Eastern San Joaquin Groundwater Subbasin

Draft Groundwater Sustainability Plan: Executive Summary

Prepared by:

EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY

July 2019

This page is intentionally left blank.

Acronyms

AF	acre-feet
AF/year	acre-feet per year
CASGEM	California Statewide Groundwater Elevation Monitoring
DMS	data management system
DWR	Department of Water Resources
GAMA	groundwater ambient monitoring and assessment
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWA	Groundwater Authority
GWA Board	Groundwater Authority Board of Directors
MAF	million acre-feet
mg/L	milligrams per liter
SGMA	the Sustainable Groundwater Management Act
SMCL	secondary maximum contaminant levels
TDS	total dissolved solids
TSS	Technical Support Services
USGS	United States Geological Survey
Workgroup	Groundwater Sustainability Workgroup

This page is intentionally left blank.

EXECUTIVE SUMMARY

ES-1. INTRODUCTION

In 2014, the California legislature enacted the Sustainable Groundwater Management Act (SGMA) in response to continued overdraft of California's groundwater resources. The Eastern San Joaquin Groundwater Subbasin (Eastern San Joaquin Subbasin, or Subbasin) is one of 21 basins and subbasins identified by the California Department of Water Resources (DWR) as being in a state of critical overdraft. SGMA requires preparation of a Groundwater Sustainability Plan (GSP) to address measures necessary to attain sustainable conditions in the Subbasin. Within the framework of SGMA, sustainability is generally defined as long-term reliability of the groundwater supply and the absence of undesirable results.

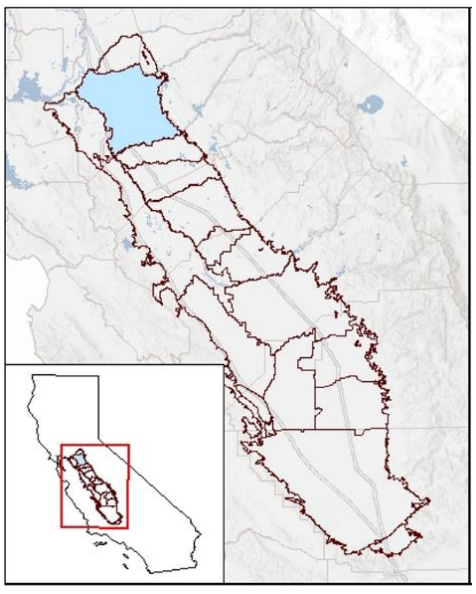
Critical Dates for the Eastern San Joaquin Subbasin

- 2020 By January 31: Submit GSP to DWR
- 2025 Review and update GSP
- 2030 Review and update GSP
- 2035 Review and update GSP
- 2040 Achieve sustainability for the Subbasin

In 2017, in response to SGMA, the Eastern San Joaquin Groundwater Authority (GWA) was formed. A Joint Exercise of Powers Agreement establishes the GWA, which is comprised of 15 Groundwater Sustainability Agencies (GSAs): Central Delta Water Agency, Central San Joaquin Water Conservation District, City of Lodi, City of Manteca, City of Stockton, Eastside San Joaquin GSA (comprised of Calaveras County Water District, Stanislaus County, and Rock Creek Water District), Linden County Water District, Lockeford Community Services District, North San Joaquin Water Conservation District, Oakdale Irrigation District, San Joaquin County #1, San Joaquin County #2 (with participation from California Water Services Company Stockton District), South Delta Water Agency, South San Joaquin GSA (comprised of South San Joaquin Irrigation District, City of Ripon, and City of Escalon), and Stockton East Water District. The GWA is governed by a 15-member Board of Directors (GWA Board), with one representative from each GSA. The Board is guided by an Advisory Committee, also with one representative from each GSA, that is tasked with making recommendations to the GWA Board on technical and substantive matters.

The Draft Eastern San Joaquin Subbasin GSP has been prepared and is now available for public review and comment. SGMA requires development of a GSP that achieves groundwater sustainability in the Subbasin by 2040. The Draft GSP outlines the need to reduce overdraft conditions and has identified 23 projects for potential development to offset reliance on groundwater to meet current and future water demands. Although current analysis indicates that groundwater pumping offsets and/or recharge on the order of 78,000 acre-feet per year (AF/year) may be required to achieve sustainability, additional efforts are needed to confirm the level of pumping reduction and/or recharge required to achieve sustainability. These efforts include collecting additional data and a review of the Subbasin model, along with other efforts as outlined in the Draft GSP.

Figure ES-1: GSP Plan Area within the San Joaquin Valley



ES-2. PLAN AREA

The GWA's jurisdictional area is defined by DWR's 2003 Bulletin 118 and updated in 2016 and 2018. The Subbasin underlies the San Joaquin Valley, as shown in Figure ES-1.

ES-3. OUTREACH EFFORTS

A stakeholder engagement strategy was developed to enable the interests of all beneficial users of groundwater in the Subbasin to be considered. The strategy incorporated monthly Groundwater Sustainability Workgroup (Workgroup) meetings, monthly Advisory Committee meetings, monthly GWA Board meetings, approximately quarterly informational open house events, outreach presentations to community groups, and information distribution to property owners and residents in the Subbasin. Figure ES-2 shows attendees at one of the informational open house events conducted during development of the GSP.

Figure ES 2 - Informational Open House Events

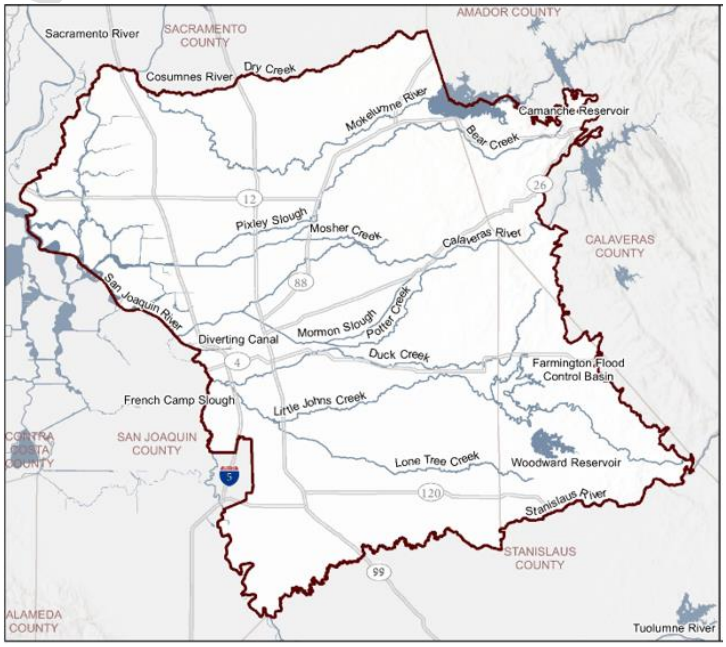
Public Meeting Type	Number of Meetings
Eastern San Joaquin GWA Board Meetings	23
Eastern San Joaquin Advisory Committee Meetings	15
Groundwater Sustainability Workgroup Meetings	12
Informational Open House Events	4
Outreach Presentations to Community Groups	6

The Workgroup was established to encourage active involvement from diverse social, cultural, and economic elements of the population in the Subbasin. The Workgroup members represent large and small landowners and growers from different geographic locations in the Subbasin, longtime residents, representatives from non-governmental organizations, disadvantaged community policy advocates, and outreach coordinators. Spanish translation was provided at informational open house events, creating an opportunity for local Spanish-speaking individuals to engage in the GSP development process.

ES-4. BASIN SETTING

The Subbasin is located to the west of the San Joaquin Delta, and is bounded by the Sierra Nevada foothills to the east, San Joaquin River to the west, Dry Creek to the north, and Stanislaus River to the south. In the eastern portion of the Subbasin, groundwater flows from east to west and generally mirrors the eastward sloping topography of the geologic formations. In the western portion of the Subbasin, groundwater flows eastward toward areas with relatively lower groundwater elevation. Surface water flows from east to west, with the major river systems traversing the Subbasin being the Calaveras, Mokelumne, and Stanislaus rivers. Multiple smaller streams flow into the San Joaquin River, which runs south to north. The location of the Subbasin is shown in Figure ES-3.

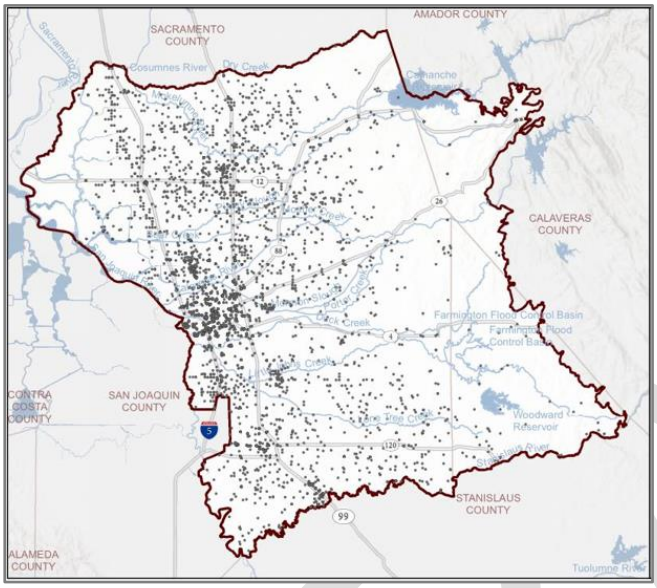
Figure ES-3: Basin Setting



ES-5. EXISTING GROUNDWATER CONDITIONS

Groundwater levels in some portions of the Subbasin have been declining for many years, while groundwater levels in other areas of the Subbasin have remained stable or increased in recent years. The change in groundwater levels varies across the Subbasin, with the greatest declines occurring in the central portion of the Subbasin. The western and southern portions of the Subbasin have experienced less change in groundwater levels, in part due to the effects of the San Joaquin Delta and the import of surface water for in-lieu use.

Figure ES-4: GAMA Water Quality Sampling Locations



Groundwater quality in the Subbasin varies by location. Areas along the western margin have historically had higher levels of salinity. Total dissolved solids (TDS), which is a measure of all inorganic and organic substances present in a liquid in molecular, ionized, or colloidal suspended form, is commonly used to measure salinity. The Groundwater Ambient Monitoring and Assessment Program (GAMA) includes numerous water quality monioring sites in the Subbasin, shown in Figure ES-4. Maximum TDS concentrations across the Subbasin have been reported as high as 2,500 milligrams per liter (mg/L) along portions of the Subbasin's western boundary. California has three secondary maximum contaminant level (SMCL) standards for TDS, all based on aestheic considerations such as taste and odor, not public health cocnerns. These are 500 mg/L (recommended limit), 1,000 mg,L (upper limit), and 2,500 mg/L (short-term limit). The maimum value of 2,500 mg/L exceeds the California recommended secondary MCLs. TDS concentrations decrease significantly to the east, to typically less than 500 mg/L (the recommended limit for aethetic considerations). Elevated concentrations of other constituents, such as nitrate, arsenic, and point source contaminants are generally localized and not widespread and have not been able to be tied to groundwater management activities.

While the total volume of groundwater in storage in the Subbasin has declined over time, groundwater storage reduction has not historically been an area of concern in the Subbasin, as there are large volumes of fresh water stored in the aquifer. The total fresh groundwater in storage was estimated as over 50 million-acre-feet (MAF) in 2015. Between 1995 and 2015, the amount of groundwater in storage decreased by less than 0.1 percent. As such, there is no expected condition under which the colume of stored groundwater poses a cocnern to the Subbasin.

Land subsidence has not historically been an area of concern in the Subbasin, and there are no records of land subsidence caused by groundwater pumping in the Subbasin.

Seawater intrusion is not present in the Subbasin. While the San Joaquin Delta ecosystem evolved with a natural salinity cycle that brought brackish tidal water in from the San Francisco Bay, current management practices maintain freshwater surface flows through a combination of hydraulic and physical barriers, and alternations to existing channels. However, the GSP establishes management criteria to address the potential for future seawater intrusion.

Interconnected surface waters are surface water features that are hydraulically connected by a saturated zone to the groundwater system. If the water table adjacent to a river or stream goes down as a result of groundwater pumping, the river or stream may "lose" water to the underlying aquifer. Major river systems in the Subbasin are highly managed to meet instream

flow requirements for fisheries, water quality standards, and water rights of users downstream. Streams identified as losing streams will be managed to protect against significant and unreasonable stream depletion.

ES-6. SUSTAINABLE MANAGEMENT CRITERIA INDICATORS

SGMA introduces several terms to measure sustainability, including:

Sustainability Indicators – Sustainability indicators refer to adverse effects caused by groundwater conditions occurring throughout the Subbasin that, when significant and unreasonable, cause undesirable results. The six sustainability indicators identified by DWR are the following:

- Chronic lowering of groundwater levels
- Reduction in groundwater storage
- Seawater intrusion
- Degraded water quality
- Land subsidence
- Depletion of interconnected surface water

Sustainability Goal – This goal is the culmination of conditions resulting in a sustainable condition (absence of undesirable results) within 20 years.

Undesirable Results – Undesirable results are the significant and unreasonable occurrence of conditions that adversely affect groundwater use in the Subbasin, including reduction in the long-term viability of domestic, agricultural, municipal, or environmental uses of the Subbasin's groundwater. Categories of undesirable results are shown in the adjacent callout.

Minimum Thresholds – Minimum thresholds are a numeric value for each sustainability indicator and are used to define when undesirable results occur. Undesirable results occur if minimum thresholds are exceeded in an established percentage of sites in the Subbasin's monitoring network.

Measurable Objectives – Measurable objectives are a specific set of quantifiable goals for the maintenance or improvement of groundwater conditions.

The method prescribed by SGMA to measure undesirable results involves setting minimum thresholds and measurable objectives for a series of representative wells.

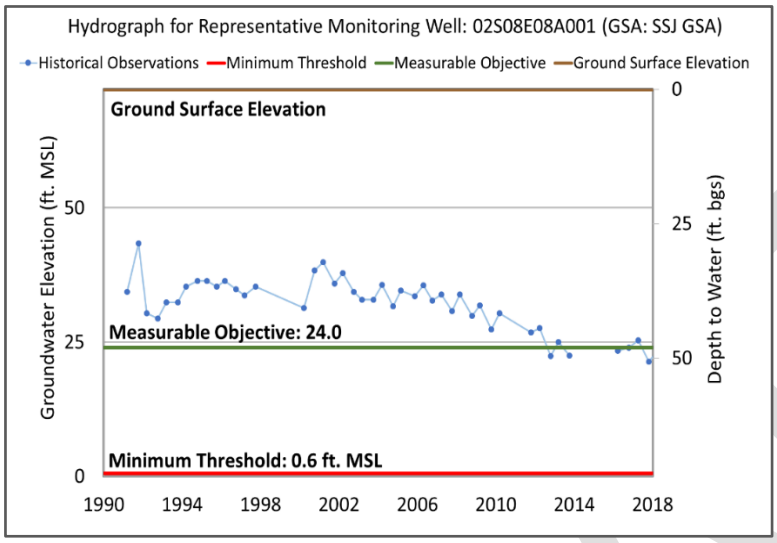
Categories of Undesirable Results

- Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon
- Significant and unreasonable reduction of groundwater storage
- Significant and unreasonable seawater intrusion
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies
- Significant and unreasonable land subsidence that substantially interferes with surface land uses
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water

- Representative wells were identified to provide a basis for measuring groundwater conditions throughout the Subbasin without having to measure each well, which would be cost prohibitive. Representative wells were selected based on history of recorded groundwater levels and potential to effectively represent the groundwater conditions.

A total of 20 representative wells have been identified for measurement of groundwater levels in the Subbasin, and 10 representative wells have been identified for groundwater quality monitoring. The GSP uses groundwater quality data as the basis for evaluating conditions for seawater intrusion and uses groundwater level data as the basis for evaluating conditions for groundwater storage, depletion of interconnected surface water, and land subsidence. As such, these representative wells provide the basis for measuring the six potential undesirable results across the Subbasin.

Figure ES-5: Sample Relationship Between Minimum Threshold and Measurable Objective



Minimum thresholds and measurable objectives were developed for each of the representative wells. Figure ES-5 shows a typical relationship of the minimum thresholds, measurable objectives, and other data for a sample groundwater level well.

Minimum thresholds for groundwater levels were developed with reference to historical drought low conditions and domestic well depths. Specifically, minimum thresholds were established based on the deeper of the historical drought low plus a buffer of the historical fluctuation *or* the 10th percentile domestic well depth, whichever is shallower – establishing levels that are protective of 90 percent of domestic wells. Measurable objectives were established based on the historical drought low and provide a buffer above the minimum threshold. A table summarizing minimum thresholds and measurable objectives is included in the GSP. Graphs showing the minimum threshold and measurable objective for each of the representative wells are contained in an appendix to the GSP.

Minimum thresholds for water quality were defined by considering two primary beneficial uses as risk of undesirable results related to salinity: drinking water quality and agriculture uses. Minimum thresholds are 1,000 mg/L for each representative monitoring well, consistent with the upper limit SMCL for TDS. Crop tolerances in the Subbasin range by crop type from 900 mg/L TDS for almonds up to 4,000 mg/L TDS for wheat.

The minimum threshold for seawater intrusion is a 2,000 mg/L chloride isocontour line eastablished at the western edge of the subbasin between sentinel monitoring locations. 2,000 mg/L chloride is approximately 10 percent of seawater chloride concentrations (19,500 mg/L) and was developed as a minimum threshold based on consideration of existing management practices in other areas of the state.

Minimum thresholds for depletion of interconnection of surface water systems default to the minimum thresholds for groundwater elevations.

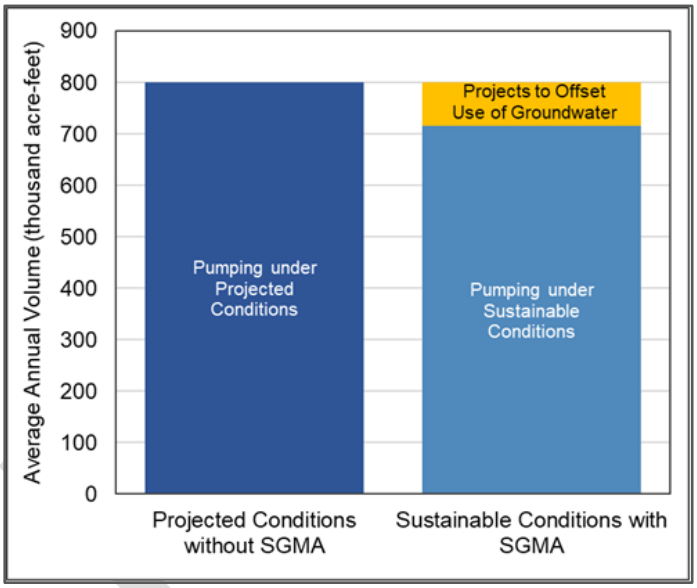
ES-7. WATER BUDGETS

The Eastern San Joaquin Subbasin has been in an overdraft condition for many years. Overdraft occurs when the amount of groundwater extracted exceeds the long-term average groundwater recharged.

The groundwater evaluations conducted as a part of GSP development have provided estimates of the historical, current, and future groundwater budget conditions.

Based on these analyses, at projected groundwater pumping levels, the long-term groundwater pumping offset and/or recharge required to achieve sustainability is approximately 78,000 AF/year. Future groundwater conditions in the Subbasin will continue to show decreased groundwater levels based on projections of current land and water uses. Projects that offset projected groundwater pumping and/or increase recharge will help the Subbasin reach sustainability. These changes are shown in Figure ES-6.

Figure ES-6: Subbasin-Wide Groundwater Pumping and Offsets Required to Achieve Sustainability



The projected Subbasin water budget was also evaluated under climate change conditions. Under the intermediate climate change scenario prescribed by DWR, the annual groundwater overdraft is projected to increase to approximately 57,000 AF/year.

The current analysis was prepared using the best available information and through development of a new groundwater modeling tool, the Eastern San Joaquin Water Resources Model. It is anticipated that as additional information becomes available, the new model can be updated, and more refined estimates of annual pumping and overdraft can be developed.

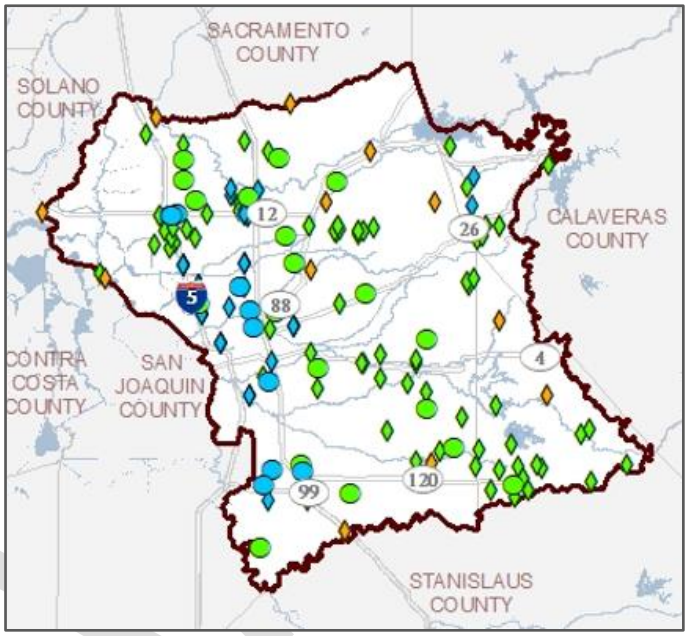
ES-8. MONITORING NETWORKS

The Draft GSP outlines the monitoring networks for the six sustainability indicators. The objective of these monitoring networks is to monitor conditions across the Subbasin and to detect trends toward undesirable results. Specifically, the monitoring network was developed to do the following:

- Monitor impacts to the beneficial uses or users of groundwater
- Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds
- Demonstrate progress toward achieving measurable objectives described in the GSP

There are four networks in the Eastern San Joaquin Subbasin: a representative network for water levels, a broad network for water levels, a representative network for water quality, and a broad network for water quality. The two monitoring networks for water quality will additionally be used to monitor for seawater intrusion. Representative networks are used to determine compliance with the measurable objectives and minimum thresholds, while the broad networks collect data for informational purposes.

Figure ES-7: Groundwater Monitoring Wells



The monitoring networks were designed by evaluating data sources provided by DWR, including the California Statewide Groundwater Elevation Monitoring (CASGEM) Program, the United States Geological Survey (USGS), and from participating GSAs. The monitoring network consists largely of wells that are already being used for monitoring in the Subbasin. Additional wells are being added, and there is the potential for installing new dedicated monitoring wells through DWR's Technical Support Services (TSS) program. Figure ES-7 shows the location of existing and planned groundwater monitoring wells.

Wells in the monitoring network will be measured on a semi-annual schedule. Historical measurements have been entered into the Subbasin Data Management System (DMS), and future data will also be stored in the DMS.

A summary of the existing monitoring wells is shown in the table below.

Summary of Monitoring Network Wells	
Representative Networks	
Groundwater Level Wells	20
Groundwater Quality Wells	10
Broad Networks	
CASGEM (GW Levels)	76
Nested or Clustered Wells (GW Level & Quality)	16
Agency Wells (GW Quality)	5
Planned Wells (GW Level & Quality)	12

ES-9. DATA MANAGEMENT SYSTEM

The Eastern San Joaquin DMS was built on a flexible, open software platform that uses familiar Google maps and charting tools for analysis and visualization. The DMS serves as a data-sharing portal that enables use of the same data and tools for visualization and analysis. These tools support sustainable groundwater management and create transparent reporting about collected data and analysis results.

The DMS is web-based; the public can easily access this portal using common web browsers such as Google Chrome, Firefox, and Microsoft Edge. The DMS is currently populated with available historical data. Additional data will be entered into the system as it is collected.

The DMS portal provides easy access and the ability to query information stored in the system. Groundwater data can be plotted for any of the available data points, providing a pictorial view of historical and current data.

The DMS can be accessed here: https://opti.woodardcurran.com/esj/

Figure ES-8: Opti DMS Screenshot

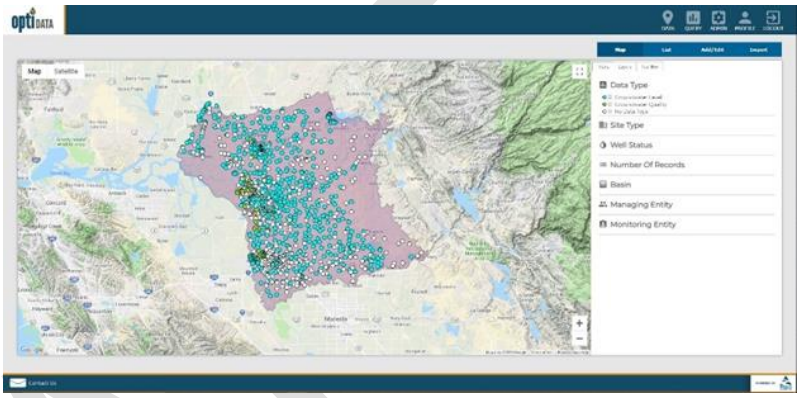
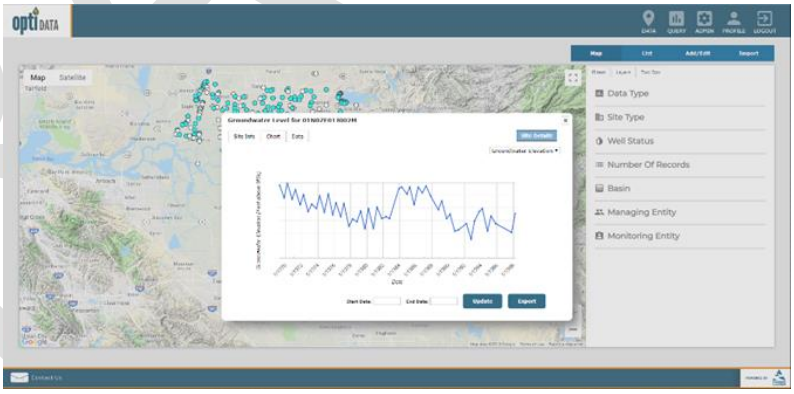


Figure ES-9: Typical DMS Data Display



ES-10. PROJECTS AND MANAGEMENT ACTIONS

Achieving sustainability in the Subbasin requires implementation of projects and management actions. The Subbasin will achieve sustainability by implementing water supply projects that either replace (offset) or supplement (recharge) groundwater to attain the estimated pumping offest and/or recharge need of 78,000 AF/year. It should be noted that this number will be reevaluated after additional data are collected and analyzed. These additional evaluations may lead to modification of levels of pumping reduction associated with the attainment of reliability. Currently, no pumping restrictions have been proposed for the Subbasin; however, GSAs maintain the flexibility to implement such demand-side management actions in the future if need is determined.

Additional management activities included in the Draft GSP include the following:

- Monitoring and recording of groundwater levels and groundwater quality data
- Maintaining and updating the Subbasin DMS with newly collected data
- Monitoring groundwater use through use of satellite imagery
- Annual monitoring of progress toward sustainability
- Annual reporting of Subbasin conditions to DWR as required by SGMA

Several projects to increase water supply availability in the Subbasin have been identified. The initial set of projects were reviewed with the GWA Board, Advisory Committee, and Workgroup. A final list of 23 potential projects are included in the Draft GSP, representing a variety of project types including direct and in-lieu recharge, intra-basin water transfers, demand conservation, water recycling, and stormwater reuse. Projects are classified into three categories based on project status: Planned, Potential, and Longer-term/Conceptual. Planned projects are anticipated to be completed and implemented prior to 2040. The projected supply of projects in this category provide enough water to offset the projected 2040 supply imbalance, bringing the basin into balance and achieving sustainability. Potential projects provide a menu of options for additional water supply projects that can be implemented in the Subbasin. These projects require further analysis and permitting to determine feasibility and cost effectiveness. Longer-term/Conceptual projects are in the early conceptual planning stages and would require significant additional work to move forward. Projects are summarized in the table below.

Project Description	Project Type	Project Proponent	Estimated Demand Reduction (AFY)
Planned Projects:			
Lake Grupe In-lieu Recharge	In-lieu Recharge	Stockton East Water District	10,000
SEWD Surface Water Implementation Expansion	In-lieu Recharge	Stockton East Water District	19,000
City of Manteca Advanced Metering Infrastructure Project	Conservation	City of Manteca	272
City of Lodi Surface Water Facility Expansion & Delivery Pipeline	In-lieu Recharge	City of Lodi	4,750
White Slough Water Pollution Control Facility Expansion	Recycling/In-lieu Recharge	City of Lodi	115
CSJWCD Capital Improvement Program	In-lieu Recharge	Central San Joaquin Water Conservation District	5,000
NSJWCD South System Modernization	In-lieu Recharge	North San Joaquin Water Conservation District	4,500
Long-term Water Transfer to SEWD and CSJWCD	Transfers/In-lieu Recharge	South San Joaquin GSA	45,000
Potential Projects			
BNSF Railway Company Intermodal Facility Recharge Pond	Direct Recharge	Central San Joaquin Water Conservation District	1,000
Stockton Advanced Metering Infrastructure	Conservation	City of Stockton	2,000
South System Groundwater Banking with EBMUD	In-lieu Recharge	North San Joaquin Water Conservation District	4,000
NSJWCD North System Modernization/Lasko Recharge	In-Lieu Recharge/Direct Recharge	North San Joaquin Water Conservation District	2,600
Manserro Recharge Project	Direct Recharge	North San Joaquin Water Conservation District	8,000
Tecklenburg Recharge Project	Direct Recharge	North San Joaquin Water Conservation District	8,000
City of Escalon Wastewater Reuse	Recycling/In-lieu Recharge/Transfers	South San Joaquin GSA	672
City of Ripon Surface Water Supply	In-lieu Recharge	South San Joaquin GSA	6,000
City of Escalon Connection to Nick DeGroot Water Treatment Plant	In-lieu Recharge	South San Joaquin GSA	2,015
Longer-term/Conceptual Projects			
Farmington Dam Repurpose Project	Direct Recharge	Stockton East Water District	30,000
Recycled Water Transfer to Agriculture	Recycling/Transfers/ In-lieu Recharge	City of Manteca	5,193
Mobilizing Recharge Opportunities	Direct Recharge	San Joaquin County	Not determined
NSJWCD Winery Recycled Water	Recycling/In-Lieu Recharge/Direct Recharge	North San Joaquin Water Conservation District	750
Pressurization of SSJID Facilities	Conservation	South San Joaquin GSA	30,000
SSJID Storm Water Reuse	Stormwater/In-lieu Recharge/Direct Recharge	South San Joaquin GSA	1,100

ES-11. GSP IMPLEMENTATION

The overdraft condition in the Subbasin requires projects to offset groundwater pumping and/or increase recharge. The exact amount of required offset/recharge will be reevaluated after additional data are collected and analyzed. Based on current information, total Subbasin-wide offset/recharge needed is estimated to be 78,000 AF/year.

Projects will be administered by the GSA project proponents. GSAs may elect to implement projects individually or jointly with one or more GSAs or with the GWA.

Implementing the GSP will require numerous management activities that will be undertaken by the GWA, including the following:

- Preparing annual reports summarizing the conditions of the Subbasin and progress towards sustainability and submitting them to DWR
- Monitoring groundwater conditions semi-annually
- Entering updated groundwater data into the DMS
- Refining Subbasin model and water budget planning estimates
- Monitoring basin-wide groundwater use using satellite imagery
- Updating the GSP once every 5 years

The GWA Board adopted a preliminary schedule for project implementation. Project implementation is scheduled to begin in 2020, with full implementation by 2040. This approach provides adequate time to put in place methods necessary to refine model estimates and verify project cost effectiveness.

Implementation of the 8 identified Planned Projects has begun and will continue through 2030. Evaluation and possible implementation of the 9 Potential Projects and 6 Longer-term/Conceptual Projects will be based on long-term management or changing needs of the GSA or Subbasin. Further evaluation is necessary to determine technical, economic, and institutional feasibility.

ES-12. FUNDING

Implementation of the GSP requires funding sources. To the degree they become available, outside grants will be sought to assist in reducing cost of implementation to participating agencies, residents, and landowners of the Subbasin. However, there will be a need to collect funds to support implementation.

The areas associated with GWA-wide management and GSP implementation will be borne by the GWA through contributions from the member GSAs, under a cost-sharing arrangement to be developed following GSP adoption. These costs include:

- GWA administration
- Groundwater level monitoring and reporting
- Groundwater quality monitoring and reporting
- Water use estimation

- Data management
- Stakeholder engagement
- Annual report preparation and submittal to DWR
- Developing and implementing a funding mechanism
- Grant applications
- GSP updates (every 5 years)

For budgetary purposes, the estimated initial cost of these activities is on the order of $450,000 to $900,000 per year excluding projects and management actions costs. Additional one-time costs are estimated to be on the order of $415,000.

GSAs will individually fund implementation of projects in their respective areas. Options for GSA funding include fees based on groundwater pumping, acreage, or combinations of these, and pursuit of any available grant funds. The GSAs will evaluate options for securing the needed funding on an individual basis.

- Developing and implementing a funding mechanism
- Evaluation and implementing water supply projects

The estimated initial costs of projects range from on the order of $50,000 to $328 million, depending on the project. Annual project costs range from $3,000 to $9 million per year to provide funds for operations and maintenance.