide an opportunity for stakeholders and members of the public to learn about, discuss, and provide input on GSP activities, progress towards meeting the sustainability goal of the GSP, and SGMA.

In addition to implementation activities across all three GSAs, each GSA individually continued similar public outreach activities for SGMA-related activities within their own jurisdictions. For example, MIUGSA implemented a Stakeholder Guidance Committee that includes a standing member representing DACs, as well as other interested parties. Committee policy discussions always include impacts of policies on low income or small farms.

Following the submittal of the 2022 GSP, DWR received three public comments through the SGMA Portal from regulatory agencies, local stakeholders, and groundwater users within the Subbasin. The public comments received generally included the following recommendations:

- Evaluate impacts of groundwater level sustainable management criteria on drinking water;
- Evaluate all contaminants of concern present in the Subbasin and establish sustainable management criteria for these contaminants;
- Include impacts to climate change;

- Include a plan to address undesirable results as groundwater levels experience short-term declines; and
- Reevaluate the use of groundwater levels as a proxy for interconnected surface water sustainable management criteria.

As outreach and engagement activities are crucial in the development of the Periodic Evaluation and GSP, the GSAs regularly presented components of these documents during public meetings to gain input from stakeholders and interested parties. Topics of discussion included, but were not limited to: establishment and refinement of sustainable management criteria; modeling efforts used to develop water budgets; changes to basin setting based on new information; and progress updates on PMAs (i.e., allocation programs). These meetings allowed the public, local stakeholders, and regulatory agencies to provide input on the GSAs' approach to developing the GSP and Periodic Evaluation. Additional details on outreach and engagement activities that took place during the evaluation cycle are outlined in **Appendix C**.

MIUGSA coordinated with MID and the Merced Integrated Regional Water Management Authority to engage with DACs through a Domestic Well Inventory and Outreach project funded through DWR's Disadvantaged Community Involvement grant. Overall, this project aimed to 1) improve domestic well location, construction, and performance information and 2) engage with members of DACs to increase local DAC capacity. The project included hiring Self-Help Enterprises to develop and implement an outreach and engagement program to accomplish the project. Over the course of almost 3 years (2020-2023), and approximately $125,000 in expenses, Self-Help Enterprises contacted landowners and improved location and construction information on approximately 30 wells. MIUGSA was involved in leading the development of a machine learning process to parse well completion reports in DWR's Online System of Well Completion Reports (OSWCR) to improve domestic well location and construction information. This machine learning process improved MIUGSA's understanding of well locations of approximately 400 wells. MIUGSA intends to continue improving domestic well location and construction inventories as a key component of the development of the Subbasin's domestic well mitigation program.

8.2 Responsibilities of GSA Boards

After pivoting to virtual Coordination Committee and Stakeholder Advisory Committee meetings in WY 2021, the GSAs began holding hybrid (in-person, with full virtual participation) meetings of both committees starting in March 2022. Meetings were held with an increased frequency (monthly or every other month) in the middle of WY 2022 in order to collect iterative feedback on the development of the 2022 GSP in response to DWR's January 28, 2022, determination letter. Following the submittal of the 2022 GSP, the GSAs continued quarterly to bi-monthly meetings with both committees to discuss components of the 2022, 2023 and 2024 Annual Reports, 2025 GSP, and Periodic Evaluation. Besides the primary topic of developing SGMA-related documentation, presentation and discussion topics have also included groundwater conditions, status of PMAs, and collection of feedback on grant application projects. A summary of topics

discussed during Coordination Committee and Stakeholder Advisory Committee meetings is available in **Appendix C**.

8.3 Coordination with Other Agencies

The GSAs engaged the United States Bureau of Reclamation (USBR) on June 11, 2024, to discuss potential impacts of the sustainable management criteria for inelastic land subsidence on criterial infrastructure (i.e., Eastside Bypass) within USBR's jurisdiction. The GSAs did not receive a response to their request for information and submitted a follow-up correspondence on July 8, 2024. The GSAs did not receive a response to their follow-up inquiry, however, the GSAs will continue to engage USBR and all other applicable parties with respect to evaluating impacts of land subsidence sustainable management criteria on critical infrastructure.

In September 2024, the GSAs held a series of meetings to discuss depletions of interconnected surface waters with the US Fish and Wildlife Service, the National Marine Fisheries Service, the California Department of Fish and Wildlife, The Nature Conservancy, Point Blue, and Audubon California. More details are presented in **Section 3.5.3.3**.

Note that interbasin coordination is discussed separately in **Section 9.1**.

9. OTHER INFORMATION

§356.4(k) *Other information the Agency deems appropriate, along with any information required by the Department to conduct a periodic review as required by Water Code Section 10733.*

9.1 Consideration of Adjacent Basins

The GSAs continued their collaborative efforts in interbasin coordination during the evaluation cycle. Interbasin coordination meetings have occurred with all three surrounding basins, and coordination agreements have been established with the Turlock and Chowchilla Subbasins to facilitate data and information exchange.

With assistance from Facilitation Support Services provided by DWR, the Chowchilla, Delta-Mendota, Madera, and Merced Subbasins met between 2021 and 2022 to address regional subsidence issues. While not all issues were resolved, the subject was advanced through significant information sharing regarding modeling approaches and management actions. Future improvements will require additional coordination and effort to address.

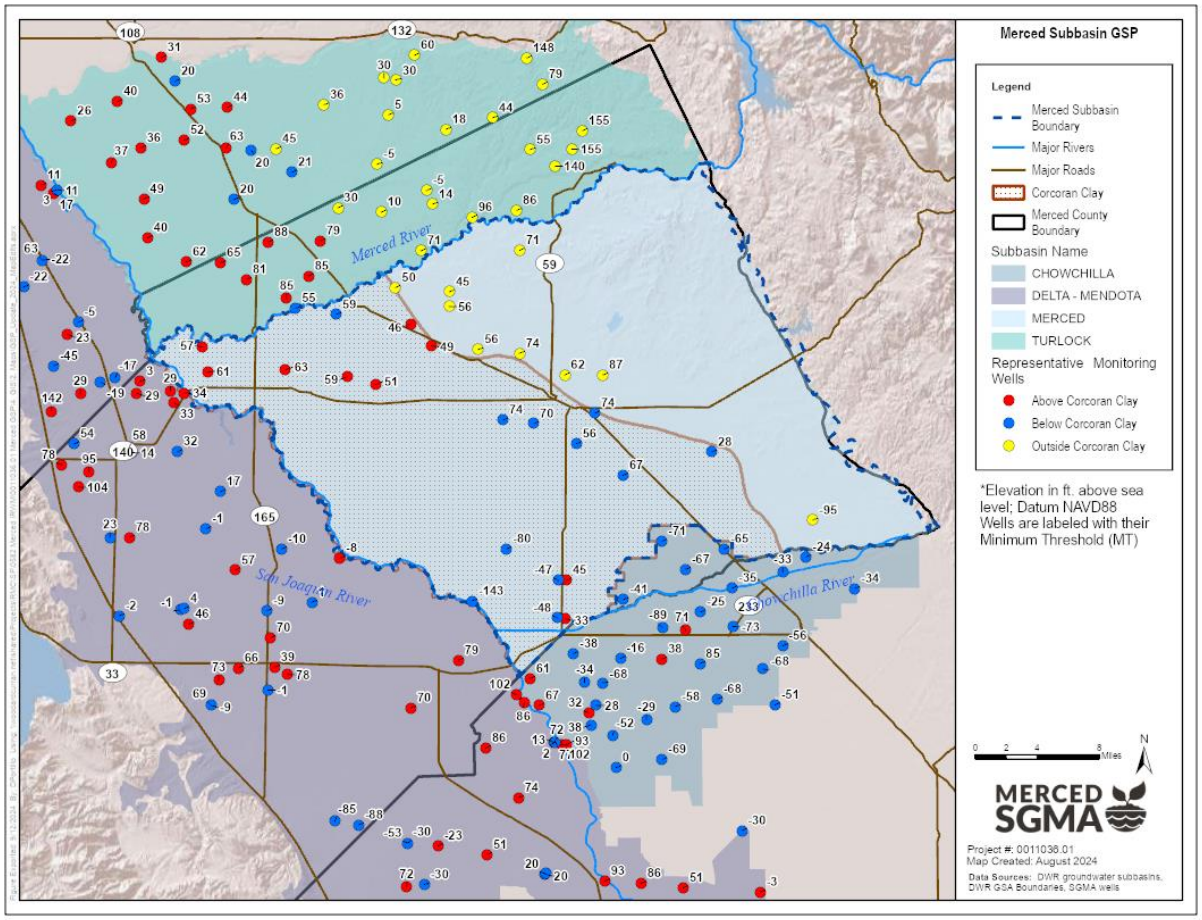
The GSAs held a meeting with the Chowchilla Subbasin GSAs in May 2023 to discuss the 2022 GSP's approach to Interim Milestones. Additionally, in August 2023, the GSAs engaged with the Delta-Mendota Subbasin to plan the placement of future monitoring wells along the San Joaquin River, with a specific focus on monitoring interconnected surface water sustainability indicators.

The GSAs have also conducted analyses of interbasin flow as part of the annual updates and the 2025 GSP update to the MercedWRM. The model simulated groundwater movement between the Merced Subbasin and adjacent subbasins: Turlock to the north, Delta-Mendota to the west, and Chowchilla to the south. The direction and rate of interbasin subsurface flow are influenced by historical and projected groundwater use and elevations on both sides of the boundary. Due to limited available data near the boundaries of neighboring basins used to calibrate the MercedWRM, simulated interbasin conditions were unable to provide sufficient information. Modeling for the 2022 GSP indicates net flows from the Merced Subbasin to the Turlock Subbasin.

With neighboring basins having completed their GSPs or recently doing so, it is anticipated that more data and assumptions on groundwater operations will be accessible for future model updates and assessments of the Subbasin achieving its sustainability goal. Furthermore, the GSAs have secured grant funding (from the Round 1 Sustainable Groundwater Management Implementation Planning and Projects Grant) for development of a Merced Subbasin Integrated Managed Aquifer Recharge (MAR) Evaluation Tool (MercedMAR). To date, this tool has involved significant enhancements to the MercedWRM as described in **Section 5.4**, including use of data outside of and along the Subbasin boundary as part of the calibration objectives for groundwater levels.

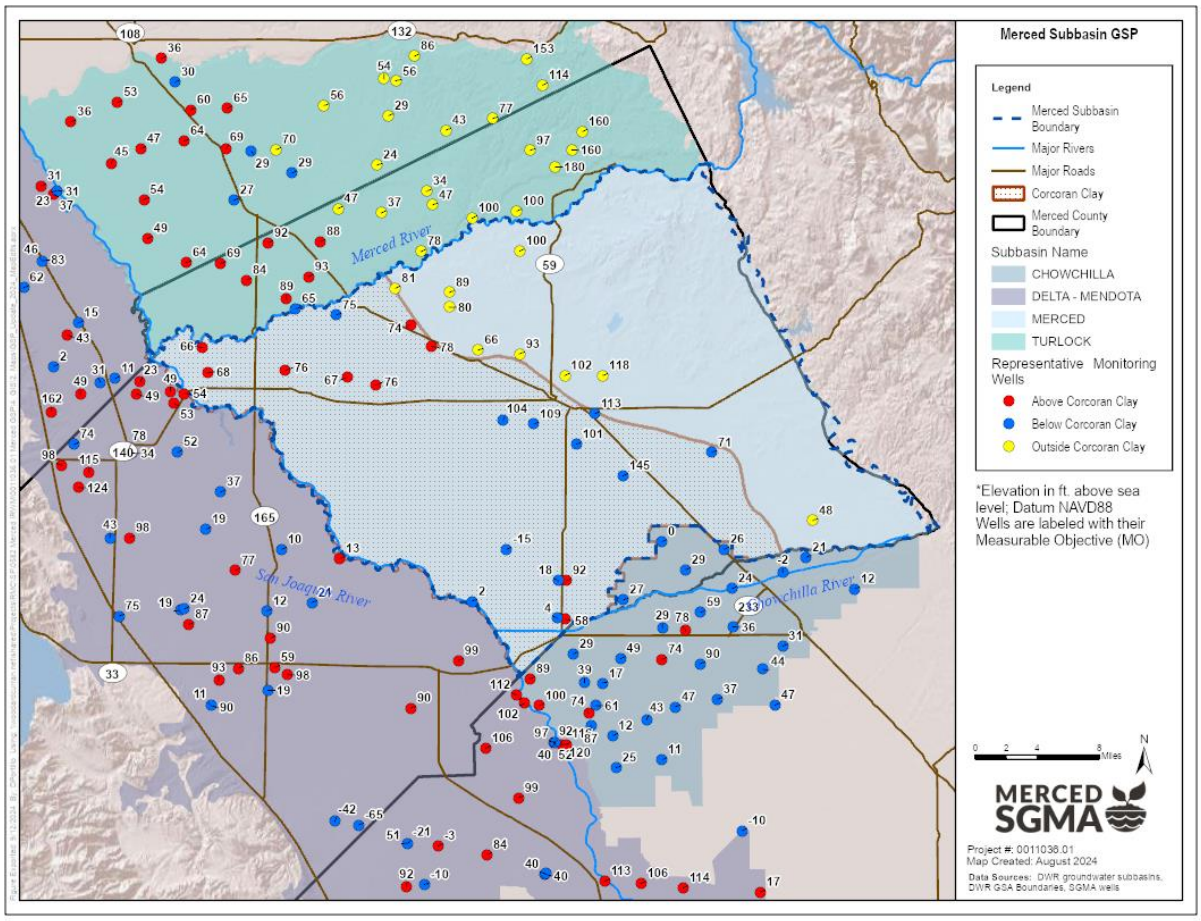
Figure 9-1 shows a map of the representative monitoring wells in the Merced Subbasin and surrounding Turlock, Delta-Mendota, and Chowchilla subbasins. Each well is labeled with the minimum threshold. **Figure 9-2** shows the same layout but is labeled with the measurable objective.

Figure 9-1: Minimum Thresholds in Merced and Surrounding Subbasins



Note - Representative Monitoring Wells in other subbasins are assigned to principal aquifers of differing names but similar meanings. For this figure, they have been reclassified for ease of visual comparison (where Eastern is Outside, Upper is Above, Lower is Below, and Composite is shown as Below).

Figure 9-2: Measurable Objectives in Merced and Surrounding Subbasins



Note - Representative Monitoring Wells in other subbasins are assigned to principal aquifers of differing names but similar definitions. For this figure, they have been reclassified for ease of visual comparison (where Eastern is Outside, Upper is Above, Lower is Below, and Composite is shown as Below).

9.2 Challenges Not Previously Discussed

The Periodic Evaluation process provides the GSAs with an important opportunity to highlight technical and financial challenges that may inform future Department assistance and services. The following reflects Basin-wide challenges collectively or individually experienced by each GSA:

- Financial and technical support for improved data remains a significant challenge. Data needs that could use additional support include improved and more frequent crop mapping, groundwater accounting and evapotranspiration estimates, and improved groundwater level monitoring.
- The GSAs have experienced challenges related to the state's water rights and Temporary Use Permit processes. MID, Merced Subbasin GSA and other local agencies previously

submitted a permanent flood water right application to the SWRCB in December 2019 but the permit has not yet been accepted. The agencies subsequently pursued floodwater rights through Temporary Use Permits (TUP). The TUP permitting process is intended to streamline how agencies may divert floodwaters for groundwater recharge. MID and DWR jointly applied for a Temporary Use Permit to divert flood flows during the wet seasons of WYs 2023 and WYs 2024 but ultimately were limited by the very high thresholds required for these diversions.

- During the evaluation period, subsidence tracking indicated subsidence is shifting in location, in part because of GSA activities. Public and private entities within the Merced Subbasin have significantly reduced pumping below the Corcoran Clay by securing additional surface water and/or transitioning pumping to above the Corcoran Clay. These efforts have resulted in lower subsidence rates, and in some areas showing almost zero subsidence. While observed subsidence in the most recent reporting year was reduced, regional subsidence, spanning multiple subbasins, is still occurring. More defined direction from DWR and the legislature to develop a unified approach and related processes would provide clarity on meeting the goals of SGMA.

- CIMIS Station #148, located in the Merced Subbasin, was decommissioned due to land use changes that occurred in 2024. Currently, there are no longer any CIMIS stations in Merced County. The result is that local evapotranspiration data used in the MercedWRM and local monitoring and enforcement of groundwater consumption and extraction is significantly less reliable. The GSAs have been working for several years to find a suitable replacement site; despite identifying several potential sites, access agreements have not yet been executed. Part of the challenge is the scarcity of large cool-season perennial grass pasture. Siting of a new station may require incentives not only for the site but also to grow the necessary crop, which is likely a lower revenue crop compared to other options.

- There are few resources comprehensively documenting Best Management Practices and methodologies for recharge and related technical approaches to filtration of recharge water, quantifying recharge credits, and undertaking field maintenance. In addition, the Subbasin includes areas with relatively impermeable surface soils preventing traditional recharge basins. There is significant advancement that could be made in providing Best Management Practices for recharge with dry wells (vadose zone recharge wells), reverse tile drains and similar mechanisms to promote recharge in these areas.

- The GSAs have expended significant staffing and financial resources to develop and implement the GSP, including:

    - Establishing robust accounting and data management programs needed to track and report success to the Department.

    - Establishing and coordinating groundwater allocation policies with growers and stakeholders that enable necessary demand reduction.

- MIUGSA recently hired staff specifically for implementing and enforcing rules such as well registration and groundwater allocations.

- Monitoring and enforcing groundwater extraction through direct measurement, such as flow meters on wells, can be costly and effort-intensive for both local well owners and GSA staff. However, the uncertainty related to remote sensing, and other site-specific conditions needed to estimate and track groundwater consumption has the potential to undermine local trust in groundwater allocation policies and may cause challenges when working between different entities at all levels of governance. The GSAs hope the state considers providing further guidance for groundwater extraction accounting methods, addressing the use of various available groundwater accounting tools and providing a framework for continuity, transparency, and trust.

- The GSAs are expending time and resources to comply with Merced County's required consistency determinations for new non-de minimis well permit applications. Executive Order N-7-22 increased burdens on the GSAs regarding well permitting.

- The GSAs continually need to evolve policies to address landowner activities that may undermine GSP implementation efforts. For instance, Merced County has proposed amendments to modify their groundwater export policy in a manner that places additional requirements on GSAs such that each GSA must determine whether a private landowner action is consistent with the GSP.

The GSAs would support the following:

- Increased financial assistance for:
    - Automated metering infrastructure
    - Monitoring wells, especially in the vicinity of natural streams
    - Remote sensing and other data, such as land use and field boundaries
    - Potential costs related to site preparation, access, and ongoing operation of CIMIS stations
- Continued research to convert consumptive use to groundwater extraction consistent with SGMA and reduce and explain inconsistencies in evapotranspiration estimates from satellite imagery, especially over idle lands and related to effective precipitation.
- Assistance with assessing the impact of groundwater pumping on river flows.

9.3 Legal Challenges

GSP implementation is not currently affected by any legal challenge or adjudication.

10. SUMMARY OF PROPOSED OR COMPLETED REVISIONS TO PLAN ELEMENTS

SGMA requires GSPs to be evaluated in the form of Periodic Evaluations every five years and whenever a GSP is amended. The purpose of this Periodic Evaluation was to provide an update to the DWR, interested parties, and the public on the progress the GSAs have made on implementing the Merced Groundwater Subbasin GSP. The Periodic Evaluation includes updates to activities implemented by GSAs, recent groundwater conditions and their progress towards meeting sustainable management criteria, new information collected and used by the GSAs, and amendments incorporated into the 2025 GSP.

During the early portion of the evaluation cycle, the Subbasin experienced groundwater level declines, as predicted in the 2022 GSP. However, undesirable results were not observed relative to the chronic lowering of groundwater levels sustainability indicator and groundwater levels showed a general increase in the final year of the evaluation cycle. Additionally, undesirable results were not observed for the degraded water quality, inelastic land subsidence, and interconnected surface water sustainability indicators.

Ten projects were completed during the evaluation cycle with 10 actively ongoing or preparing for implementation. The GSAs anticipate benefits for priority PMAs to begin shortly after implementation.

New information, such as data for wells below the bottom of the Subbasin, AEM survey data, well impact analysis, and refinements to the MercedWRM were utilized during the evaluation cycle, discussed in the Periodic Evaluation, and incorporated into the 2025 GSP.

As discussed previously, the 2022 GSP was amended as a result of new information collected and to address Recommended Corrective Actions included in DWR's 2023 determination letter. The most significant revisions to the 2025 GSP include:

- The establishment of sustainable management criteria for the reduction of groundwater in storage sustainability indicator.
- The evaluation of the nexus between groundwater level changes and arsenic and nitrate concentrations to determine if sustainable management criteria were required.
- The addition of new groundwater level monitoring wells to address data gaps and establishment of sustainable management criteria at a subset.
- Beyond regular annual updates, the MercedWRM underwent a significant update and refinement process using new datasets to improve the overall representation of the Subbasin. Results from the model update were used to evaluate sustainable yield, the ability of PMAs to achieve sustainability, the reduction of groundwater in storage sustainability indicator, the correlation between storage and groundwater levels, and the indicator's applicability to the Subbasin.

- The updated MercedWRM was used to refine the estimates of timing and locations of depletions of interconnected surface waters.

The GSAs will continue to progress in implementing the ongoing PMAs to arrest groundwater level declines. Priority action items anticipated for near-term completion are the adoption of a domestic well mitigation plan and implementation of demand reduction (allocation) programs for MSGSA and MIUGSA. The GSAs will continue to use the annual reports as their primary mechanisms for regular updates on the state of the Subbasin relative to groundwater conditions, water use, and progress on GSP implementation.

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