EXECUTIVE SUMMARY

SOLANO SUBBASIN

GROUNDWATER SUSTAINABILITY PLAN

Draft October 15, 2021

SOLANO SUBBASIN GROUNDWATER SUSTAINABILITY PLAN
PUBLIC DRAFT

ACKNOWLEDGEMENTS

The Solano Subbasin Groundwater Sustainability Agency (GSA) Collaborative (Solano Collaborative) appreciate and acknowledge the funding contribution of $1,000,000 from the California Department of Water Resources (DWR) Funding under the Sustainable Groundwater Planning Grant Program (SGWP), using funds authorized by the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1) in 2017. The Solano Collaborative is using these funds for development of the Solano Subbasin Groundwater Sustainability Plan (GSP).

The Solano Subbasin GSP received an additional $490,000 of Proposition 1 funding through DWR to coordinate with the Solano Subbasin GSA, local partners and stakeholder groups to schedule, prepare and conduct a series of focused workshops with Severely Disadvantaged Communities (SDACs) and work to ensure that information collected from stakeholder meetings and workshops is included as part of the GSP process.

The Solano Collaborative was also successful in securing $705,000 from the California Drought, Parks, Climate, Coastal Protection, and Outdoor Access For All Act of 2018 (Proposition 68). Tasks under this grant include extended outreach, expanding knowledge regarding data gaps within the groundwater monitoring system, and exploring potential groundwater recharge locations within the Solano Subbasin.

Additional funding for GSP development has come from direct contributions and in-kind service from the Solano Collaborative and the Solano County Water Agency.

Solano Collaborative

City of Vacaville GSA, Sacramento County GSA, Solano Irrigation District GSA, Solano GSA, and Northern Delta GSA comprise the Solano Collaborative.

Luhdorff & Scalmanini Consulting Engineers, Kennedy/Jenks Consultants, Inc., West Yost, Davids Engineering, Inc., and ERA Economics compose the LSCE Team for the Solano Subbasin Groundwater Sustainability Plan.

Public outreach efforts were supported by Ag Innovations, Local Government Commission, The Freshwater Trust, and the Solano Resource Conservation District.

SOLANO SUBBASIN GSP OVERVIEW

ES 1.

Introduction (Section 1)

Section 1 introduces the purpose and background of the GSP, the Solano Subbasin GSP management structure, and beneficial uses and users of groundwater in the Solano Subbasin.

ES 2.

Plan Area (Section 2)

Section 2 describes existing water resource monitoring and management programs in the Solano Subbasin as well as existing general plans and land use plans.

ES 3.

Basin Setting (Section 3)

Section 3 details the Solano Subbasin geologic setting, the hydrogeologic conceptual model, groundwater and surface water conditions, and monitoring networks and programs.

ES 4.

Historical, Current, and Projected Water Supplies (Section 4)

Section 4 describes the water supplies used throughout the Subbasin considering land use, population trends, water demands, and conservation projects.

ES 5.

Water Budget (Section 5)

Section 5 describes the historical, current, and projected water budgets for the Solano Subbasin, including consideration of future land use and climate change for the 50-year future planning and implementation horizon.

ES 6.

Sustainable Management Criteria (Section 6)

Section 6 details sustainable management criteria including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, interim milestones, and the monitoring networks for five sustainability indicators (seawater intrusion is not a relevant indicator for the Solano Subbasin).

ES 7

Monitoring Data Management and Reporting (Section 7)

Section 7 describes the data management system for reporting on and tracking GSP development and implementation and the annual and five-year reporting requirements.

ES 8

Projects and Management Actions (Section 8)

Section 8 describes ongoing, planned and potential projects and management actions for the Solano Subbasin that achieve the sustainability goal in the Subbasin and can be implemented as needed to avoid undesirable results.

ES 9

Plan Implementation (Section 9)

Section 9 presents the activities needed to implement the Solano Subbasin GSP for the first five years, including associated costs and schedule.

SECTION 1: INTRODUCTION

Sustainable Groundwater Management Act: Background

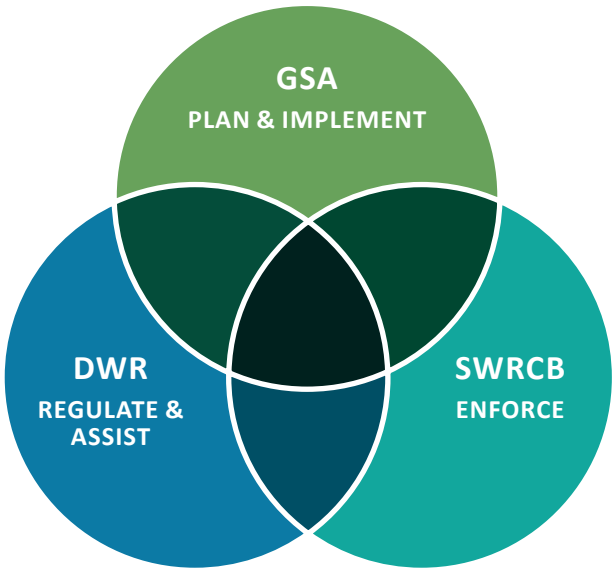
In September 2014, Governor Jerry Brown signed the Sustainable Groundwater Management Act (SGMA), a three-bill legislative package now codified in Section 10720 et seq. of the California Water Code. Effective in California on January 1, 2015, SGMA provides a framework for the sustainable management of groundwater resources.

SGMA encourages groundwater management at the local level. Local water agencies form groundwater sustainability agencies (GSAs) to develop and implement Groundwater Sustainability Plans (GSPs) to guide sustainable management of their groundwater basins. Five GSAs in the Solano Subbasin organized to form the Solano Collaborative to sustainably manage groundwater in the Subbasin: Solano Subbasin GSA, City of Vacaville GSA, Northern Delta GSA, Sacramento County GSA, and Solano Irrigation District GSA.

Sustainability Goals

The Solano Collaborative must achieve the Subbasin sustainability goal within 20 years of GSP implementation, including achieving basin wide sustainability criteria. Achieving the sustainability goal and ensuring the Subbasin achieves or maintains balance means avoiding significant and unreasonable adverse effects (i.e., undesirable results) on six sustainability indicators:

- **Chronic lowering of groundwater levels**
- **Reduction of groundwater storage**
- **Seawater intrusion**
- **Water quality degradation**
- **Land subsidence**
- **Depletion of interconnected surface water**



▲ **Working with state agencies, GSAs develop and implement plans to sustain their groundwater resources.**

The purpose of the GSP is to provide a detailed road map for how the Solano Subbasin will achieve and maintain long-term sustainability. The GSP development process primarily included:

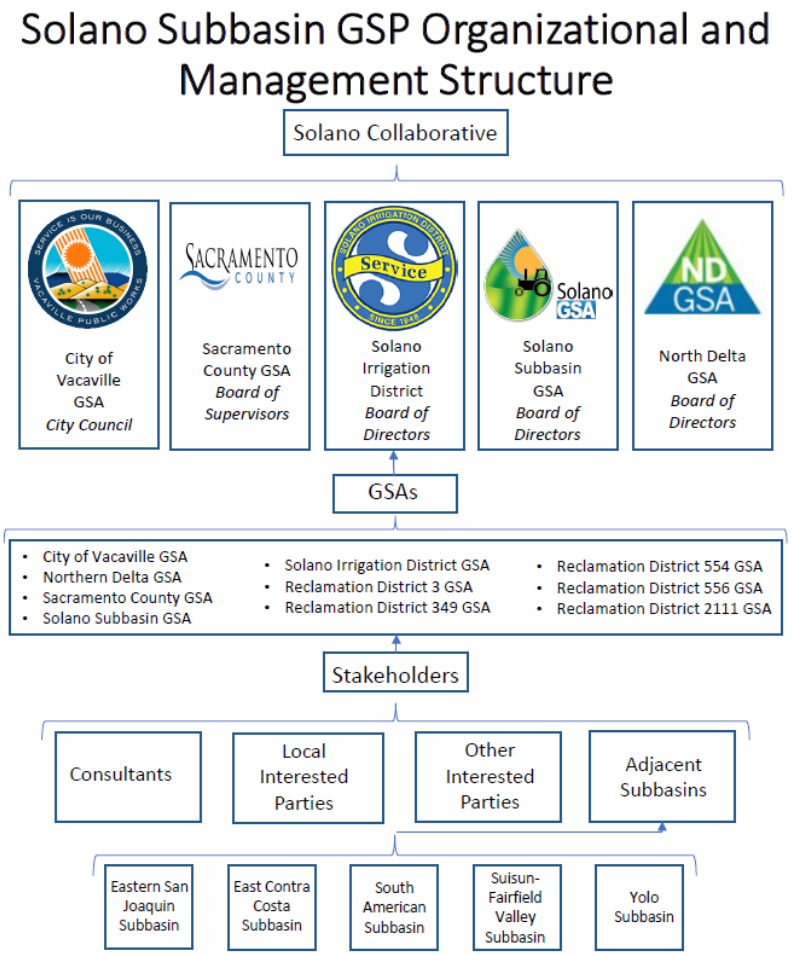
- Defining groundwater conditions, identifying data gaps and levels of uncertainty, and developing tools to improve data collection
- Developing water budgets, sustainable yield estimates, and defining sustainable management criteria including measurable objectives, minimum thresholds, and undesirable results
- Establishing projects and management actions to achieve and maintain sustainability and avoid undesirable results

Section 1 provides an overview of the Solano Subbasin and Groundwater Sustainability Plan organization per the California Code of Regulation (CCR) requirements. (§354, §354.2, §354.6, §354.24)

Solano Collaborative

The Solano Collaborative comprises five GSAs that work together to manage the Solano Subbasin. As a designated medium priority subbasin, the Solano Subbasin must develop and submit its GSP to DWR by January 31, 2022.

The GSP must consider the interests of all beneficial uses and users of groundwater, and encourage involvement of diverse social, cultural, and economic elements of the population within the Subbasin during GSP preparation and implementation.



CITY OF VACAVILLE GSA

The City of Vacaville formed a GSA in April 2017 to manage groundwater resources beneath and within City limits.

SACRAMENTO COUNTY GSA

Sacramento County GSA worked with Sacramento County Water Agency to form the Sacramento County GSA over unmanaged areas in the South American, Cosumnes, and Solano Subbasins.

SOLANO IRRIGATION DISTRICT GSA

Solano Irrigation District (SID) is the GSA for its jurisdiction in the Solano Subbasin. SID has combined governance over surface water and groundwater.

SOLANO SUBBASIN GSA

Solano Subbasin GSA (Solano GSA) is a Joint Powers Agency representing City of Dixon, City of Rio Vista, Solano County, Dixon RCD, Solano RCD, Maine Prairie Water District, and Reclamation District (RD) 2068 and associated members from the Solano Farm Bureau, Solano County Agricultural Advisory Committee, and California Water Service. The Solano Subbasin GSA is the Grant Administrator of $1.7 million State DWR grant for GSP development.

NORTHERN DELTA GSA

The Northern Delta GSA is a Joint Powers Agency formed in early 2018 representing RD 501 as well as several other Reclamation and Water Districts outside the Solano Subbasin.

COMMUNITY ADVISORY COMMITTEE

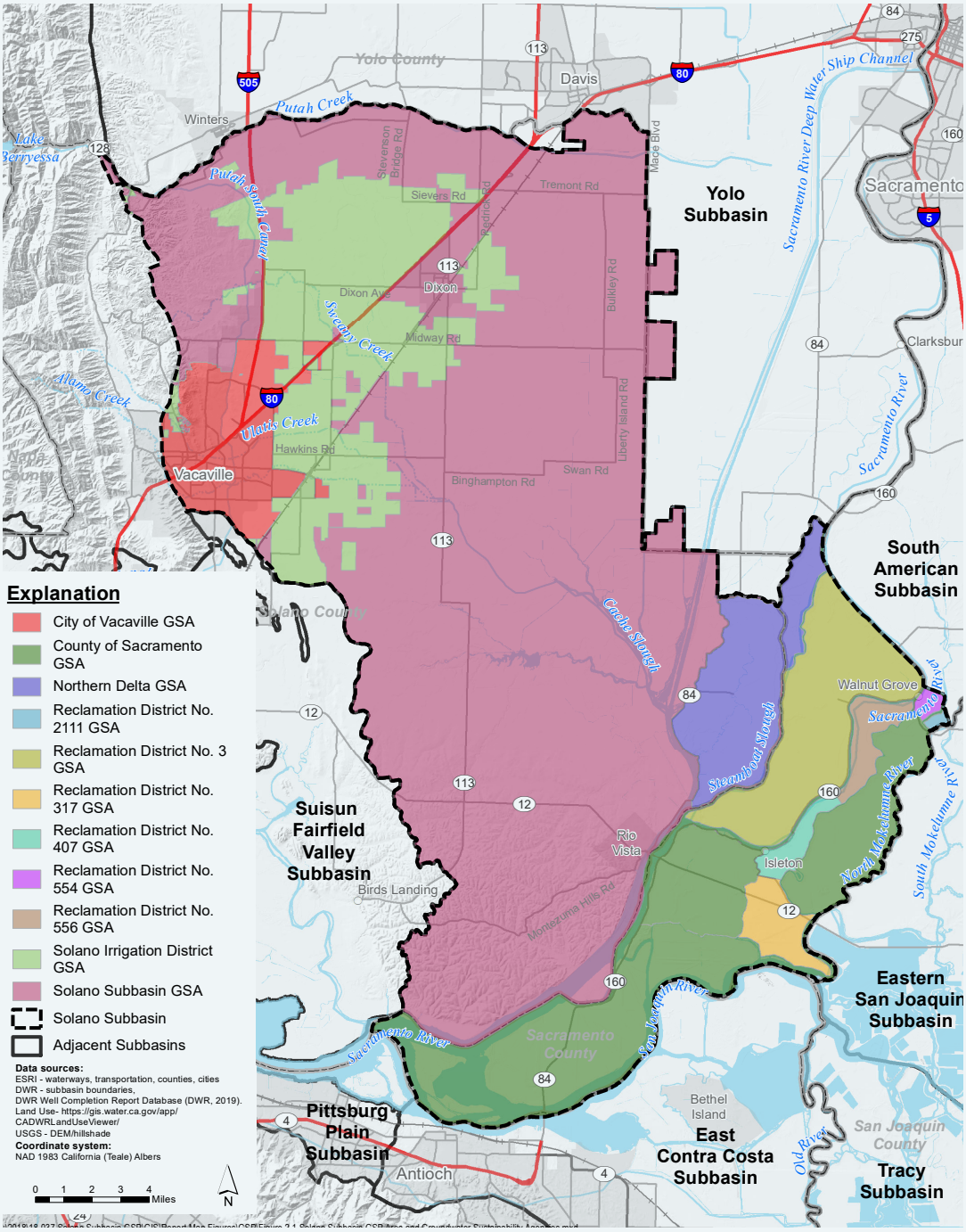
The Community Advisory Committee (CAC) comprised 16 geographically diverse community members representing beneficial uses and users who represented the wide array of community, economic, agricultural, and environmental interests in the Subbasin. CAC members provided focused input on technical recommendations on behalf of the public during GSP development but did not have decision-making authority.

TECHNICAL ADVISORY COMMITTEE

The Technical Advisory Committee (TAC) supported the involvement of the Solano GSAs in the GSP process. The TAC included agencies and organizations involving Solano County agriculture, land managers, land use planning, businesses, and residents.

Legal Authority of the Groundwater Sustainability Agencies

The agencies in the Solano Collaborative entered into a formalized Collaboration Agreement in 2020 to facilitate GSP development. The Collaboration Agreement outlines meeting and voting protocol, the structure of subcommittees and workgroups, and responsibilities of the agencies involved. The Collaboration Agreement demonstrates the legal authority of the Solano Collaborative to prepare and implement the GSP.



▲ **Groundwater Sustainability Agencies in Solano Subbasin**

SECTION 2: PLAN AREA

Description of the Plan Area

The Plan Area is adjacent to the Yolo Subbasin to the north and the east, the South American Subbasin to the east, the Eastern San Joaquin Subbasin to the southeast, the East Contra Costa Subbasin to the south, and the Suisun-Fairfield Groundwater Basin to the west.

Of the 354,600 acres in the Solano Subbasin 79% are located in Solano County, 20% in Sacramento County and 1% in Yolo County.

Previous relevant groundwater management planning efforts and activities within the Plan Area are discussed, including:

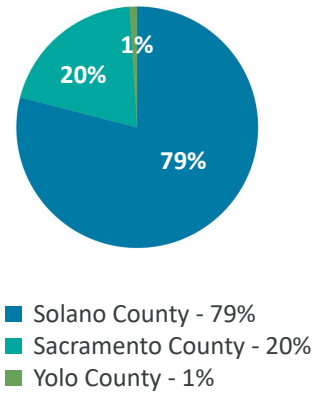
- Control of saline water intrusion
- Wellhead protection efforts
- Migration of contaminated groundwater
- Conjunctive use of surface and groundwater
- Groundwater replenishment and recharge
- Contamination cleanup

Jurisdictional Area and Land Use

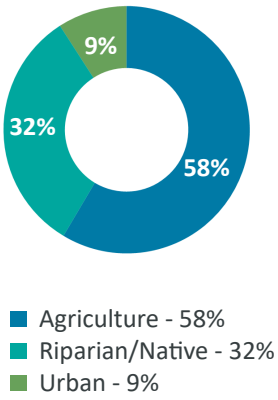
The Plan Area comprises the Solano Subbasin GSA, City of Vacaville GSA, Solano Irrigation District GSA, Sacramento County GSA, Northern Delta GSA and GSAs for Reclamation Districts (RD) 3, 349, 554, 556, and 2111.

Land use areas in the Solano Subbasin are broadly classified across three sectors: agricultural, urban, and native vegetation. The urban land use is concentrated around Vacaville, Rio Vista, Dixon, Walnut Grove, and Isleton.

Solano Subbasin 354,000 Acres



Land Use by Area



General Plans & Public Entities

A variety of land use plans at the county, city, and community level may have jurisdiction in the Solano Subbasin. State and federal public entities also may impact available land uses.

The Solano Subbasin is subject to the jurisdiction of the following general plans:

- **City of Dixon**
- **City of Isleton**
- **City of Rio Vista**
- **City of Vacaville**
- **Sacramento County Walnut Grove Special Planning Area**
- **Solano County**
- **Yolo County**

The following public entities operate within the boundaries of the Solano Subbasin:

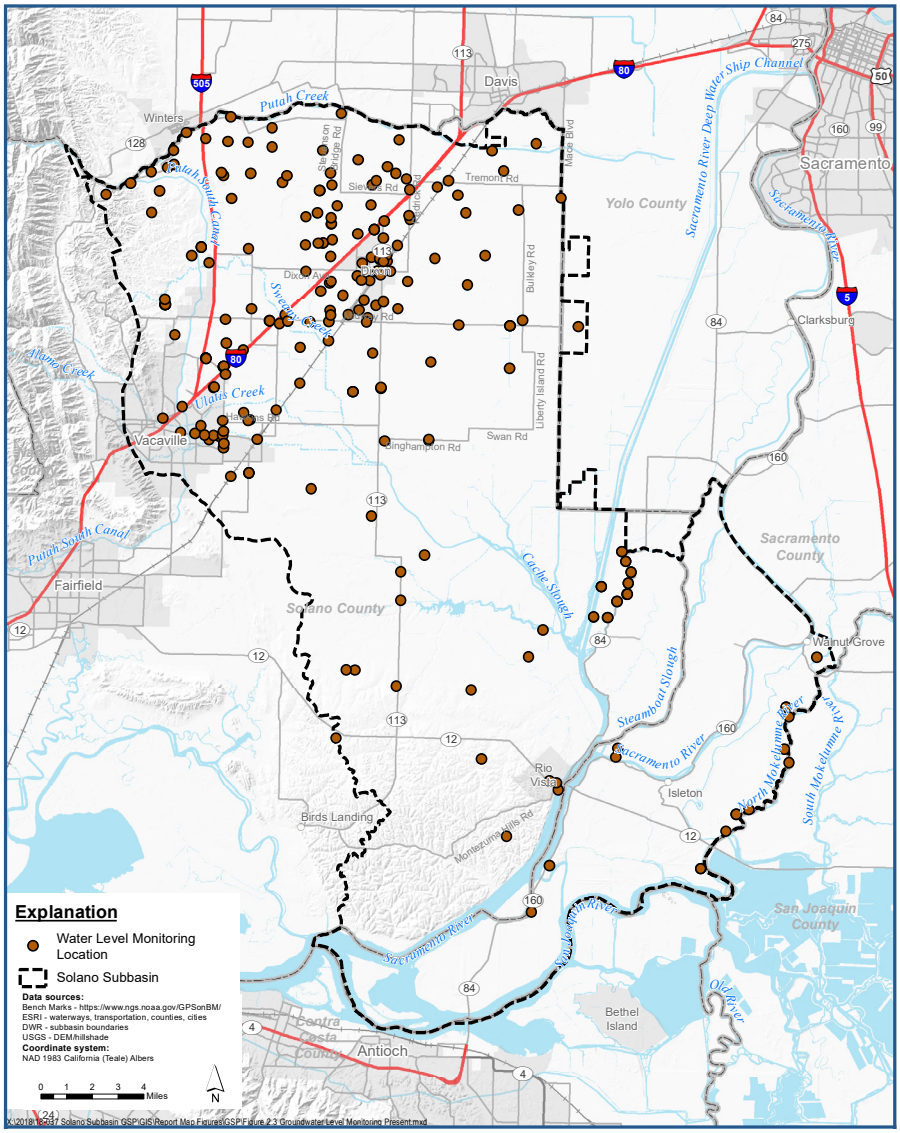
- **U.S. Department of Defense**
- **U.S. Fish and Wildlife Service**
- **California Public Lands Commission**
- **California Parks and Recreation Commission**

Section 2 describes existing water resource monitoring and management programs in the geographical area of the Solano Subbasin as well as existing general plans and land use plans.

Water Code satisfied:

§354.8, §354.10,

Groundwater level monitoring can provide information on the volume, availability, and reliability of groundwater in an aquifer system and can also indicate the direction of groundwater flow within an aquifer system. Groundwater level monitoring has been underway in the Solano Subbasin for many decades.



▲ **Groundwater Level Monitoring 2015 - Present**

HISTORICALLY MONITORED WELLS (PRIOR TO 2015)	CURRENTLY MONITORED WELLS (SINCE 2015)
695	**852**

Groundwater Level Monitoring Agencies in Plan Area

- CALIFORNIA DEPARTMENT OF WATER RESOURCES
- CALWATER
- CITY OF VACAVILLE
- CITY OF DIXON
- COUNTY OF SACRAMENTO
- RURAL NORTH VACAVILLE WATER DISTRICT
- RECLAMATION DISTRICT NUMBER 2068
- SOLANO COUNTY WATER AGENCY
- SOLANO IRRIGATION DISTRICT
- STATE WATER RESOURCES CONTROL BOARD, GEOTRACKER
- UNITED STATES GEOLOGICAL SURVEY
- UNITED STATES BUREAU OF RECLAMATION

Notice and Communication

The Solano Collaborative created a Communication and Engagement Plan to encourage stakeholder participation at each stage of GSP development. Community engagement efforts included:

Solano Collaborative Meetings

Meeetings to address GSP objectives, direction, and scope; stakeholder engagement planning; GSA governance; funding updates; and GSP topics.

Newsletter and Interested Parties List

The newsletter was regularly distributed to engage and inform the public on the GSP, including public engagement meetings, CAC meetings, and updates to the GSP development.

Solano Subbasin Surveys

Surveys and polls were developed and distributed in paper form at public engagement meetings, and electronically through multiple outreach channels.

Solano GSP Website

Meeting results, announcements, deliverables, and surveys were posted as they occurred via the Solano GSP website (https://www.solanogsp.com/).

Focus Groups

Focus groups on specific aspects of the GSP were held as needed to include technical expertise and topic-dependent stakeholders.

Public Engagement Meetings / Town Halls / CAC Meetings

The Solano Collaborative, in partnership with The Freshwater Trust and Local Government Commission, held Town Hall and CAC meetings, and also focused discussions and input sessions around specific topics that required further exploration and engagement.

Special Outreach

Mapping, identifying and engaging groundwater-dependent communities, disadvantaged communities and severely disadvantaged communities.

▲ **Public Engagement During GSP Development**

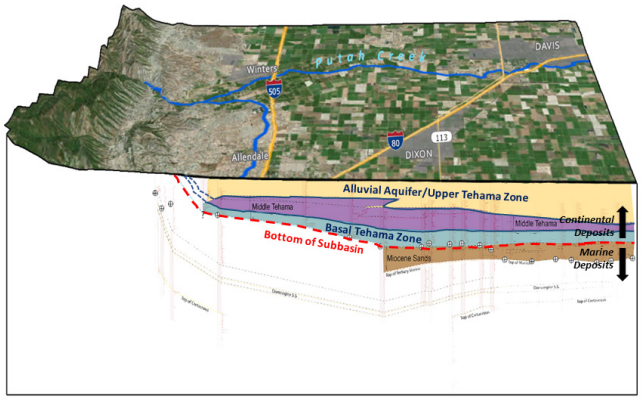
SECTION 3: BASIN SETTING

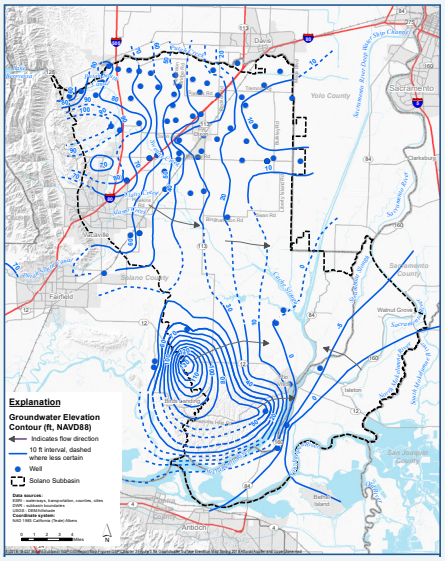
Hydrogeologic Conceptual Model

Most of the Solano Subbasin topography is relatively flat, with elevations ranging from 700 feet above sea level in the northern and western areas to 20 feet below sea level in the southern part of the Subbasin.

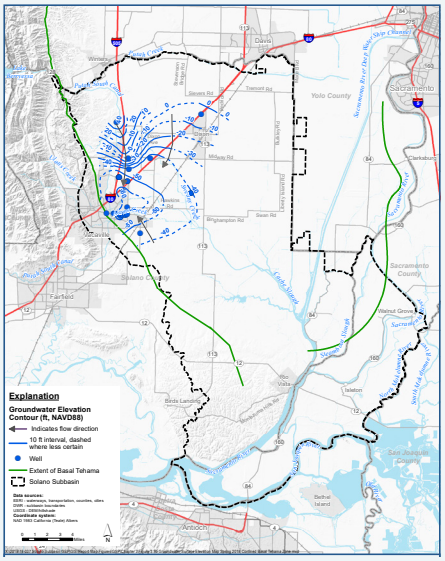
There are two primary aquifer zones in the Solano Subbasin, the Alluvial Aquifer and Upper Tehama Zone, and the Basal Tehama Zone. Most of the groundwater pumping in the Subbasin occurs from the Alluvian Aquifer and the Upper Tehama Zone. The Basal Tehama Zone is utilized locally by the City of Vacaville and is generally found at great depths and under highly confined conditions, whereas the Alluvial Aquifer and Upper Tehama Zone are shallower.

Groundwater flows from areas of higher groundwater elevation or pressure to areas of lower groundwater elevation or pressure. Prevailing groundwater flow directions in the Subbasin within the Alluvial Aquifer and Upper Tehama zone tend to be from west/northwest to east/southeast away from the English Hills and Montezuma Hills towards the Sacramento River and Delta. In the deeper confined Basal Tehama zone where groundwater is under pressure, there are fewer groundwater level data, but groundwater gradients indicate flow is generally to the southwest towards the city of Vacaville, largely because this is the area where the most historical groundwater pumping in the Basal Tehama zone has occurred. Overall long-term trends in groundwater levels are stable in the Subbasin with some declining levels evident in localized areas of the Subbasin, most notably in the northwestern part of the Subbasin. Groundwater levels exhibit declines during drought periods and recovery during and after wet periods with seasonal fluctuations observed throughout the Subbasin as a result of the cyclic annual trends in groundwater pumping for urban and agricultural uses during the irrigation season.





▲ Alluvial Aquifer and Upper Zone



▲ Confined Basal Tehama Zone

Section 3 details the Solano Subbasin geologic setting and the hydrogeologic conceptual model. Groundwater and surface water conditions and monitoring networks and programs

Water Code satisfied § 354.14.

Land Subsidence

The sinking or settling of the land surface due to groundwater pumping is known as land subsidence. Subsidence has the potential to cause adverse impacts to infrastructure at the land surface. There are two general types of land subsidence: elastic (reversable) and inelastic (permanent). Currently, there is no documented inelastic subsidence due to groundwater pumping. Small amounts of subsidence (majority of vertical displacement between -0.1 feet to -0.005 feet with a few areas being <-0.2 feet or >0.1 feet) recorded in other parts of the Subbasin have not resulted in reported adverse impacts to infrastructure or conditions at the land surface.

Groundwater Quality

Groundwater quality in the Subbasin has been evaluated for the following key constituents of concern relating to the beneficial use of groundwater: total dissolved solids (TDS), chloride, nitrate, arsenic, hexavalent chromium (chromium-6), and boron. While these constituents are naturally occurring in the environment, their occurrence and concentrations in groundwater can be affected by anthropogenic (i.e., human influenced) activities.

The Maximum Contaminant Level (MCL) for contaminants is provided where regulations exist. MCLs are the highest level of a contaminant that is allowed in drinking water. MCLs are enforceable standards.

Nitrate

Nitrate is a groundwater contaminant that is commonly associated with agricultural fertilizer application or leaching from septic and wastewater systems. Nitrate as nitrogen concentrations exceeding the MCL of 10 mg/L occur regionally in and around the cities of Dixon and Vacaville, and more localized high nitrate areas also exist around several regulated facilities (i.e., contamination sites) within the Subbasin.

Arsenic

Arsenic exceedances of the MCL of 10 µg/L are most common in the more southern parts of the Subbasin. The elevated arsenic levels in wells in the Subbasin are due to naturally occurring arsenic in the local geologic materials.

TDS

TDS concentrations in parts of the Subbasin are above the recommended secondary drinking water MCL of 500 mg/L with most areas having TDS concentrations below the upper secondary MCL of 1000 mg/L. Elevated TDS concentrations are most associated with groundwater occurring and moving within marine-sourced geologic deposits.

Chromium-6

Chromium-6 concentrations are elevated in some areas in the northern Subbasin, although most concentrations are below the total chromium MCL of 50 µg/L; currently no MCL for chromium-6 is in effect. The elevated chromium-6 levels are believed to be primarily from natural rock sources and geochemical processes.

Boron

Boron levels in the Subbasin typically range from 0.35 to 0.7 mg/L throughout the Subbasin with some more local areas of higher concentrations greater than 0.7 mg/L in the southern Subbasin. No drinking water MCL exists for boron, although some crop and vegetation types are sensitive to elevated boron levels.

Groundwater Pollutants

In addition to these constituents of concern, a few known contaminant plumes are also found in the Subbasin and may impair groundwater quality. These plumes are under the oversight of regulatory agencies.

Seawater Intrusion

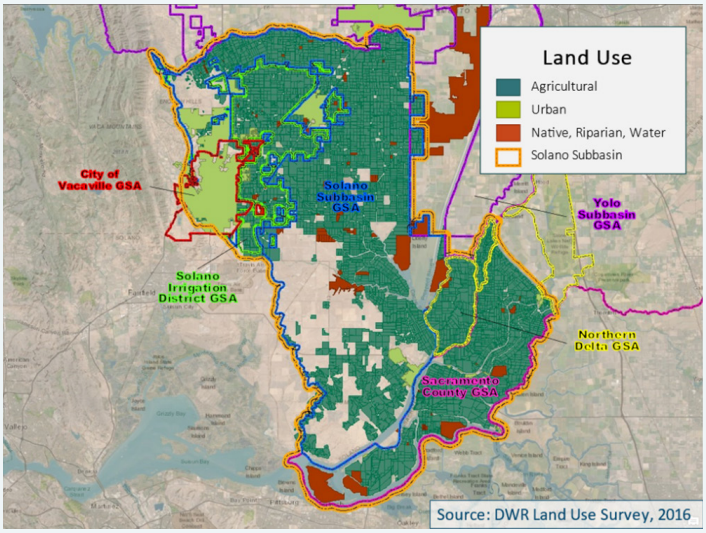
The Subbasin does not have coastline, but a portion of it is located within the Delta, where brackish surface water conditions exist due to tidal influences from the San Francisco Bay. However, there is no historical indication of higher salinity water intrusion from the Delta. Chloride concentrations in groundwater in the Subbasin are generally less than 50 mg/L, well below the secondary drinking water standard (i.e., MCL) of 250 mg/L.

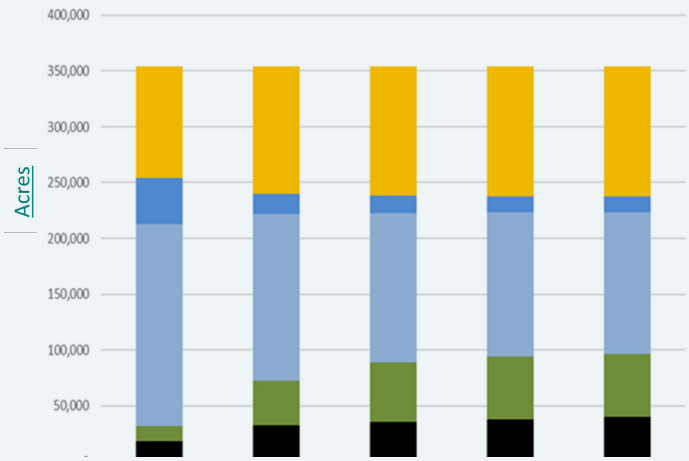
SECTION 4: HISTORICAL, CURRENT, AND PROJECTED WATER SUPPLIES

Land Use

Land use in the Subbasin is predominantly agricultural. Urban land use classification includes urban and semi-agricultural lands. Total agricultural acreage in the Subbasin has gradually decreased since the mid-1990s to 2017, corresponding to increases in urban and native vegetation acreage. On average, agricultural, native vegetation, and urban lands covered approximately 219,000 acres, 110,000 acres, and 25,000 acres, respectively, between 1991 and 2017.

It is anticipated that land use changes will consist of increases in urban acreage and decreases in irrigated land with minimal changes in native vegetation area in the Subbasin. Although the overall agricultural area is anticipated to decrease in the future, the GSAs expect increases in acreages for permanent crop types.





Section 4 describes water supplies, and throughout the Subbasin, considers water sources, land use, population trends, water demands, and conservation projects.

Water Code satisfied § 354.18C

Population Trends

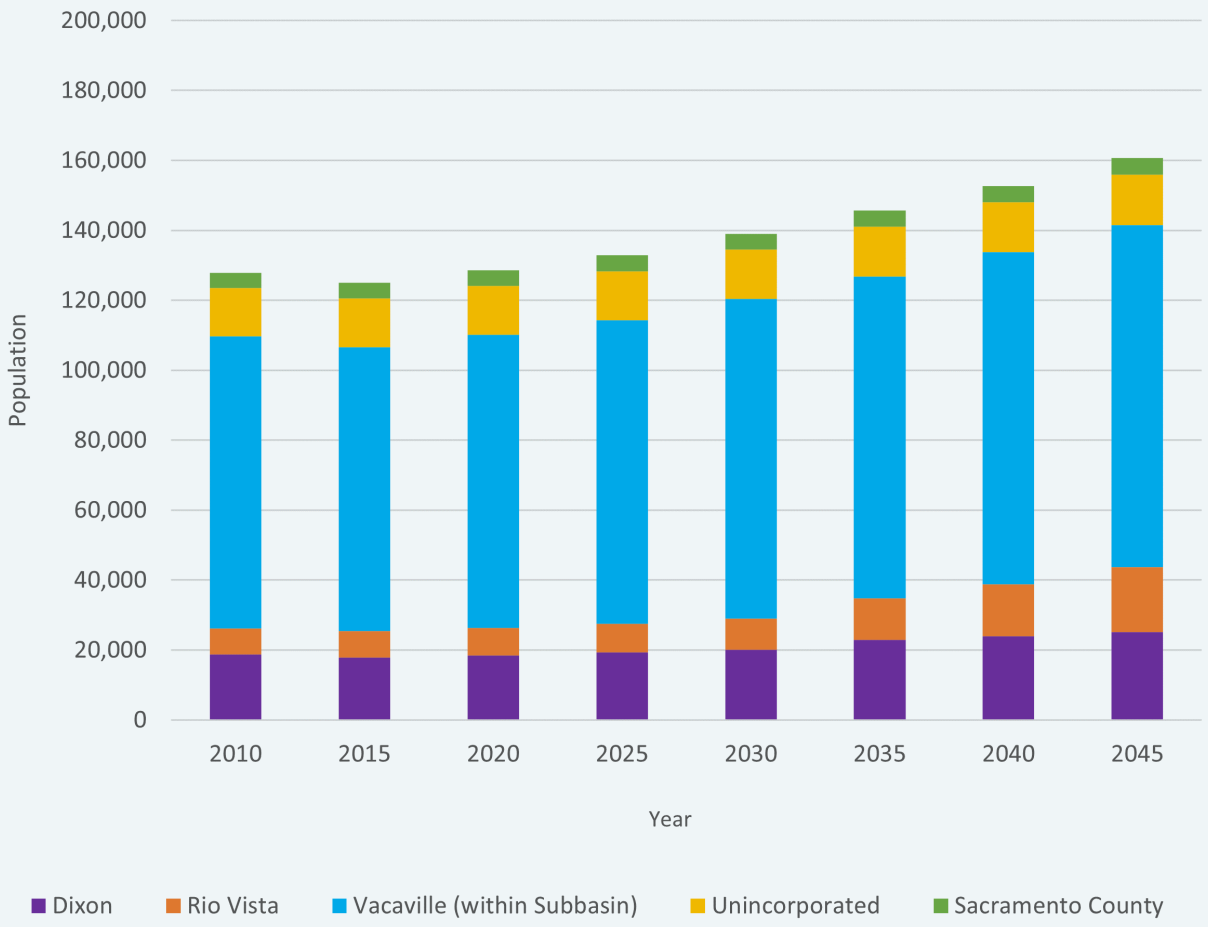
Many factors interact with population trends and water use estimates, including economic conditions, drought, changes in water use efficiency technologies, and land use policies. Determining population increases in the Subbasin is complicated by the misalignment of natural and socio-political boundaries, city boundaries, and service area boundaries, county and Subbasin boundaries may not align.

Projected Water Demands

Changing land use conditions and population with potential additional changes due to climate conditions and water use efficiency standards will lead to a new profile for water use. Projected future water demands were modeled using the Solano Integrated Hydrologic Model (Solano IHM) developed for use in preparing the GSP. Future Solano IHM scenarios consider changing land use and population growth and anticipated changes in management of water use (e.g., efficiency) for a 50-year planning and implementation horizon.

Projected Water Supplies

Current sources of water supplies within the Subbasin consist of the State Water Project (SWP), Solano Project, and groundwater. Changes in water supplies each year depend on allocation availability from SWP, Solano Project, and additional water sources. The Solano Collaborative does not anticipate major changes to water supply availability or sources for the GSP implementation. Additional water sources contributing to the groundwater system are expected to vary with water year type.



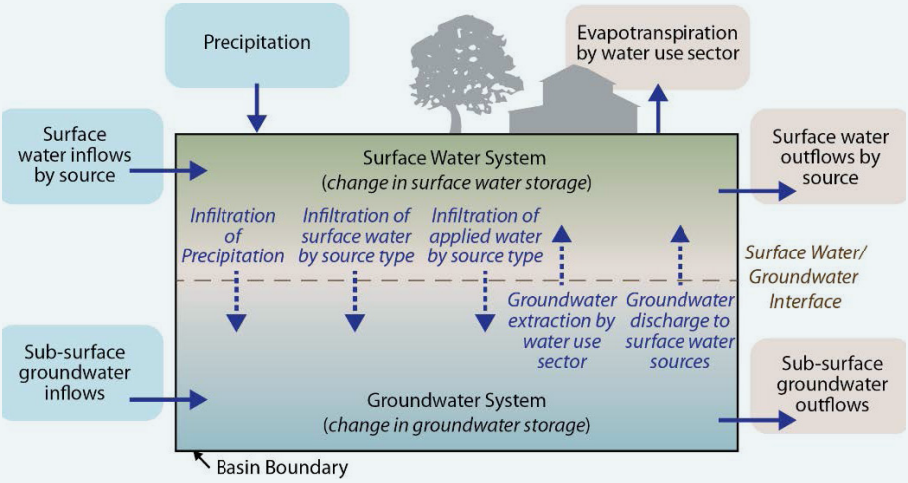
▲ **Overall, population in the Subbasin is expected to increase to 160,600 by the year 2045.**

SECTION 5: WATER BUDGET

Water Budget

A water budget for a subbasin provides a complete assessment of the total volume of groundwater and surface water entering and leaving the subbasin over time, along with the change in volume of water stored within the subbasin. Major components include: precipitation, groundwater extraction, evapotranspiration, evaporation, deep percolation, subsurface flows, and surface water infiltration. Water budgets were developed through application of the Solano IHM, a numerical groundwater flow model.

Water budgets in the next 51 years were analyzed considering changes in land use and climate change. Overall, the water budget results for the 51-year projected (future land use) period indicate a cumulative increase in groundwater storage of about 50,000 acre-feet (990 acre-feet per year).



▲ **Water Budget Overview**

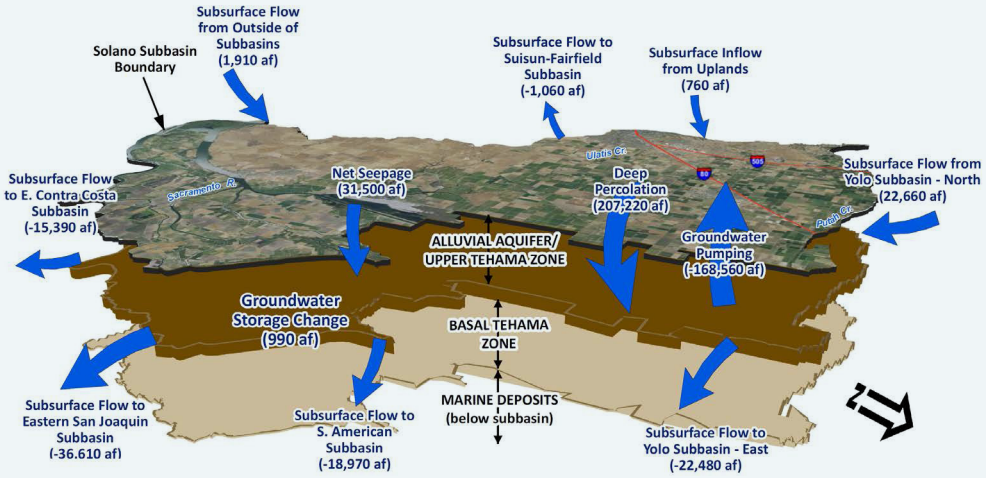
Sustainable Yield

Based on the Solano IHM, it is unlikely that any beneficial users of surface water would be significantly and unreasonably adversely affected by groundwater management under any of the projected future conditions evaluated, including under climate change. Similarly, changes in subsurface flows under the projected scenarios are small and will not impede the ability of adjacent subbasins to achieve or maintain sustainability. Therefore, the sustainable yield is estimated to total about 190,000 acre-feet per year (for the combined sustainable yield of the primary aquifers), which is equal to the volume of groundwater extracted annually in the Subbasin under the projected model scenario with future land use and 2070 climate change conditions.

Annual groundwater storage is expected to increase by around 990 acre-feet

Section 5 describes the historical, current, and projected water budgets for the Solano Subbasin.

Water Code satisfied § 354.18



▲ **Diagram of the Solano Subbasin Projected (Future Land Use) Average Annual Water Budget, 2022-2072**

Climate Change

Climate change scenarios were developed using the DWR guidance for the 2030 and 2070 central tendencies, which might be considered most likely future conditions; in other words it is equally likely that future climate conditions will be more stressful or less stressful. Adjustments to the Solano IHM to model climate change included:

Increased

- **precipitation**
- **groundwater extractions**
- **infiltration of surface water**

Slightly Increased

- **surface water inflows**
- **surface water outflows and evapotranspiration**

Decreased

- **groundwater discharge to the surface**
- **deep percolation**

These climate change adjustments had the following effects on the water budget:

- Increase in net seepage, indicating greater stream seepage to groundwater
- Decrease in deep percolation, decreasing inflows to the groundwater system
- Reduction in negative net subsurface flows, indicating less outflow from the Subbasin
- Increase in groundwater pumping, becoming a greater outflow from the groundwater system

Under climate change scenarios, annual change in groundwater storage is estimated to be 1,030 to 1,401 acre-feet by 2030 and 800 to 1,200 acre-feet by 2070.

SECTION 6: SUSTAINABLE MANAGEMENT CRITERIA

Sustainable Management Criteria

Sustainability in the Plan Area is defined according to sustainable management criteria. This section is a core element of the GSP, providing the criteria for overall basin health. Undesirable results, minimum thresholds, and measurable objectives identified in this section are the backbone of the GSP. These criteria define sustainable management and use of groundwater in a manner that avoids undesirable results. Sustainable management criteria were defined based on information developed and presented in the basin setting, water supplies, and water budget sections of this GSP, and reflect community outreach and engagement efforts to receive input during development of the criteria.

UNDESIRABLE RESULTS (URs)

When one or more of the six identified sustainability indicators is significantly and unreasonably affected by unsustainable groundwater use and conditions occurring throughout the basin.

MINIMUM THRESHOLDS (MTs)

A numeric value for each sustainability indicator at each representative monitoring site.

MEASURABLE OBJECTIVES (MOs)

Specific, quantifiable criteria for maintaining or improving specific groundwater conditions included in a GSP to achieve the sustainability goal.

INTERIM MILESTONES (IMs)

A target value representing measurable conditions set in increments of 5 years.

The GSP uses sustainability indicators to manage the sustainability goal now and over the planning and implementation horizon

Sustainability Goal

The sustainability goal for the Plan Area is to continue operating the Subbasin in a sustainable manner in the following ways:

- Protect and maintain safe and reliable sources of groundwater for all beneficial uses and users.
- Ensure current and future groundwater demands account for changing groundwater conditions due to climate change.
- Establish and protect sustainable yield by achieving measurable objectives set forth in this GSP in accordance with implementation and planning periods.
- Avoid undesirable results as defined under SGMA.

Section 6 provides a discussion of the Sustainable Management Criteria, which define sustainability in the Subbasin and avoid undesirable results.

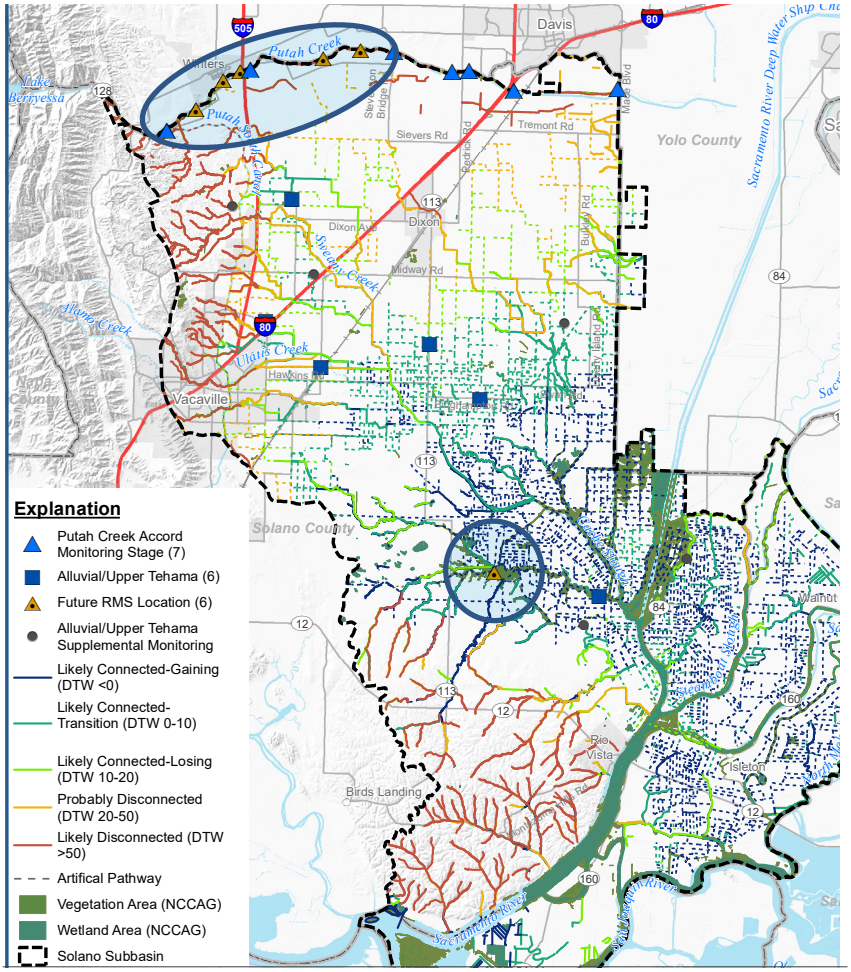
Water Code satisfied: § 354.22., § 354.24., § 354.26., § 354.28., § 354.30.

SGMA requires that GSPs look at six sustainability indicators. Each indicator was evaluated for its relevance to the Subbasin and was assigned minimum thresholds and measurable objectives to avoid undesirable results and ensure continued sustainable groundwater management. Interim milestones were set equal to measurable objectives because the basin is sustainable under current conditions.

Interim sustainable management criteria for each indicator were developed with stakeholder input and using best available science and data.

Monitoring Networks

There are 129 total basin-wide monitoring locations including 33 representative monitoring sites (RMS) in the Alluvial Aquifer/Upper Tehama Zone, and 15 total basin-wide monitoring locations including 8 RMS in the Basal Tehama, to monitor for chronic lowering of ground water levels and groundwater storage. Six monitoring wells will be used for monitoring interconnected surface waters, which are important for groundwater dependent ecosystems.



▲ **Deplection of Interconnected Surface Water Sustainability Indicator: RMS Well Locations**

Seawater Intrusion

The Solano Subbasin is located in the Sacramento-San Joaquin Delta (the Delta) and is not adjacent to a coastline. Although potential impacts could conceivably occur as a result of intrusion of higher-salinity surface water from Delta, at present there is no evidence that intrusion of higher-salinity water from Delta surface water features has occurred or adversely affected groundwater resources and beneficial uses in the Subbasin. **Seawater Intrusion is not currently included in Sustainable Management Criteria, except via monitoring of water quality.**

Six new RMS wells are planned to fill data gaps along Putah Creek and in the center of the Subbasin.

- Increase density of groundwater level monitoring wells.
- Provide information on surface water and groundwater interaction and conditions near groundwater dependent ecosystems.
- Provide information on boundary conditions.
- Ensure long-term monitoring results are consistent and reliable.
- Better understand impact of groundwater management to beneficial users.
- Improve characterization of groundwater flow regimes.

Chronic Lowering of Groundwater Levels

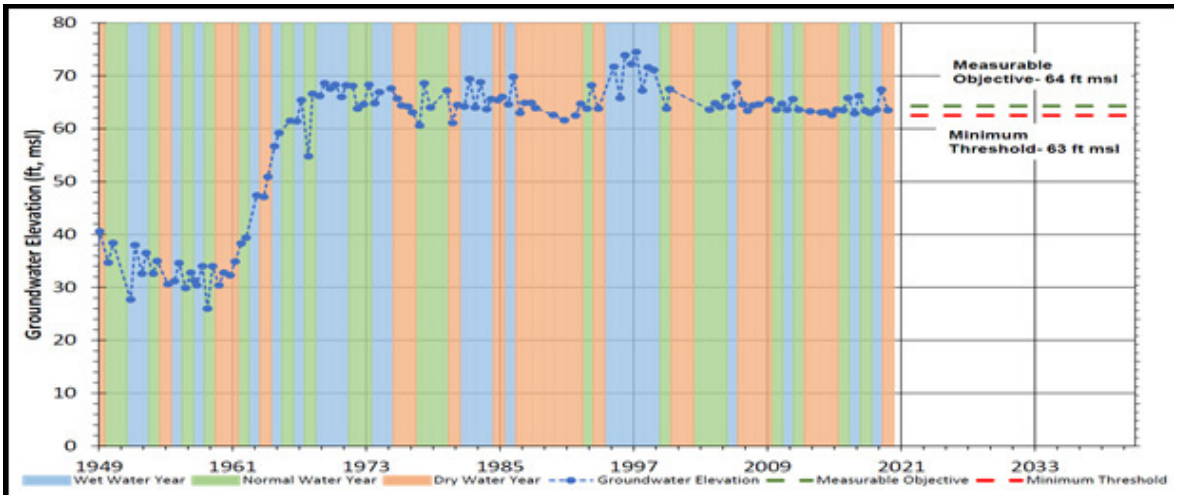
UNDESIRABLE RESULTS:

A UR for chronic lowering of groundwater levels is defined as lowering of groundwater levels across a large enough area and at a magnitude to result in significant and unreasonable adverse impacts to beneficial uses and users in the Subbasin.

- Thirty percent (30%) of wells below MTs for two consecutive years.

Current Condition

There is no evidence that groundwater levels are chronically declining in the Subbasin, and they are not expected to do so in the future. Water levels in the Solano Subbasin are generally stable with seasonal fluctuations, temporary downward trends during drought period, and recovery during wet periods. However, SGMA regulations require the GSP to identify future conditions (over 50 years) that may lead to chronically declining water levels.



▲ **Sample RMS Monitoring Well Groundwater Elevation Data**

Undesirable Result (URs)	Minimum Threshold (MT)	Measurable Objective (MO)
30% of wells below MTs for two consecutive years. Trigger level is any MT exceedance. Trigger levels initiate evaluation of factors related to groundwater declines.	**Alluvial/Upper Tehama** Minimum static groundwater elevation in the base period (prior to January 2015) **Basal Tehama** 50 feet lower than the recent 5-year average static groundwater elevation (prior to January 2015)	Average static groundwater elevation in the base period (prior to January 2015)

Reduction of Groundwater Storage

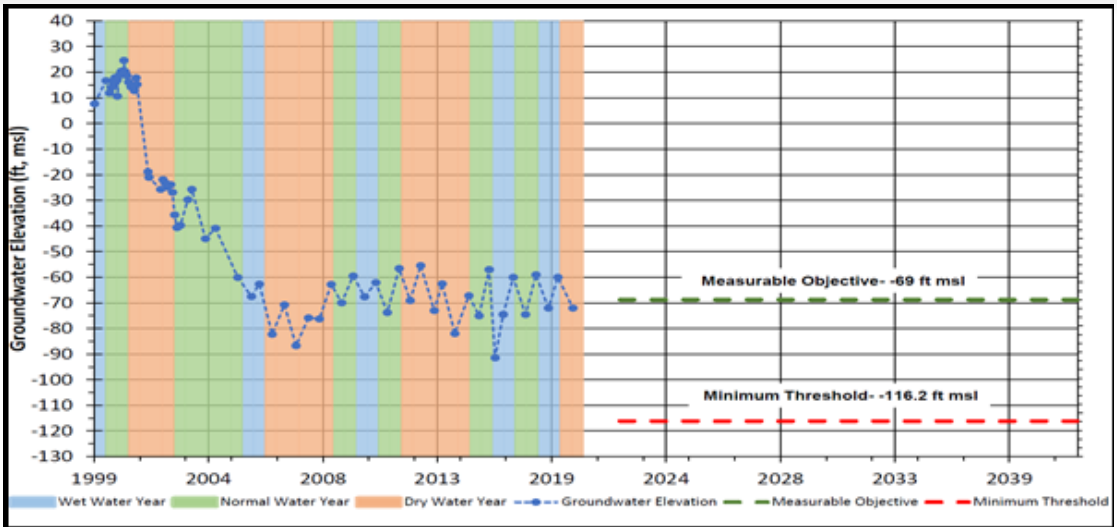
UNDESIRABLE RESULTS:

A UR for reduction in groundwater storage is excessive regional groundwater pumping that causes a significant and unreasonable decrease in groundwater storage over an extended period of time that results in existing water supply wells (drinking water, industrial, and irrigation wells) not being viable for intended beneficial uses due to reduction in pumping capacity, or groundwater levels exhibit ongoing lowering (not due to drought) that significantly affects other beneficial uses.

- *Thirty percent (30%) of wells below MTs for two consecutive years.*

Current Condition

Historical and current groundwater conditions in the Subbasin indicate that URs for reductions in groundwater storage have not occurred in the Subbasin. Projected model simulations suggest that URs are not anticipated to occur during the 50-year planning and implementation horizon



▲ **Sample RMS Well Groundwater Elevation Data**

Undesirable Result (URs)	Minimum Threshold (MT)	Measurable Objective (MO)
30% of wells below MTs for two consecutive years. Trigger levels are the same as chronic lovering of groundwater levels.	**Alluvial/Upper Tehama** Minimum static groundwater elevation in the base period (prior to January 2015) **Basal Tehama** 50 feet lower than the recent 5-year average static groundwater elevation (prior to January 2015)	Average static groundwater elevation in the base period (prior to January 2015)

Land Subsidence

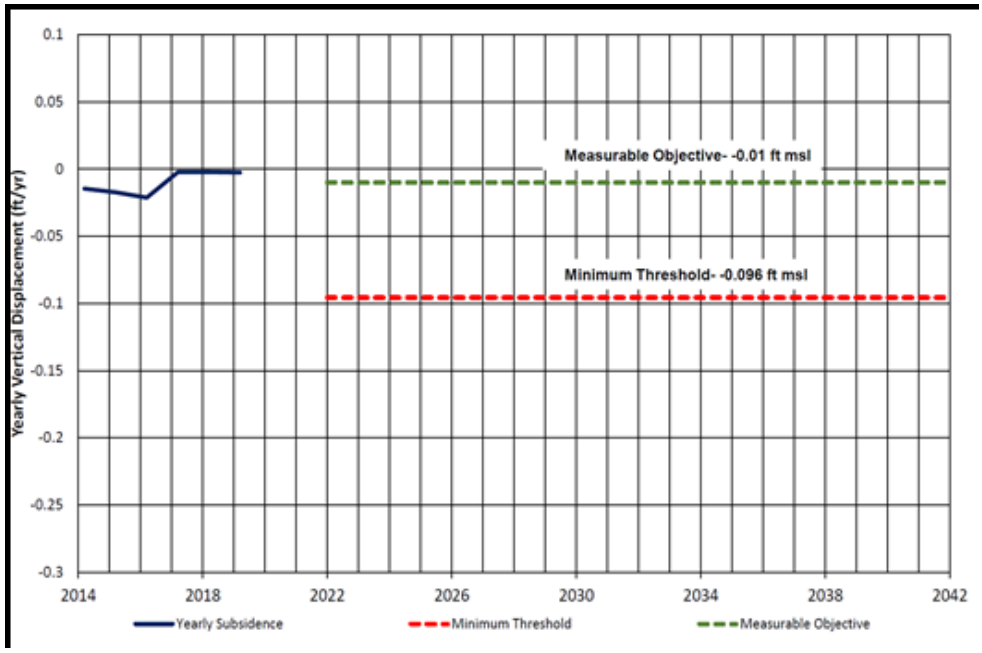
UNDESIRABLE RESULTS:

A UR for land subsidence is excessive regional groundwater pumping that leads to the occurrence of inelastic subsidence that results in significant and unreasonable damage at a regional scale to public infrastructure critical for public health and safety (i.e., levees, flood control channels, water supply canals or pipelines).

- *Any RMS location exceeding MT for three consecutive years*

Current Condition

The Subbasin does not have documented inelastic subsidence or impacts to surface infrastructure. SMCs consider historical rates of displacement, seasonal fluctuations in displacement.



▲ **Sample RMS Vertical Displacement (Subsidence) Data**

Undesirable Result (URs)	Minimum Threshold (MT)	Measurable Objective (MO)
Any representative monitoring site exceeding MT for three consecutive years. Trigger Level is a MT exceedance at any location. Trigger levels would initiate a review of factors related to negative displacement rates	Annual subsidence rate exceeding the historical average range of the yearly fluctuation in vertical displacement	Rate of vertical displacement equal to average historical rate of vertical displacement

Water Quality Degradation

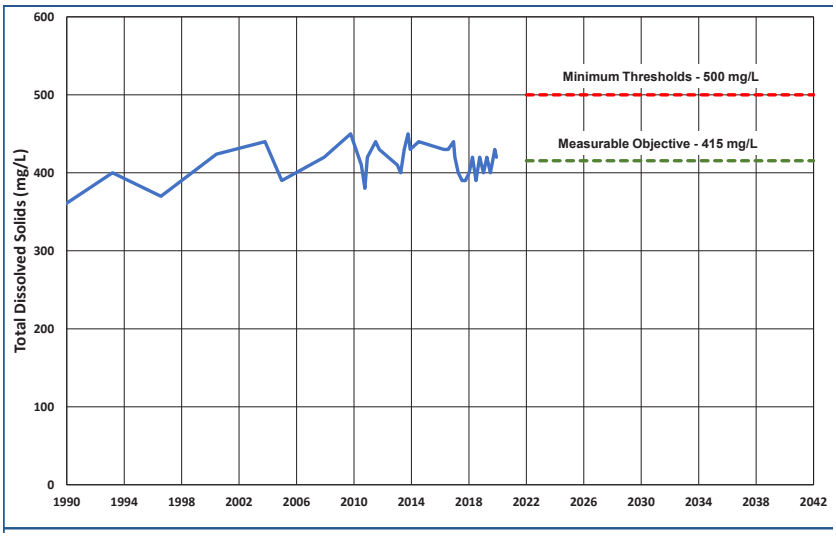
UNDESIRABLE RESULTS:

Degraded water quality in the Subbasin would become significant and unreasonable if SGMA-related groundwater management activities or implementation of GSA projects and management actions cause degradation in water quality.

- *Greater than 25% of wells above the MT for the same constituent, based on average of most recent three-year period.*

Current Condition

Overall groundwater quality conditions in the Subbasin are satisfactory. There are notable but limited areas with historical point-source contamination, or historically elevated, naturally occurring concentrations of arsenic or hexavalent chromium. Chloride concentrations in the Subbasin are generally low except in the central portion of the Subbasin, likely due to geologic materials.



▲ **Sample RMS Well Water Quality Data**

Undesirable Result (URs)	Minimum Threshold (MT)	Measurable Objective (MO)
Greater than 25% of wells above the MT for the same constituent, based on average of most recent three-year period. Trigger level set at 75% of MT. Trigger levels initiate evaluation of factors related to increasing constituent concentrations	Drinking water MCLs or existing concentration plus 20%, whichever is greater	Current concentrations of nitrate, arsenic, chloride, TDS, and hexavalent chromium. For constituents with primary MCL MT, trigger level set at 75% of MCL.

Depletion of Interconnected Surface Waters

UNDESIRABLE RESULTS:

Surface water depletion in the Subbasin would become significant and unreasonable if excessive regional groundwater pumping causes significant and unreasonable effects to potential beneficial uses/users (e.g., aquatic species or groundwater dependent ecosystems).

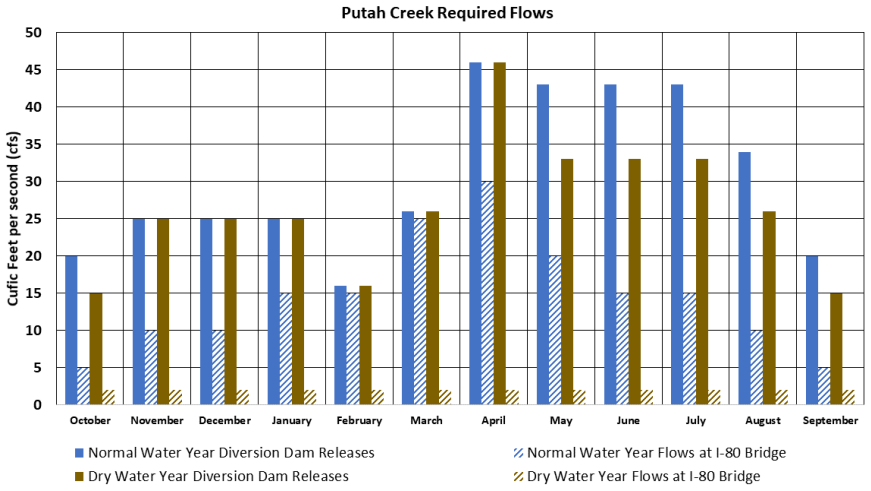
- *Non-compliance with the Putah Creek Accord flow requirements along Putah Creek.*

  OR

- *30% of wells below MTs for two consecutive years.*

Current Condition

Putah Creek has a long-standing historical guidance for flows. GDE distribution / viability and reduction in surface water availability were considered. Smaller streams are confounded by management and are not sufficient indicators of stream depletions. Water levels are used as a proxy. Flows in the Delta are so large and groundwater is so shallow that depletions are not significant. Data gaps in RMS well coverage are being addressed by the construction of six additional monitoring wells in 2021/2022.



▲ **Putah Creek Accord Required Flows**

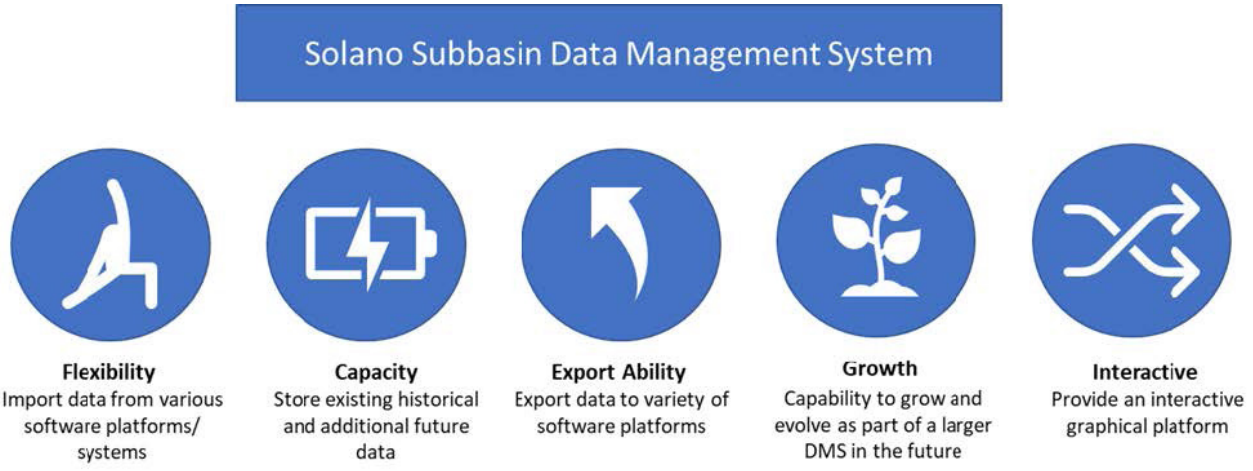
Undesirable Result (URs)	Minimum Threshold (MT)	Measurable Objective (MO)
Non-compliance with the Putah Creek Accord flow requirements along Putah Creek 30% of wells below MTs for two consecutive years. Trigger level is any MT exceedance. Trigger levels initiate evaluation of factors related to groundwater declines.	Minimum flows for Putah Creek outlined in the Putah Creek Accord Minimum static groundwater elevation in the base period (prior to 2015) for wells located close to groundwater connected waterways	Compliance with the Putah Creek Accord for Putah Creek Average static groundwater elevation in the base period

SECTION 7: MONITORING DATA MANAGEMENT AND REPORTING

Data Management System

The Solano County Water Agency (SCWA) developed a Data Management System (DMS) for tracking data related to monitoring, analysis, and reporting on groundwater conditions in Solano County prior to passage of the SGMA (LSCE, 2012). The SCWA DMS was modified to include data relevant to the entire Subbasin and to meet the requirements of the GSP Regulations. The five key attributes of the Solano Subbasin DMS are flexibility, capacity, export ability, potential for growth, and interactivity.

The Solano Subbasin DMS contains a variety of data types, including well location and construction details, groundwater level and quality data, land subsidence data, and streamflow and stage data. While not currently housed in the Solano Subbasin DMS, data related to groundwater use, including groundwater extractions and water deliveries and weather (e.g., precipitation and evapotranspiration), will be incorporated as part of ongoing DMS updates and maintenance.



Data associated with the six sustainability indicators are maintained in the DMS for ongoing tracking and assessment of groundwater conditions. In the future, the participating GSAs may be able to export data from the Solano Subbasin DMS to software programs that allow three-dimensional or animated depictions of the data. **Appendix 7A** – The Solano Subbasin Data Management User Manual – provides additional information about the DMS structure, data import and export procedures, quality control processes, and data analysis queries.

Section 7 describes data management software for reporting on and tracking GSP development and implementation

Water Code satisfied

§ 352.4, § 352.6, and § 354.4.

Data Maintained in the DMS

Sustainability Indicator	GW Levels	GW Quality	PBO Subsidence	Well Pumping & Water Deliveries	Stream Stage and Flow
Chronic Lowering of Groundwater Levels	✓			✓	✓
Reduction of Groundwater Storage	✓		✓	✓	✓
Degraded Water Quality	✓	✓		✓	✓
Land Subsidence	✓		✓	✓	
Depletion of Interconnected Surface Water	✓	✓		✓	✓

Reporting: Annual Report and Five-Year GSP Update

After GSP submission, annual reports covering previous water year (Oct 1st to Sept 30th) information primarily including groundwater elevations, total water use, changes in groundwater storage, and progress on Plan implementation are required. Additionally, a more comprehensive evaluation of basin conditions and Plan implementation actions are required every five years that primarily include:

- Updates to groundwater and surface water conditions
- Updates to basin setting, add new information pertinent to the GSP including management actions, URs, MTs, and MOs, if necessary
- Evaluation of MOs, MTs, and IMs for each sustainability indicator
- Changes in water resources that may impact the basin setting or lead to URs
- Projects and management actions and their implementation progress as applicable
- Review of monitoring networks
- Update of any notable new information since GSP adoption

SECTION 8: PROJECTS AND MANAGEMENT ACTIONS

Projects

The Solano Collaborative is committed to maintaining the sustainability of groundwater resources in the Subbasin. Projects and management actions (PMAs) have been developed to support the sustainability goal for the Subbasin. Based on historical, current, and projected water budgets, the Solano Subbasin can be maintained at sustainable groundwater levels and quality with minimal to no additional intervention by the GSAs; however, the northwestern portion of the Subbasin is a local area vulnerable to declining groundwater levels. The PMAs identified in this GSP may not be necessary to maintain sustainability throughout the Solano Subbasin but are available to the GSAs should conditions change.

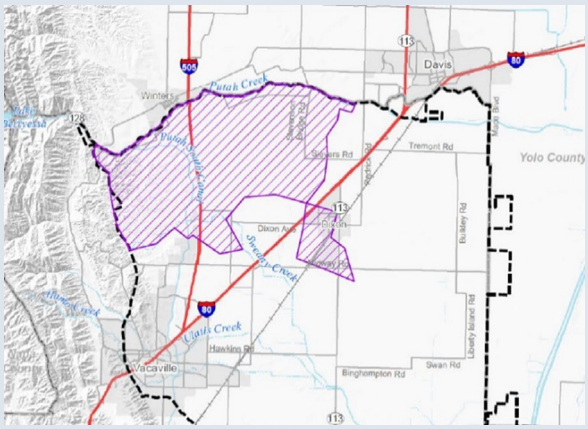
Section 8 describes projects and management actions needed for the Solano Subbasin that achieve the sustainability goal in the Subbasin.

Water Code satisfied: § 354.42. and § 354.44.,

Localized decline in groundwater levels

In the northwestern region of the Subbasin, an approximately 38,000-acre area identified as the "Northwest Focus Area" has experienced localized decline in groundwater levels of approximately 10 feet between the period of 1988 and 2018. PMAs have been developed to address this specific region.

See Section 5.8.1 for discussion of the Northwest Focus Area water budget.



Ongoing PMAs	
Municipal & Industrial Water Use Efficiency Outreach & Implementation	Develop Outreach materials and incentives for municipal and industrial water users to increase water use efficiency.
PMAs Developed for Implementation	
City of Vacaville Recycled Water	Develop City's Recycled Water Program as recommended in the 2020 Recycled Water Master Plan Feasibility Study,
Westside Streams Stormwater Capture Project	Develop an implementation schedule for potential projects in the Northwest Focus Area to enhance groundwater recharge and support local groundwater sustainability.
Rainfall Managed Aquifer Recharge Demonstration Project	Evaluate the use of specific managed aquifer recharge activities on local farms to generate multiple benefits for groundwater sustainability and stormwater management.

Potential PMAs	
Other Groundwater Recharge Opportunities	Several conceptual recharge projects have been identified along Ulatis Creek to support ongoing groundwater sustainability in the Solano Subbasin. The Nature Conservancy has provided GSAs with guidelines to implement on-farm, multi-benefit groundwater recharge efforts that would also be applicable in the Solano Subbasin.
Grower Education Related to On-Farm Practices for Sustainable Groundwater Management	Use of Solano Agricultural Scenario Planning System (SASPS), a web-based application that GSAs and other local agencies can use to design voluntary programs to engage agricultural producers in on-farm sustainable groundwater management projects.
Demand Management	Develop a program that would incentivize voluntary participants to reduce water consumption.
Groundwater Trading Institution	Monitor Solano Subbasin conditions and consider a groundwater trading market to increase flexibility (options) to respond to potential demand management programs.
Education and Collaboration	The Solano Resource Conservation District, The Freshwater Trust, Local Government Commission, and RD 2068 all provide groundwater and water conservation education to classrooms and growers within the Solano Subbasin.
Well Owner Outreach and Education	Develop and implement education and outreach about private domestic well monitoring.
Participation in Other Water Resources Management Programs	Implement other groundwater management strategies including further use of recycled water, expanded conjunctive water management, changes to well regulations, and other actions.

Multi-Benefit Recharge

Multi-benefit recharge projects can maximize recharge benefits for numerous beneficial uses and users of groundwater. The multi-benefit recharge opportunities explored in the Solano Subbasin focus on capturing and utilizing rainfall runoff on agricultural fields for managed aquifer recharge (MAR).

The main goals of the Rainfall MAR (Rain-MAR) Demonstration Project and exploration of Other Groundwater Recharge Opportunities are twofold:

- Recharge groundwater supplies using available surface water supplies and runoff, and
- Create temporary habitat for environmental water users, such as migratory shorebirds along the Pacific Flyway

Multi-benefit recharge resource management strategies:

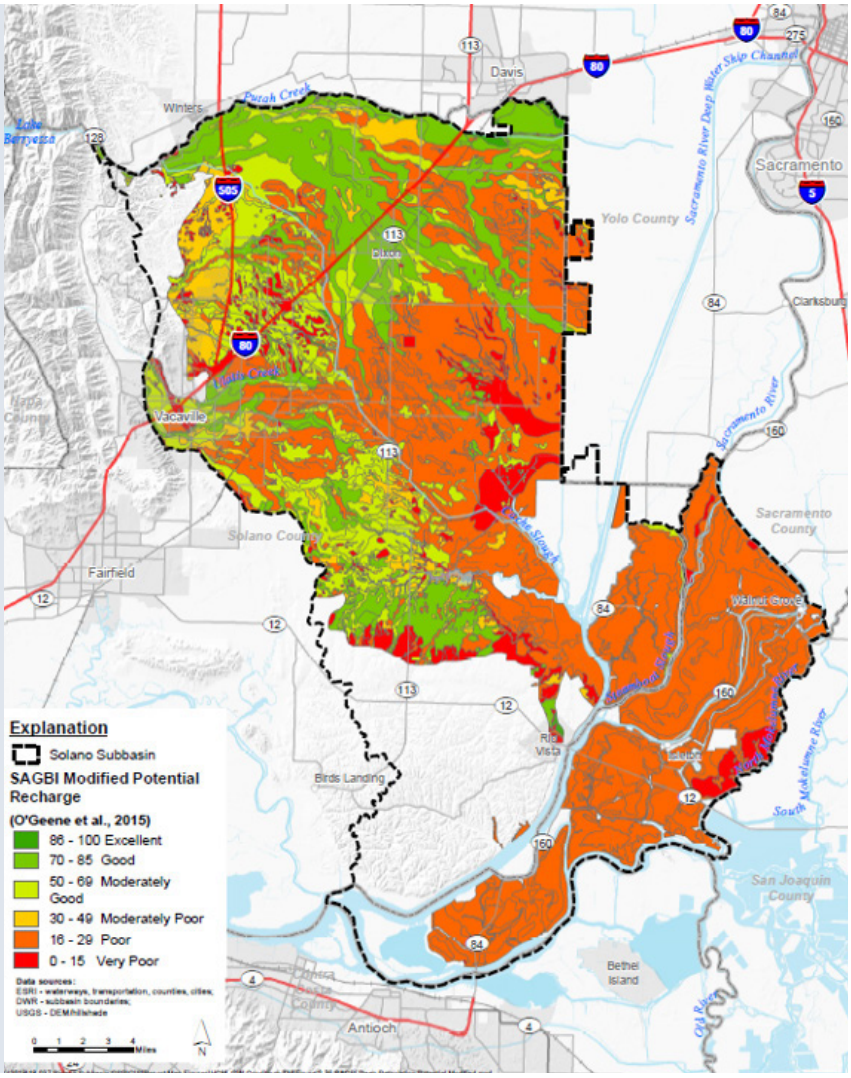
FLOODMAR:
Strategic inundation of fields.

RAIN-MAR:
Strategic capture and recharge through rainfall.

Participating growers would voluntarily flood their fields with available stormflows (FloodMAR) or construct berms or sumps to capture and recharge rainfall runoff (Rain-MAR). These projects could contribute recharge to the aquifer system. Multi-benefit recharge projects would also provide benefits to flood risk reduction, water quality improvement, climate change adaptation, and ecosystem enhancement for wildlife, especially shorebirds during peak migratory periods along the Pacific Flyway.

Potential Sites

Successful multi-benefit recharge projects benefit from selecting sites with high groundwater recharge potential, flooding those sites at times when environmental benefits are greatest, and implementing recharge methods with the greatest practicality depending on site conditions. The map shows areas with the highest potential for recharge in green.



Multi-Benefit Recharge

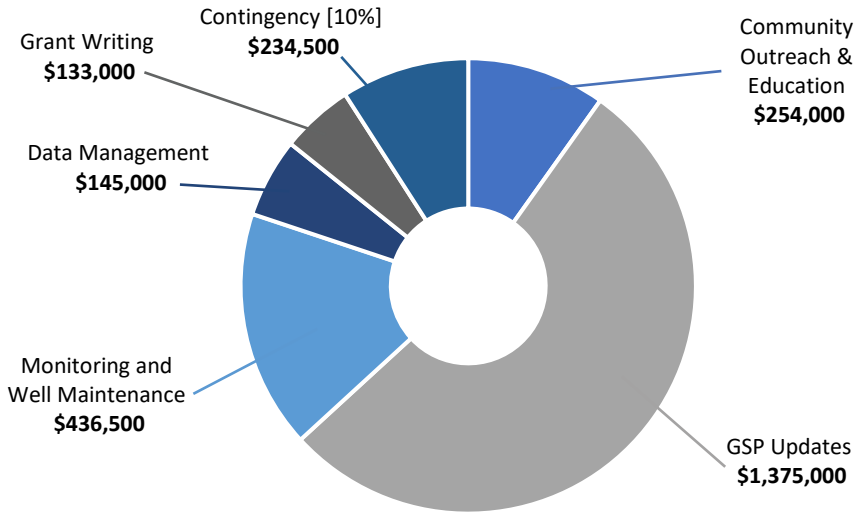
GSP implementation will be a collaborative effort by the GSAs and includes the following:

- **Community Outreach and Education:** Collaborative meetings, coordination meetings, website maintenance and updates, newsletters, and other outreach activities.
- **GSP Monitoring and Data Management:** Monitoring of wells and well maintenance, metering and monitoring water use, and implementation and maintenance of the DMS.
- **GSP Reporting:** Annual reports, Five-Year GSP updates, addressing DWR comments on the GSP, and other GSP studies.
- **Grant Writing**
- **Contingency**

Estimated implementation costs do not include implementation of PMAs.

Because groundwater storage in the Solano Subbasin is not anticipated to decline under current or future land use conditions, or under baseline or climate change scenarios, PMAs identified in Section 8 are not required as part of this GSP.

Not including the costs of PMA implementation, the estimated annual cost ranges from $405,500 to $553,000, with a five-year total of $2.58 million. The GSA Collaborative, as well as individual GSAs, will continue to evaluate the assumptions used to estimate GSP activities and costs.



▲ **Five-Year Estimated Costs For Plan Implementation**

The estimated annual cost for GSP implementation ranges from $405,500 to $553,000, with a five-year total of $2.58 million (shown in figure).

GSP Funding and Financing

Under SGMA legislation (Water Code §10730 and §10730.2), GSAs have the authority to charge fees to fund the costs of GSP implementation. Additional funding for GSP implementation may also include grants, bonds, bank loans, or other financing sources. As detailed in the Solano MOU, member GSAs agree to prepare joint grant applications for funding sources where appropriate.

Funding sources for GSAs and other PMA project proponents may include:

- Grants and loans from DWR, Proposition 1 and Proposition 68 funding programs, US Bureau of Reclamation WaterSmart Grants, US Department of Agriculture grants, State Revolving Funds.
- Bond issuance
- Private funding or borrowing (including environmental easements)
- Schedule for implementation

Schedule for Implementation

Medium-priority groundwater basins such as the Solano Subbasin are required to submit and implement a GSP by January 31, 2022. SGMA also requires that groundwater basins meet their sustainability goals within 20 years of implementation (by 2042) and maintain sustainability for the next 50 years (through 2072).

Most GSP activities are ongoing efforts, including GSA Administration, Community Outreach, Monitoring Activities, Grant Writing and Data Management. GSP Reporting Activities take place on annual and 5-year increments. Responses to DWR comments on the GSP are a one-time activity with expected completion in 2023.

Task Name	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
GSA Administration and Operations																					
Public Outreach	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Legal Services	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Community Outreach and Education																					
Community Outreach and Education[1]	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
GSP Monitoring and Data Management																					
Monitoring of Wells	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Data Management	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
GSP Reporting																					
Annual Reporting	×	×	×	×	×		×	×	×	×		×	×	×	×		×	×	×	×	
Responding to DWR Comments on GSP		×					×														
GSP Five-Year Updates						×					×					×					×
Grant Writing																					
Grant Writing	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

[1] Conducted on behalf of GSAs by consultants
× Indicates a submittal
■ Indicates ongoing effort.

▲ **General Schedule of 20-Year Solano GSP Implementation**

Contact

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