Sustainable Groundwater Management Act (SGMA) Program Guide

For the Delta-Mendota Subbasin

January 23, 2017

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1545 River Park Dr., Suite 425
Sacramento, CA 95815
916.999.8700

SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA) PROGRAM GUIDE

Contents

1. INTRODUCTION

In November 2014, the Governor of California signed the Sustainable Groundwater Management Act (SGMA), 100 years after the passing the Water Commission Act of 1914 establishing California's surface water rights system. Effective January 1, 2015, SGMA establishes a new structure for sustaining groundwater and, for the first time, attempts to comprehensively manage groundwater use in California outside of the courts.

1.1 SUMMARY OF SGMA

The SGMA legislation included a timeline and framework for California to move towards sustainable groundwater use. SGMA requires the creation of Groundwater Sustainability Agencies (GSAs) to lead the new regulation implementation, and the development and implementation of local Groundwater Sustainability Plans (or GSPs), documenting the proposed plan and programs for achieving groundwater basin sustainability within the prescribed 20-year window. To aid in the GSP development and implementation, SGMA gives the GSAs a variety of authorities by which they can manage groundwater sustainably with limited state intervention. In summary, there are four basic phases of SGMA implementation:

Phase 1: Basin Definition

Under SGMA, the Department of Water Resources (DWR) was directed to develop initial basin prioritization, identifying which groundwater basins must comply with SGMA requirements. (Under SGMA, only alluvial groundwater basins deemed to be high or medium priority are mandated to meet the legislative requirements.) The California Statewide Groundwater Elevation Monitoring (CASGEM) program basin prioritization were utilized, and an interim classification list released in June 2014. As of the end of 2016, 127 groundwater basins classified as medium or high priority under CASGEM are required to comply with SGMA, accounting for approximately 96% of groundwater use in California.

SGMA also allowed for modifications to groundwater basin boundaries, based on technical information and/or jurisdictional boundaries, to promote and streamline SGMA compliance. Modifications were made to the Delta-Mendota Subbasin and approved during this process to bring areas that straddle the Delta-Mendota basin and adjacent basins to be fully within or outside the Delta-Mendota basin. Specifically, areas were removed from the Delta-Mendota basin and into the Westside Basin to prevent bifurcation of the Westlands Water District, and additional areas were removed from the Madera Basin and Tracy Basin and added to the Delta-Mendota basin to prevent bifurcation of the Aliso Water District and Del Puerto Water District.

Operating within one Basin will allow for simpler governance and an increased ability to sustainably manage groundwater The DWR provided an interim update to Bulletin 118 (*California's Groundwater*) in 2016, documenting the revised basin boundaries, identifying groundwater basins in critical overdraft, and providing priority rankings of groundwater basins to help local agencies meet requirements and deadlines under SGMA. The reassessment of the prioritization of California's groundwater basins is still underway and will be amended in 2017.

Phase 2: GSA Formation

Groundwater Sustainability Agencies are required to be formed by June 30, 2017. Any local public agency that has water supply, water management, or land use responsibilities within a groundwater basin may become a GSA. A single local agency can become a GSA, or a combination of local agencies overlying a groundwater basin may form a GSA utilizing a joint powers agreement (JPA),

memorandum of agreement (MOA), or other legal agreement. While a water corporation regulated by the California Public Utilities Commission or a mutual water company may not become a GSA in and of itself, they may participate in a GSA through an MOA or other legal agreement. Similarly, federal entities, such as military bases and/or Native American tribes, may opt to participate in a GSA.

Phase 3: GSP Development

Groundwater Sustainability Plan (GSP) development must be completed by January 31, 2020 for basins in critical overdraft and by January 31, 2022 for all other medium/high priority basins. Regulations guiding GSP requirements were approved in August of 2016, and include requirements for the development of a conceptual model and water budget, identification of sustainability management criteria, including sustainability goals, minimum thresholds and measurable objectives, development of a monitoring program, and identification of projects and management actions to achieve and maintain basin sustainability.

Phase 4: GSP Implementation

SGMA allows a 20-year timeframe for basins to achieve sustainability. The GSPs submitted by 2020 or 2022 (depending on the state of overdraft) are required get basins under sustainable management by 2040 or 2042, respectively. During the GSP implementation phase, GSAs are required to adopt programs to facilitate measures outlined in the GSP, update the GSP every five years, and provide DWR with annual updates on the progress of achieving sustainability.

Given the developing nature of the SGMA regulations and guidelines and ongoing activities for forming GSAs statewide, the direct implications of SGMA will be basin-dependent. In moving forward with groundwater-related projects, it is important to identify potential basin management strategies that may be employed to be bring a groundwater basin into sustainability, and to evaluate these strategies in the context of the proposed project or plan. Expectations for increases in future groundwater extractions will need to be re-evaluated under this new paradigm, and groundwater recharge opportunities should be considered in light of how the groundwater basin will ultimately be managed (i.e. will a particular recharge project 'qualify' as a basin management strategy and in that context, how would it be managed?).

Additionally, it is important for GSAs to evaluate interactions and/or partnerships with the surrounding communities and agencies and with adjoining groundwater basins. As stated above, SGMA provides for multiple GSAs in any given basin, but it also requires coordination for achieving sustainable groundwater management within the entire basin. To this end, it will be important for GSAs to engage with the other entities such as cities, irrigation districts, resource conservation districts, and other regional water entities in developing and implementing the GSPs. Early and active coordination will help guide the GSA formation process and offer early recommendations for associated planning and project implementation in the basin.

1.2 STATUS OF SGMA IMPLEMENTATION IN DELTA-MENDOTA SUBBASIN

The Delta-Mendota Subbasin of the San Joaquin Valley Groundwater Basin is a long, relatively narrow groundwater basin that covers portions of five counties, from north to south, San Joaquin, Stanislaus, Merced, Madera and Fresno Counties. The northern boundary of the subbasin begins just south of Tracy in San Joaquin County. The eastern boundary generally follows the San Joaquin River and Fresno Slough. The southern boundary is near the small town of San Joaquin, and the subbasin is bounded on the west by the coast range.

At present, eight GSAs have filed to be exclusive in the Delta-Mendota Subbasin. However, for the portion of the groundwater basin over which SLDMWA is operating, GSAs will be as follows:

- Northern Area GSAs include Del Puerto Water District, Stanislaus County, Patterson Irrigation District, the City of Patterson, and West Stanislaus Irrigation District. These organizations will be operating via a coordinating organization.
- Central Area GSA will be a single GSA with members including Eagle Field Water District, Fresno Slough Water District, Laguna Water District, Mercy Springs Water District, Oro Loma Water District, Pacheco Water District, Panoche Water District, San Luis Water District, Santa Nella County Water District, San Joaquin River Irrigated Lands Program (SJRIP), Tranquillity Irrigation District and Widren Water District
- Grasslands Water District will be its own GSA
- Fresno County GSA representing the Mendota Pool Group
- The San Joaquin River Exchange Contractor Water Authority will also be its own GSA

To date, all GSAs overlying the Delta-Mendota Subbasin are still considering preparation of a single GSP.

2. OVERVIEW OF SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA)

2.1 STATUTORY REQUIREMENTS AND LIMITATIONS

The Sustainable Groundwater Management Act empowers local agencies to manage groundwater basins in a sustainable manner over a long-term period. SGMA requires local agencies to form Groundwater Sustainability Agencies (GSAs) and to develop a Groundwater Sustainability Plan (GSP) that will have a 20-year implementation horizon and a 50-year planning horizon, with the ultimate goal of achieving groundwater sustainability. Core provisions of the Act are the formation of GSAs, the creation of GSPs, DWR evaluation and assessment of GSPs and their implementation, and State agency intervention if the SGMA requirements are not fully implemented. SGMA exempts GSP preparation from California Environmental Quality Act [CEQA] (though it does not exempt the implementation of projects under a GSP from CEQA), and specifically states that it is the intent of the Act to "respect overlying and other proprietary rights to groundwater, consistent with Section 1200 of the California Water Code (CWC), and also to "preserve the security of water rights in the state to the greatest extent possible consistent with the sustainable management of groundwater." Additionally, SGMA states that "nothing in this part or in any groundwater management plan adopted pursuant to this part, determines or alters surface water rights or groundwater rights under common law or any provision of law that determines or grants surface water rights."

As previously noted, implementation of SGMA is limited to California's alluvial groundwater basins that have been deemed to have a high or medium priority. SGMA may be implemented in all other groundwater basins, but is not mandated.

2.2 ROLES AND RESPONSIBILITIES

The primary parties involved in SGMA implementation are local agencies comprising the GSAs, DWR, and the State Water Resources Control Board (SWRCB). Per SGMA, the counties are automatically assigned a role as the GSA when part of a medium or high priority basin is not within the management area of a GSA; although, counties may also actively participate as part of a GSA. Individual groundwater users, while ultimately the most potentially affected by SGMA implementation, will need to work through their local agency(ies) to be represented in the discussion.

2.2.1 Local Agencies

Local agencies are responsible for the formation of GSAs and the subsequent development and implementation of GSPs. DWR and SWRCB serve to facilitate this process and provide guidance for the formation and filing process. Local agencies are expected to collaborate and coordinate their GSA formations on a basin-wide scale to sustainably manage groundwater at a local level. A local agency that decides to become a GSA will be required to perform the duties, and may exercise the necessary powers of a GSA when developing, implementing, and enforcing a basin's groundwater sustainability plan.

Once a GSA is formed, it becomes the primary planning and implementing agency, responsible for lead communications, outreach, and engagement efforts within the basin. This communication includes the development and sharing of technical information both intra- and inter-basin to ensure the consistent use of the same data and assumptions. GSAs are also responsible for the development and implementation of the GSP, along with subsequent 5-year GSP updates and other monitoring, evaluating and reporting to ensure the basin is progressing towards achieving its sustainability goals and to demonstrate that the sustainability goal (as stated in the GSP) is being achieved.

2.2.2 Department of Water Resources

The Department of Water Resource is primarily responsible for providing guidelines and assistance for the GSA and GSP development processes. It serves as the regulating and technical assistance agency. DWR leads communication, engagement and coordination at a statewide level, and provides data and information, tools, funding, and non-technical and technical support. It is also responsible for reviewing GSPs for adequacy and for evaluating the GSP implementation and 5-year updates.

DWR has developed five objectives in its Strategic Plan for SGMA. The objectives and corresponding actions are as follows; key intended outcomes of SGMA are also included in the Strategic Plan.

1. *Develop a Framework for Sustainable Groundwater Management*

DWR is working with local agencies to provide technical expertise to quantify comprehensive water budgets for the groundwater basins, including establishing current groundwater conditions and projecting for future, sustainable groundwater conditions. As part of this process, basin prioritization, established in 2014 under CASGEM, will be reviewed and updated accordingly based on the revised basin boundaries published in 2016. Basins subject to overdraft are also identified. Additionally, DWR has published its first round of Best Management Practices (BMPs) for essential elements to be incorporated into the GSP, though use of these BMPs is optional and additional BMPs are expected in the future.

2. *Provide Technical Assistance to Groundwater Sustainability Agencies*

DWR is developing a web-based groundwater management system to collect, organize, store, and manage the exchange of information between DWR and GSAs. DWR will continue to collect data on groundwater quality, groundwater elevation, and subsidence. The State's well standards will be updated, and DWR will provide continuing support to local enforcing agencies in administering the updated standards. DWR will also continue the CASGEM program and provide assistance and water management strategies for water conservation.

3. *Provide Statewide Planning Assistance to Support Groundwater Sustainability*

DWR will provide an update to Bulletin 118 by 2017, with additional updates in 2020 and every 5 years thereafter. Basin water budget information in Bulletin 118 will be incorporated into the *California Water Plan* updates. DWR will also support the development, protection, and operation of a statewide network of locally- and regionally-operated natural and artificial recharge projects.

4. *Assist State and GSA Alignment and Provide Financial Assistance*

State agency steering committees, policy groups, and technical advisory groups will be established to strengthen and improve alignment and collaboration with the State and GSAs, and to provide guidance and support to GSAs and other stakeholders. DWR will also provide funding to help local agencies develop tools and models, prepare water budgets, and provide technical assistance in preparing GSPs. Finally, DWR will provide facilitation and engagement assistance and assist in the development of effective communication pathways between GSAs and stakeholders, including, but not limited to, the development of educational materials for stakeholders.

5. *Provide Inter-Regional Assistance*

In an effort to provide assistance to local agencies in implementing groundwater conjunctive use and helping curb groundwater overdraft, DWR could develop storage projects, conveyance, inter-regional and system-wide infrastructure improvements for basin supply reliability. DWR will provide system-wide water supply availability information, including State Water Project and Central Valley Project water

supply reliability and delivery information. DWR will also advance studies, modeling, tools, and integrated water management actions that support the understanding and ability to manage water as a single resource. Finally, DWR has published a draft report providing a statewide estimate of water available for groundwater replenishment.

2.2.3 State Water Resources Control Board

The State Water Resources Control Board's role in SGMA is as an enforcing agency. The SWRCB may intervene and create an interim plan if a GSA is not formed or it fails to develop or implement a GSP by the prescribed deadline. It may also assess fees for purposes of supporting interim plan intervention.

Per SGMA legislation, the SWRCB can only step in when local efforts do not succeed. The timing and role of intervention depends on how far the local agencies are from compliance. There are numerous off-ramps for locals to avoid management by the State. The following are triggers by which the Board is allowed to intervene

Table 1: SWRCB Intervention Triggers

After	Intervention Trigger
June 30, 2017	No Groundwater Sustainability Agency formed.
Jan 31, 2020	In basins in critical overdraft: 1) No sustainability plan has been adopted, or 2) DWR, in consultation with the SWRCB, finds that the sustainability plan or its implementation is inadequate.
Jan 31, 2025	DWR, in consultation with the SWRCB, finds that the sustainability plan is inadequate or the plan is not being implemented in a manner that is likely to achieve the sustainability goal, and the SWRCB finds there are significant depletions of interconnected surface waters.

SWRCB can step in as the State backstop and serve as the data manager and basin manager. Under this situation, the Board has indicated that they will assess fees to support basin management, designate probationary basins, develop interim sustainability plans for these basins, and manage according to these plans until local efforts come up to speed. The SWRCB has also indicated that they will require meters on every well, regular reporting of groundwater extractions, and that management actions will focus predominantly on limiting groundwater withdrawals (rather than creating recharge projects).

In general, SWRCB intervention falls under three categories: data, fees, interim plans.

Data: The same data required by a GSA will be collected and managed by the SWRCB. A higher frequency of reporting may be required.

Fees: The State will establish fees associated with reporting and recover costs for all intervention-related activities, including, but not limited to, monitoring plans, well construction, facilitation, technical studies, and models.

Interim Plans: The State will likely utilize pumping restrictions as the primary means for address overdraft and/or over use conditions. State-developed physical solutions are unlikely.

2.2.4 Other Parties Involved

The federal government and tribal interests participate at their own discretion with communication efforts with DWR and local agencies. They may participate as part of a GSA and/or in the development and implementation of a GSP. Other stakeholders (such as individual pumpers) can also provide input to regulations development, GSA formation, and GSP development and implementation. They may also provide comments during review periods pursuant to SGMA.

2.3 TIMELINE

The SGMA timeline has three primary deadlines: By June 30, 2017, local agencies in medium or high priority basins are required to form GSAs. GSAs in critically overdrafted basins have until January 31 2020 to adopt their Groundwater Sustainability Plans (GSPs) and 20 years after that to achieve basin sustainability. GSAs in non-critical medium and high priority basins have until January 31, 2022 to adopt their GSPs, and also have 20 years after that to achieve basin sustainability. Following adoption of GSPs, GSAs are required to submit annual reports and 5-year interim plan updates to DWR.

2.3.1 Timeline for Locals/GSAs

The following dates are key milestones for GSAs:

- **June 30, 2017:** All medium and high priority basins are required to establish GSAs or equivalent entities. The SWRCB may hold a meeting to designate basin as "probationary" if a GSA or approved alternative is not established.
- **July 1, 2017:** Counties must affirm or disaffirm responsibility as a GSA if no GSA has been established. The SWRCB adopts a schedule for "state back-stop"-related costs.
- **December 15, 2017:** The SWRCB begins collecting annual reports from persons extracting more than 2 acre-feet per year (AFY) of groundwater from areas not managed by a GSA.
- **January 31, 2020:** High and medium priority basins identified as critically overdrafted must be managed under a GSP. On April 1st following GSP adoption and annually thereafter, GSAs must provide reports on progress towards sustainability to DWR.

2.3.2 Timeline for DWR and SWRCB

The following dates are key milestones for DWR and the SWRCB:

- **December 2016:** DWR published an interim update to Bulletin 118 (*California Groundwater*), documenting basin boundary modifications, basin prioritization, and critical overdraft. Additionally, DWR published best management practices for the sustainable management of groundwater.
- **January 2017:** DWR published a draft report on water available for groundwater replenishment.
- **June 30, 2017:** SWRCB may hold hearing to designate a basin as "probationary" if a GSA or alternative is not established.
- **July 1, 2017:** SWRCB adopts a fee schedule for State back-stop-related costs.

- **December 15, 2017:** SWRCB begins collecting annual reports from persons extracting more than 2 AFY from areas outside GSA jurisdiction.
- **January 1, 2018:** SWRCB begins development of interim plans if local agency has not remedied deficiency resulting in "probationary basin" status. Probationary basins may petition for un-designation. DWR to consult.
- **January 31, 2020:** Board may hold hearings to designate critically-overdrafted basins as "probationary" if DWR determines their GSP is inadequate or will not achieve sustainability.
- **January 2021:** SWRCB begins development of interim plans for critically-overdrafted basins designated as "probationary".
- **January 31, 2022:** SWRCB may hold hearing to designate high and medium priority basins as "probationary" if DWR determines that the GSP is inadequate or will not achieve sustainability
- **January 31, 2025:** SWRCB may designate a groundwater basin as "probationary" if DWR determines the GSP is inadequate or not being implemented properly and SWRCB determines the basin is in a condition where groundwater extractions result in significant depletion of interconnected water surfaces.

2.4 GROUNDWATER SUSTAINABILITY AGENCIES (GSAS)

DWR released their GSA formation notification guidelines for local agencies in January 2016. The definitions for GSA and local agency as defined in California Water Code Section 10721 are as follows:

> "Groundwater sustainability agency" means one or more local agencies that implement the provisions of this part [Part 2.74]. For purposes of imposing fees pursuant to Chapter 8 (commencing with [Water Code] Section 10730) or taking action to enforce a groundwater sustainability plan, "groundwater sustainability agency" also means each local agency comprising the groundwater sustainability agency if the plan authorizes separate agency action.
>
> "Local agency" means a local public agency that has water supply, water management, or land use responsibilities within a groundwater basin.

GSAs must be formed by June 30, 2017. Any local agency or combination of local agencies overlying a groundwater basin may form a GSA by joint powers agreement, memorandum of agreement or understanding, or other legal agreement. Key requirements to GSA formation are:

- A public hearing held in the county or counties underlying the basin prior to GSA formation.
- The proposing GSA must file a notification with DWR and include specific required back-up information.
- Other coordination and notification requirements as required by the legislation and/or implementing regulations.

For basins where no agency forms a GSA, the County may assume the GSA role. In general, there are three types of GSAs with GSPs that can be formed.

1. **A single GSP covering the entire basin developed and implemented by one GSA -** One GSA assumes responsibilities and authorities for the entire basin. This could be a new or existing agency. The GSA would need to coordinate with local land use and water use agencies in the basin.
2. **A single GSP covering the entire basin developed and implemented by multiple GSAs -** Several GSAs covering the same basin allows existing agencies to retain authorities within its service area and assume new groundwater-related authorities. This requires significant coordination between GSAs in development and implementation of the GSP.

3. **Multiple GSPs implemented by multiple GSAs and coordinated pursuant to a single coordination agreement that covers the entire basin -** This agreement provides flexibility in terms of responsibilities and authorities; however, it does require a single coordination agreement among all GSAs for the entire basin.

Under SGMA, GSAs are provided the broad ability to manage groundwater within a basin through a variety of authorized powers including, but not limited to, new regulations, ordinances, investigations, metering, monitoring, levying of fees, and enforcement actions. The SGMA does not afford GSAs or any other entity the ability to determine or alter surface water or groundwater rights under common law or any provision of law that determines or grants surface water rights. However, how those rights are applied will likely be impacted. Additionally, Native American Tribes and federal agencies have the opportunity to participate in basin management, but are not mandated to do so.

2.5 GROUNDWATER SUSTAINABILITY PLANS (GSPs)

The groundwater sustainability plans will serve as the primary resource by which the GSAs will operate. GSPs are required to include measurable goals and objectives and implementation actions to achieve and maintain basin sustainability. A GSP can be a single plan covering the entire basin prepared by one or more GSAs, or multiple plans prepared by multiple GSAs coordinated pursuant to an agreement that covers the entire basin. If multiple plans are prepared for the same basins, GSAs must coordinate to ensure the same assumptions are made in GSP development.

DWR adopted GSP Emergency Regulations in August 2016 and published a guide to the regulations in July 2016 outlining the requirements for each step of the GSP development and implementation process. Specific requirements for the plan are in the approved GSP regulations.

To assist in the preparation of the GSP, DWR has prepared and released two relevant documents for use by GSAs: *Preparation Checklist for GSP Submittal* and *GSP Annotated Outline*. Following formation of GSAs, local agencies are expected to coordinate to prepare and submit a GSP by the 2020s deadline. GSAs are also expected to coordinate with adjacent basins if a hydraulic connection exists between the basins to ensure that the same data and common assumptions are used in GSP development. Details of the GSP requirements are discussed in Section 3.1 of this document; however, the fundamental components of a GSP are the Basin Setting/Conceptual Model, Management Area Definition (if such areas are to be used), Sustainable Management Criteria, Monitoring Programs, and Projects and Management Actions for achieving sustainability.

2.5.1 Basin Setting

The primary purpose of the basin setting section of the GSP is to establish what the conditions of the basin were as of January 2015. This section of the GSP includes a description of the physical characteristics of the basin as well as the dynamic components affecting the water budget. The two primary components are the hydrogeologic conceptual model and the water budget. The hydrologic conceptual model describes the static condition of the basin through mapping of geology, as well as identification of aquifers and aquitards, and cross sections, and maps. The dynamic component is described through a combination of the historical and present conditions, and the water budget, which accounts for the total groundwater and surface water flows into and out of the system. Baseline conditions relating to supply, demand, hydrology, and water reliability are established to better understand future project conditions.

2.5.2 Management Area

Management areas are sub-regions within the basin that differ from the basin at large due to local conditions. Defining separate management areas allows for more specific management requirements and criteria. It also allows for the establishment of measurable objectives, minimum thresholds, and undesirable results in problematic or low groundwater demand areas to better manage the basin.

2.5.3 Sustainable Management Criteria

The goal of SGMA is to have no undesirable results in the basin within 20 years of GSP implementation. Undesirable results are defined as the following effects caused by groundwater conditions occurring in the basin:

- Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply
- Significant and unreasonable reduction of groundwater storage
- Significant and unreasonable seawater intrusion
- Significant and unreasonable degraded water quality
- Significant and unreasonable land subsidence
- Surface water depletions that have significant and unreasonable adverse impacts on beneficial uses of the surface water

GSPs are required to identify one or more measurable objectives for each undesirable result and establish interim milestones for each 5-year interval to establish or maintain groundwater conditions to avoid undesirable results. Progress is reported to DWR to ensure the basin is on track to meet the sustainability goals.

2.5.4 Monitoring Network

The GSP is required to include a detailed description of the basin-specific monitoring network and program established for GSP implementation. Existing monitoring networks, such as that utilized for CASGEM compliance, may be used as a foundation to trach each parameter. The monitoring density and frequency may need to be adjusted as time goes on in order to more accurately capture the cause or source of undesirable results.

2.5.5 Projects and Management Actions

In order to achieve sustainability, GSPs are required to explicitly describe the necessary projects and management actions that will be implemented. The projects and management actions should outline required permitting, implementation schedule, expected benefits, required legal authority, and estimated costs for implementation. Each GSP must also include contingency projects or management actions that will be implemented should groundwater conditions not adequately respond to implementation of the GSP.

2.6 BEST MANAGEMENT PRACTICES

On December 27, 2016, DWR published the first five Best Management Practices (BMPs) guidance documents, a series of documents providing regulatory clarification, technical guidance, and general examples to assist GSAs and inform local agencies and stakeholders. BMPs rely on technical information from other groundwater management efforts, existing standards, or other guidance or reference reports. The recent BMPs cover five topics:

- Monitoring Protocols, Standards, and Sites
- Monitoring Networks and Identification of Data Gaps
- Hydrogeologic Conceptual Model
- Water Budget
- Modeling

Each BMP follows the same general approach, first outlining the use and limitations of the BMP, then describing the fundamental concepts of the topic at hand, discussing the relationship with other BMPs, and finally describing available technical assistance to support the development.

2.7 GSP IMPLEMENTATION

The goal of SGMA is to achieve sustainability within 20 years of GSP adoption. To ensure the GSP is properly implemented, each year, GSAs must submit an annual report to DWR. The GSP must be periodically evaluated to determine whether modifications need to be made to the plan due to changing conditions of the basin or to adaptively manage the basin and ensure the sustainability goal is met. The annual reports are to include groundwater elevation, groundwater extraction, surface water supply used for available for groundwater recharge or in-lieu recharge, total water use, or change in groundwater storage.

Management actions, projects and/or programs may be identified in the GSP and implemented to help address groundwater contamination, promote recharge, diversions to storage, water conservation, water recycling and conveyance, and manage groundwater extraction. Projects would be implemented in order to achieve a basin's sustainability goal and to help address identified basin issues such as groundwater overdraft or poor water quality. One example of a management action could be a voluntary fallowing program to reduce groundwater extractions. To effectively manage groundwater extraction, a GSA can require registration of a groundwater extraction facility, require installation of a water-measuring device, require facilities to report annual groundwater extraction, or regulate, limit, or suspend extractions. GSAs do not, however, have the authority to issue permits for construction, modification, or abandonment of wells.

Groundwater elevation monitoring will primarily be handled by DWR through the CASGEM program. DWR will identify the extent to which groundwater elevation monitoring will be conducted, and will prioritize monitoring programs based on population, number of public supply wells, and other relevant information. If a basin is deemed to have an insufficient monitoring program, a groundwater management plan or integrated regional water management plan with a groundwater management component may be required or a voluntary groundwater monitoring association may need to be established.

GSAs are required to commit to groundwater management, monitoring, reporting, and planning for decades. Annual reports submitted to DWR will require ongoing coordination among GSAs, water agencies, public agencies, and private well owners. DWR is responsible for reviewing GSPs every five years and issuing assessments for each basin evaluating progress in achieving the basin's sustainability goals. DWR assessments could include recommendations for corrective actions to address identified deficiencies.

3. PLANNING AND RESOURCES

Official GSP regulations were published in May 2016. To help GSAs more efficiently interpret the regulations and develop GSPs, DWR also published guidance documents, including a checklist for GSP submittal and a sample annotated GSP outline.

3.1 GSP REQUIREMENTS

The 2016 GSP regulations contained a myriad of items that must be addressed in the GSP. The following section summarizes those requirements.

3.1.1 Technical and Reporting Standards

The technical and reporting standards for GSPs primarily encompass the monitoring protocols. Specifically, the GSP must describe monitoring protocols for data collection and management, as well as monitoring protocols designed to detect changes in groundwater levels, quality, subsidence, and surface water quality.

3.1.2 Administrative Information

The administrative information sections of the GSP establish the foundation for the rest of the plan, describing the organization structure of the GSA and what legal authority it has. This includes information regarding the GSA (e.g., contact information) and maps showing the coverage area, adjudicated areas, jurisdictional boundaries of state and federal land, land use designations, and density of wells. The plan area is described though a summary of jurisdictional areas and other features. Existing water resources monitoring and management programs are also discussed in this section. The GSP is to describe how these will be incorporated into the GSP and what limits they will place on operational flexibility.

3.1.3 Land Use

The land use section summarizes relevant General Plans and other applicable land use plans in the GSP's jurisdiction and highlights potential impacts to these existing plans. Implementation of the GSP could impact projections and/or goals outlined in these plans, such as water supply and demand or ability to achieve sustainability; this section describes how the GSP will address those impacts. The land use section also includes information regarding land use plans outside of the jurisdictional area of the GSP that have potential to impact the ability of the Agency to achieve sustainable groundwater management. The process for permitting new or replacement wells in the basin is also discussed in this section.

3.1.4 Basin Setting

The basin setting section of the GSP is designed to provide an overview on the current, historical, and projected conditions of the basin. This section is divided into four main topics which include a discussion of the hydrogeologic conceptual model, current and historical groundwater conditions, information on the water budget, and identification of Management Areas within the basin.

The hydrogeologic conceptual model is summarized in the basin setting section and includes two scaled cross-sections (at minimum), and maps of the area's physical characteristics, including topographic information, surficial geology, soil characteristics, surface water bodies, and the source and point of delivery for imported water supplies. This section also includes a map of existing and potential recharge areas (areas that substantially contribute to the replenishment of the basin) and discharge areas. The

map is to include a description of how the recharge areas identified will contribute substantially to the replenishment of the basin.

Current and historical groundwater conditions are described in this section and include data such as groundwater elevation data, groundwater storage estimates, seawater intrusion conditions, groundwater quality issues, and land subsidence conditions. Baseline conditions are also described in this section and refer to historic information used to project future basin conditions; specifically, SGMA requires that data from January 1, 2015 to the present are used described basin conditions. This section also identifies interconnected surface water systems and groundwater dependent ecosystems (GDEs).

Information on the basin's water budget is described in this section as well. This includes a description of inflows into and outflows from the basin and change in storage, a quantification of overdraft (if appropriate), an estimate of sustainable yield, and quantification of current, historical, and projected water budgets. Surface water supplies used for groundwater recharge or in-lieu use are also described.

Finally, the basin setting section describes Management Areas within the basin (if they are to be used) and explains the purpose of each. Each Management Area is assigned their own minimum thresholds and measureable objectives. A detailed description of the level of monitoring and analysis done within each Management Area is provided, along with an explanation of how the management of the Management Area will not lead to undesirable results outside of the Management Area.

3.1.5 Sustainable Management Criteria

The sustainable management criteria section of the GSP describes the metrics used to track the sustainability goal and monitor for undesirable results through the use of minimum thresholds and measurable objectives. This section provides a summary of the sustainability goal for the basin and a description on how it was formed using data from the basin setting. The section should also explain how the sustainability goal is likely to be achieved within 20 years of the GSP implementation and throughout the planning and implementation period.

In order to monitor progress towards achieving the sustainability goal, the GSP identifies undesirable results for any of the sustainability indicators and any groundwater conditions that would cause undesirable results. This section describes potential effects of undesirable results on the beneficial uses and users of groundwater, land uses and property interests, and other areas. The criteria used to define undesirable results are based on minimum thresholds established for each sustainability indicator. The purpose of each minimum threshold is described along with how it was established, how it relates to each sustainability indicator, and how each threshold may affect beneficial uses and users of groundwater. Each minimum threshold will be quantitatively measured for each relevant sustainability indicator and the method for quantifying each threshold is described here.

In addition to minimum thresholds, measurable objectives are used to monitor each sustainability indicator. measurable objectives are described in detail in this section along with an explanation of how the objectives were established for each relevant sustainability indicator and how a reasonable margin of safety was established for each objective. To measure progress towards achieving and maintaining the sustainability goal, interim milestones for each relevant sustainability indicator are described using the measurable objectives. Therefore, a reasonable path to achieve interim and final milestones at 5, 10, 15, and 20 years using the measurable objectives for each sustainability indicator is described in this section.

3.1.6 Monitoring Networks

The monitoring network section of the GSP describes how the GSA is capable of collecting sufficient data to demonstrate short-term, seasonal, long-term trends in groundwater and related surface conditions, and will yield representative information about groundwater conditions as necessary to evaluate GSP implementation. A map of the location and type of each monitoring network is provided along with a description of how the network will be developed and the methods used to monitor groundwater data. Sites identified on the map correspond to a sustainability indicator, minimum threshold, measureable objective, and interim milestone.

The GSP also describes the monitoring protocols for data collection and monitoring by outlining the technical standards, data collection methods, and protocols required to ensure standard data and methodologies. Important factors to consider when establishing the monitoring network include density of monitoring sites, frequency of measurements required to demonstrate the short-term, seasonal, and long term trends, methods consistent with data and reporting standards, and adequate coverage of sustainability indicators. Scientific rational for site selection and description of how each site meets criteria listed above must be provided. The monitoring network is intended to identify impacts to beneficial uses or users of groundwater, monitor changes in groundwater conditions and quantify annual changes in water budget components. A review and evaluation of the monitoring network is required to ensure adequate coverage is achieved and to improve the network by identifying and describing data gaps and taking efforts to fill these data gaps. Through monitoring, the GSP demonstrates progress towards achieving measurable objectives, such as:

- Chronic lowering of groundwater levels: demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features
- Reduction of groundwater storage: estimate the annual groundwater in storage
- Seawater intrusion monitor seawater intrusion
- Degrade water quality: determine groundwater quality trends
- Land subsidence: identify the rate and extent of land subsidence
- Depletion of Interconnected Surface Water: calculate depletions of surface water caused by groundwater extractions

SGMA regulations also allow for the use of representative monitoring. Representative monitoring is defined as the use of a monitoring site with a broader network of sites that typifies one or more conditions within the basin or an area of the basin. If representative monitoring is to be used, the GSP must describe the representative sites and provide adequate evidence that the site(s) reflects general conditions in the area and is a reliable proxy for groundwater elevation and other sustainability indicators.

At present, the Delta-Mendota Groundwater Subbasin is monitored for groundwater elevations under the CASGEM program. The SLDMWA Groundwater Monitoring Program as it currently exists already meets the majority of the SGMA monitoring network requirements. The existing monitoring program consists of an assortment of wells, both CASGEM approved and voluntary. The basin's CASGEM network includes 25 CASGEM wells and 50 Warren Act approved wells that are monitored quarterly, in addition to five USGS multi-well groundwater monitoring wells from which water level data are collected monthly. The CASGEM network also includes 23 agricultural production wells also used to record water level data monthly and four agricultural production wells from Grassland Water District from which data are recorded quarterly. Semi-annual water level data are also collected from a number of private/public

agricultural production wells. Public groundwater level data received from cities and counties in the basin are incorporated into the database when received.

It is recognized that the basin's CASGEM monitoring network as it presently exists has data gaps that will directly relate to less reliable models and understanding of groundwater conditions. To date, 10 data gaps have been identified and potential workarounds and remedies are proposed. Most alternatives involve obtaining data from private wells or others that are not presently part of the monitoring network (well construction data, groundwater conditions) or installing new wells and extensometers to obtain additional data. The SGMA requires that GSAs describe steps to fill data gaps before the next five-year assessment; the current CASGEM monitoring plan already notes this and the key will be to implement the proposed solutions in a timely manner.

With the exception of known areas of data gaps, the basin's existing network meets the criteria necessary for monitoring of chronic lowering of water levels and changes in groundwater storage. In regards to subsidence, there are two extensometers currently used to monitor subsidence; additional extensometers are being considered in areas with known data gaps to create more comprehensive coverage of the basin. Seawater intrusion is not of concern in the basin and therefore monitoring for this undesirable result is not required. The existing monitoring network does not adequately account for water quality data and surface water-groundwater interconnection, so additional work will be required to address these potential undesirable results. To comply with the SGMA regulations, the GSP monitoring plan will need to incorporate surface water monitoring from existing sources, such as USGS, or develop its own monitoring system.

Monitoring data will be used in model development for calibration as well as to demonstrate progress towards basin sustainability. If boring logs are developed during well construction, this can be used to designate aquifer parameters. Pumping records can be incorporated directly into groundwater models as input data. New extensometers to track subsidence will also help calibration of the groundwater model. In general, the wells in the monitoring network would serve primarily as additional calibration targets. Updating the monitoring network to fill data gaps could improve model calibration; however, better input data is more important than calibration targets.

3.1.7 Projects and Management Actions

The project and management action section of the GSP is to describe the actions that will help achieve the sustainability goal. For each project and management action, the expected benefit is to be described along with how each benefit will be evaluated and accomplished. In addition, each action is outlined in terms of circumstances for implementation, public noticing, overdraft, permitting and regulatory process, legal authority required, cost estimate, management of groundwater extraction and recharge, a time-table for initiation and completion, and the accrual of expected benefits. If a project or management action relies on water outside of the jurisdiction of the GSA, an explanation of the source and reliability of that water must be included.

3.1.8 Plan Implementation

To successfully implement the GSP, GSAs must include a plan of action and a description of the efforts required to successfully report and evaluate the GSP. This includes an estimate of costs to implement the GSP, a schedule for implementation, and a process for periodic evaluations and annual reporting.

3.1.9 Intrabasin and Interagency Agreements

The GSPs for medium and high priority basins are intended to guide groundwater management in the basins in order to meet the sustainability goal established by the GSA. Multiple GSPs can be developed for the same basin, but they must meet specific coordination, data, and monitoring requirements for overall basin compliance. Each GSP has a number of required elements that will require coordination, including physical description, measureable objectives, planning and implementation horizon, various monitoring protocols, consideration of applicable county and city general plans, and other groundwater quality and quantity criteria. SGMA also requires annual reporting and evaluation of the effectiveness of GSP implementation, which must be done on a basin-wide basis and will therefore require interagency coordination if more than one GSP is within a groundwater basin.

3.2 OPTIONAL GSP COMPONENTS

Additional optional GSP contents include the description of actions related to: control of saline water intrusion, wellhead protection, migration of contaminated groundwater, well abandonment and destruction program, replenishment of groundwater extractions, conjunctive use and underground storage, well construction policies, policies addressing groundwater contamination cleanup, recharge, diversions to storage, conservation, water recycling, conveyance, and extraction projects, and impacts on groundwater dependent ecosystems. Inclusions of these elements in the GSP is recommended if they are enacted to help achieve basin sustainability. GSAs may also include descriptions of state and federal regulatory agencies (including their impacts relative to basin sustainability), efficient water management practices and/or review of land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity.

4. DATA

4.1 DATA USE IN SGMA

Data is paramount to establishing an acceptable water budget and sustainable goal that all parties in the Delta-Mendota Subbasin can agree upon. It is also necessary to have reliable data to support and justify the Delta-Mendota Subbasin's sustainability goals to adjacent subbasins and DWR. Data will be used for the following aspects of GSP preparation:

- Developing a hydrogeologic conceptual model
- Developing and updating a water budget
- Preparing a numerical groundwater flow model
- Defining sustainability and setting a sustainability goal
- Determining measurable objectives and minimum thresholds for sustainability indicators
- Tracking sustainability indicators for undesirable results
- Preparing annual reports for submittal to the State
- Verifying assumptions while preparing 5-year Interim Updates, and
- Managing groundwater in the subbasin

4.2 DATA REQUIRED

To develop an accurate water budget and appropriate basin operating criteria, sufficient data must be collected to understand the inflow and outflows of the basin. A schematic diagram of a water budget is shown in Figure 1. Furthermore, if groundwater is to be managed at a GSA level, enough data must exist to track water movement within the basin and from one GSA to another. SGMA also requires the collection of data to monitor water quality and subsidence issues as a result of groundwater pumping. Per their communications, DWR will be providing data for the analysis of the following:

- Subsidence
- Interconnected streams
- Groundwater dependent ecosystems

A list of parameters that are required to develop a compliant GSP is presented in Table 2. A majority of this data exists and can be obtained from publicly available sources. However, to develop an accurate representation of the Delta-Mendota Subbasin, local data will be required to supplement and improve the regional sources.

It is recommended that data be collected covering a period that represent average hydrologic conditions, which will likely cover a period of 10-20 years. A hydrologically average period should be sufficiently long to establish average water conditions, include wet and dry periods, generally be in close proximity to the present, and reflect current land and water management practices. SGMA legislation requires:

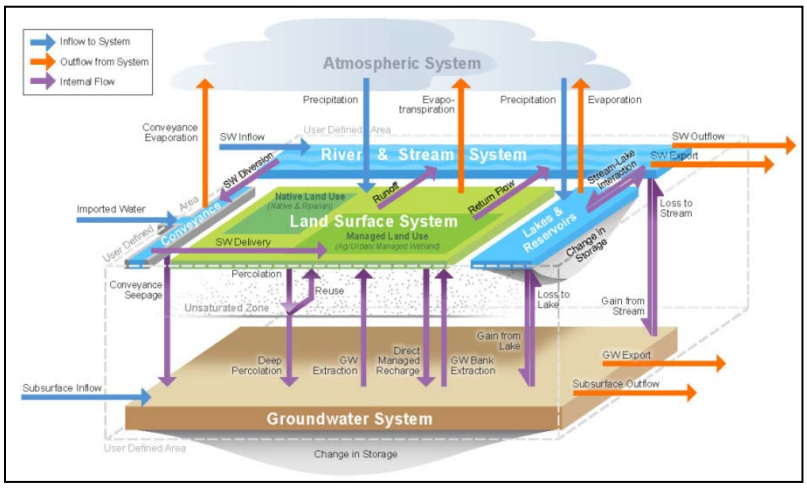
- Ten most recent years of water supply information
- 50 years of precipitation, evapotranspiration, and streamflow information
- 50-year planning horizon

A monthly time step is standard for regional groundwater models and is highly recommended by DWR. Annual data may be appropriate for some parameters if limited data exists.

Table 2: Required Data

HYDROGEOLOGIC CONCEPTUAL MODEL	GROUNDWATER RECHARGE
Management Area Boundaries	Groundwater inflow parameters (gradient and transmissivity)
Hydrostratigraphy	Deep percolation of crop irrigation
Geology	Deep percolation of precipitation
Well Construction Characteristics	Deep percolation of M&I water use
Depth of usable water	Channel and pipeline leakage
Configuration of surface water features	Reservoir and lake seepage
Water resources facilities	Urban stormwater recharge
	Local stream/river seepage
WATER SUPPLIES	Intentional groundwater recharge
Surface Water (Irrigation)	
Surface Water (M&I)	**WATER QUALITY**
Agency groundwater pumping (Irrigation)	Surface water quality
Private groundwater pumping (Irrigation)	Groundwater quality
Agency Groundwater Pumping (M&I)	
Private Groundwater Pumping (M&I)	**OTHER PARAMETERS**
Precipitation	Groundwater storage change parameters (groundwater levels and specific yield)
	Soils
CROPPING AND CROP WATER USE	Soil infiltration rates
Cropping Data/Maps	Subsidence
Irrigation Methods	Population / Anticipated growth
Irrigation Efficiencies	Groundwater levels
Crop Evapotranspiration	Groundwater-surface water interactions
Effective Precipitation	Geology
M&I Landscape Evapotranspiration	Well locations
	Temperature
NON-RECOVERABLE LOSSES	Land use
Groundwater outflow parameters (gradient and transmissivity)	
Channel evaporation	
Reservoir/recharge basin evaporation	
Precipitation evaporation and runoff	
Operational spills	
Water exports	

Figure 1: Components of a Water Budget



4.3 EXISTING DATA AND DATA GAPS

A literature review was performed to develop a list of known reports, investigations, and plans specific to the Delta-Mendota Subbasin (see Appendix A). Below is a brief assessment of the level of understanding for various parameters:

- **Groundwater Levels -** CASGEM has begun to develop a representative network of wells for reliable groundwater management. Additionally, many groundwater studies exist that covers a period many years. Some data gaps have been preliminarily identified across the basin. An increased density of wells beyond the CASGEM-required 1 monitoring site per 10 square miles 'rule' would refine results.
- **Aquifer Characteristics –** Existing groundwater models (CVHM and C2VSim) and groundwater studies have begun to develop an understanding of aquifer characteristics. Aquifer tests and other similar exploration protocols should be sought to supplement this understanding.
- **Surface Water Supply** – Agricultural Water Management plans, CIMIS stations, and deliveries from the Delta-Mendota Canal provide a good representation of surface water entering the basin. Few stream gages exist on the westerly tributaries to account for inflow. Many Districts keep records of applied water as required by the U.S. Bureau of Reclamation (USBR). Information on intentional recharge efforts and water transfers will need to be obtained from Districts.
- **Water Quality** – A fair amount of data exists due to GAMA reporting, and the ILRP reports. Additionally, data should be easily obtained from the SWRCB, Division of Drinking Water (DDW) for public supply wells. Drainage studies will also be useful. Few local sources of water quality data were found.
- **Subsidence –** Studies have been performed along the Delta-Mendota Canal and along the San Joaquin River by the USGS. Data exists from surveys, extensometers, and satellite. DWR suggests they will provide data to monitor subsidence as well.

- **Groundwater Extractions –** Groundwater management plans, agricultural water management plans, urban water management plans are useful here. It is unclear what kinds of records are available from districts or private growers. Also, records of industrial water use and discharge are lacking at this point.
- **Land use –** it is understood that USBR contractors are required to submit land use data to USBR as Crop Usage Data Reports. Some Districts correlate this data to assessor parcel numbers (APNs). General Plans and Agricultural Commissioner data will be useful here too. The existing CVHM model notes land use and understanding of double cropping as areas for further development.

Figures 2 and 3 depict the study areas and areas where data gaps may exist based on currently known information. It is acceptable at this point to have gaps in the data sets, but a goal will be to address these data gaps in the 5-year interim updates to the GSP.

Figure 2: CASGEM Wells shown over Water Districts

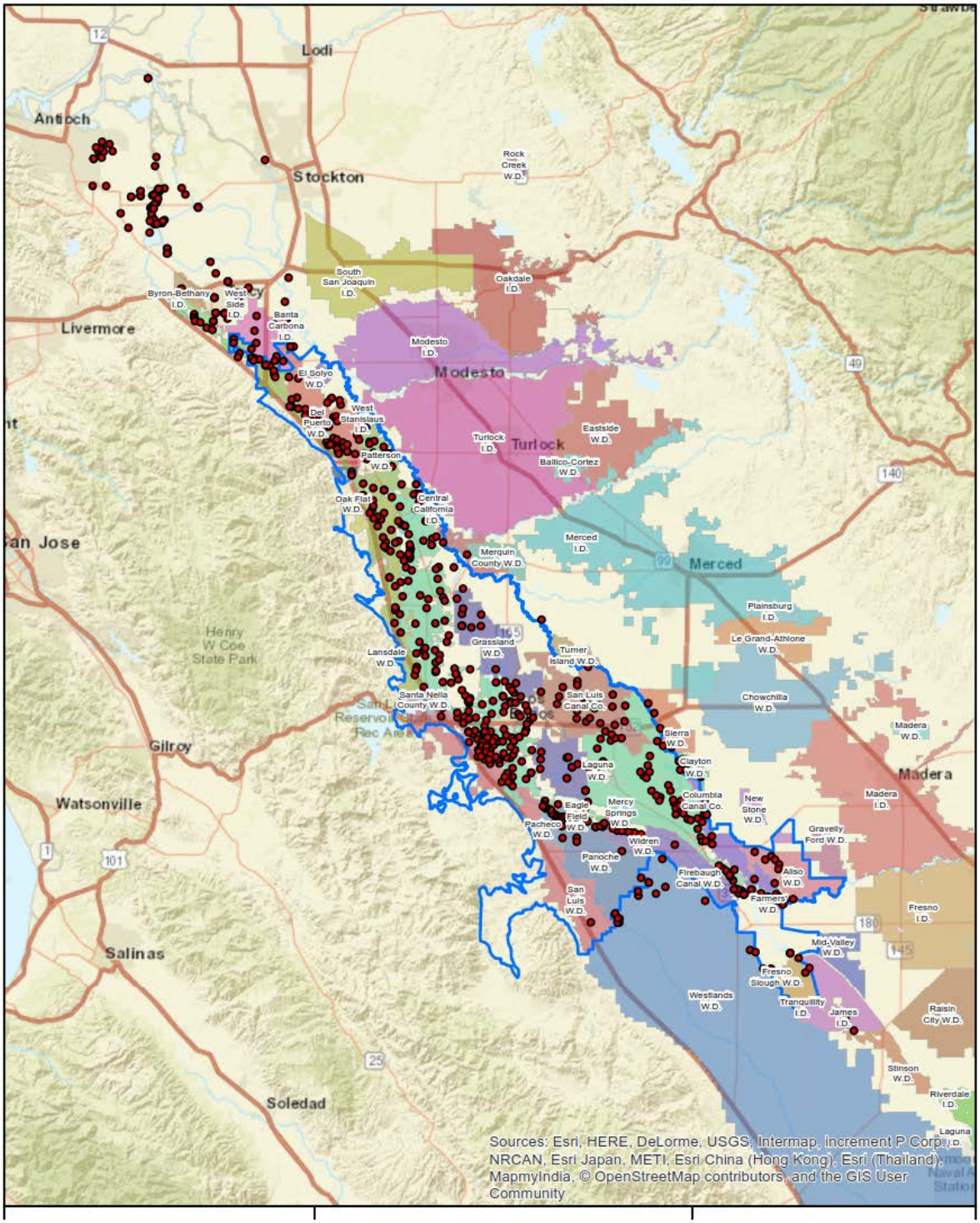


Figure 3: Other Basin Data Sets

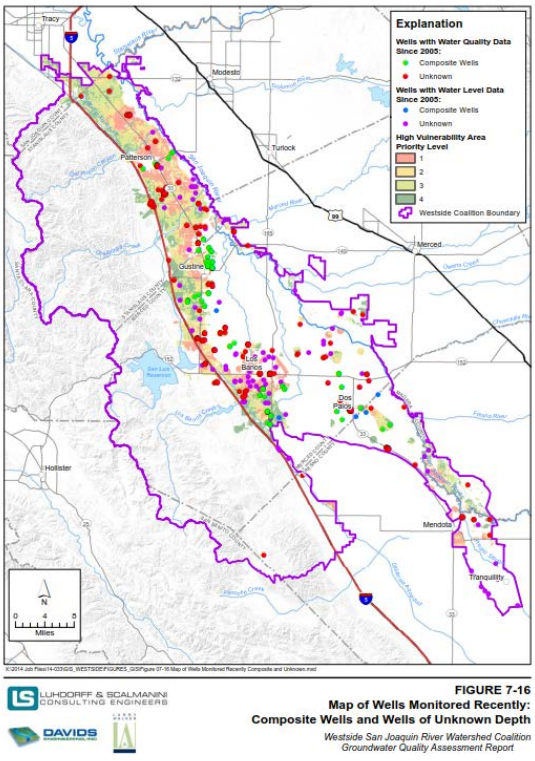


FIGURE 7-16
Map of Wells Monitored Recently: Composite Wells and Wells of Unknown Depth
Westside San Joaquin River Watershed Coalition Groundwater Quality Assessment Report

ILRP GAR

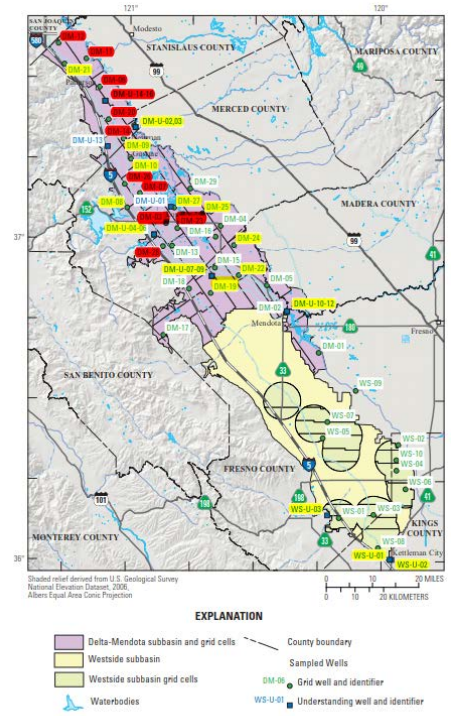


Figure 5. The Delta-Mendota (DM) subbasin and the Westside (WS) subbasin study areas, the distribution of the grid cells, and the location of sampled grid and understanding wells.

GAMA Report

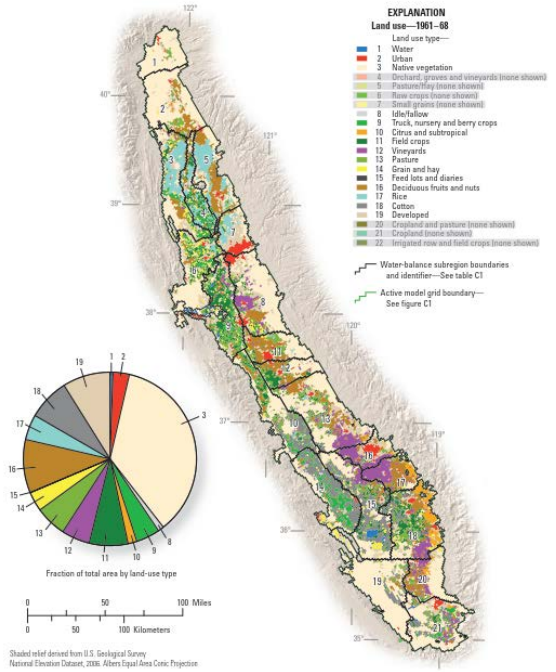


Figure C8. Virtual crops for 1960 (modified with 2000 data), including pie chart of percentage of different virtual crops (sources: California Department of Water Resources, 2000; California State University, Chico, 2003;). The water-balance subregions are described in *table A1*.

CVHM Study

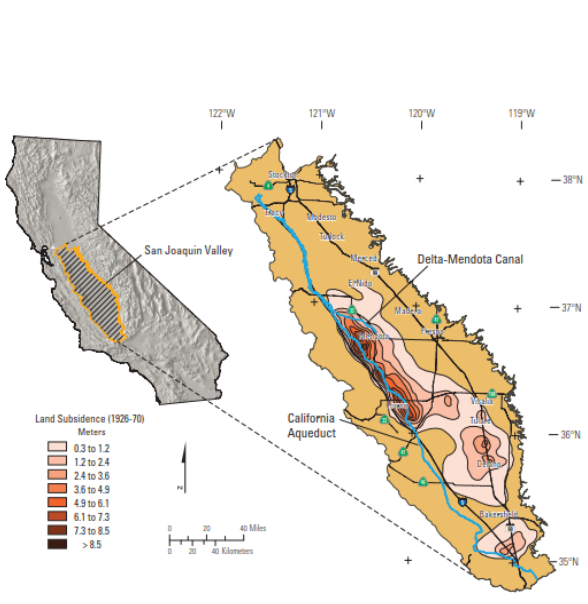


Figure 2. Land subsidence in the San Joaquin Valley, California, 1926–70 (modified from Ireland and others, 1984).

Subsidence Study

4.4 DATA REQUEST AND FORMATTING

To further develop an understanding of the Delta-Mendota Subbasin, data should be requested from local agencies, as well as obtained from publically available databases. This process will also hone in on where data gaps still exist. There are two problems foreseen with collecting these data from so many different agencies and sources. First, the data will not be in the same format. Some will be in digital spreadsheets, some will be in print, and some will be handwritten. This will require a large effort to get all of the data into one place and in one format for analysis. Second, the level of uncertainty associated with the data maybe high. Without basin wide monitoring protocols in place, the comparison of data will not be "apples to apples". With the implementation of SGMA, this will correct itself in time as monitoring protocols will be in effect.

The following data should be requested from the local agencies in the groundwater basin over a minimum period of the last 10 years:

- Well data – construction and location
- Groundwater extractions
- Groundwater levels
- Water quality
- Water deliveries to growers
- Land use / Crop maps
- Recharge project data
- Spills
- Transfers
- Drain water use
- Locations of facilities
- Aquifer characteristics
- Narrative of water supply and issues (Description of projects and actions taken to become sustainable, and how long they have been in effect for)
- Groundwater policies

These data will likely exist as:

- Groundwater studies
- Water management plans (including agricultural, groundwater and urban water management plans)
- Delivery accounting records
- Pump tests
- Studies investigating recharge and water supply
- Subsidence surveys

As a GSA, a local agency will have the ability and the discretion to require data from its constituency. Some authorities granted to a GSA include:

- Right to investigate facilities
- Register extraction facility
- Require meters at owners' expense
- Require individual to report groundwater extractions annually

It is important to note that while the GSA can collect all of these data, it may not be necessary as more data does not equal good data. The data sources need to be evaluated and pared down so that only quality data are being obtained. This will also reduce costs in the future regarding collection and management of data.

4.5 MONITORING AND REPORTING

The GSP regulations are quite prescriptive in their data collection requirements moving forward. The goal is to have compatibility between collection efforts. As such, the following units and resolutions must be used:

  - Surface Water – cubic feet per second (cfs)
  - Groundwater Flow – acre-feet/year (AFY)
  - Elevations – Feet, 0.1-foot accuracy, NAVD 88
  - Reference Point – 0.5-foot accuracy, NAVD 88
  - Locations – GPS coordinates Latitude/longitude in decimal degrees, 0.00001, 30-foot accuracy, NAD 83

Wells used to collect data must have the following in both tabular and GIS formats:

- Well Name
- CASGEM Well Number
- Well location
- Elevation of Ground Surface
- Elevation of Reference Point
- Description of Reference Point
- Description of Well Use
  - Ag, municipal, monitoring, domestic
  - Active, inactive
  - Single, nested/clustered
  - Casing perforations
  - Borehole depth
  - Total well depth
  - Well completion reports (names redacted)
  - Geophysical logs, well construction diagrams, other info
  - Aquifer monitored
  - Well capacity
  - Casing diameter

Monitoring protocols will need to be developed for basin-wide use. This will include protocols for when data are collected (spring and fall), acceptable devices, tolerances and calibrations, and forms or software to be filled out for streamlined entry to a data management system. These protocols will have to be shared with neighboring GSAs and subbasins to ensure that similar data are being collected by call. SLDMWA has a starting point with its CASGEM process, but this will need to be expanded for stream measurement, water quality, and subsidence. DWR has provided the framework for monitoring protocols in their BMPs.

Ultimately, data collected will need to be used in annual reports to DWR. Efforts made now for data collection should be cognizant of what is required in the annual report. This includes the deployment of standard forms, protocols, and data management systems. Annual reporting requirements are as follows:

- Groundwater elevation data (contour maps, hydrographs)
- Annual aggregated data identifying groundwater extractions for the preceding water year (estimated or measured), map with volumes by sector
- Surface water supply used for or available for use for groundwater recharge or in-lieu use
- Total water use (estimated or measured), in table by sector and source,
- Change in groundwater storage
    - Map
    - Graph showing- Water year, groundwater use, annual change in groundwater storage, cumulative change in groundwater storage

4.6 DATA ACQUISITION TIMELINE

Data acquisition from local agencies should begin immediately. It will take time for each agency to track down the data and provide it in a useable format; it will then take additional time to make these data comparable. After data are 'normalized', the data will need to be evaluated, removing poor data and sources from the pending investigation. Next, the data will be used to develop the hydrogeologic conceptual model and the water budget. Once both are complete, the groundwater model will be developed. Current estimates are that it will take approximately one year to establish a groundwater model that will determine sustainable yield throughout the basin. This modeling effort would begin in early 2018, so data must be received by then to be incorporated in the model. Additional time will be required to gather and submit the data and to review the data for consistency. If data are not received from an agency, the model may yield inaccurate results for their area.

4.7 COORDINATION WITH ADJACENT BASINS

The Delta-Mendota Subbasin shares a boundary with nine other groundwater subbasins (see Figure 4, below). This means that inflows and outflows from the boundaries must be agreed upon between subbasins. Given the shared boundary for a majority of these subbasins is the San Joaquin River, a coordinated effort will be necessary to understand the impacts of the river on groundwater conditions in the adjacent subbasins. Another consideration with adjacent subbasins is the compatibility of their model with the Delta-Mendota Subbasin.

Figure 4: Map of Surrounding Subbasins (Delta-Mendota Subbasin in light blue)

4.8 DATA MANAGEMENT OPTIONS

4.8.1 Introduction

Section 352.6 of the SGMA regulations requires each GSA to develop and maintain a data management system that is capable of storing and reporting information relevant to the development or implementation of a GSP and monitoring of the basin. The volume of data that will be generated for GSP preparation and updates, and to demonstrate progress towards basin sustainability will be large, and selection and use of a data management system (DMS) will be key in not only making those data accessible for analysis, but for communicating those data to basin stakeholders and the State.

4.8.1.1 What is a DMS?

A data management system (DMS) is a software application that manages data storage and retrieval in a secure and structured environment. Data management systems have many different features and functionalities based on the platform and purpose. According to DWR's *Best Management Practices for the Sustainable Management of Groundwater*, the "DMS should include clear identification of all monitoring sites and a description of the quality assurance and quality control checks performed on the data being entered." The DMS should also allow for upload and storage of all information related to the development and implementation of the GSP, including, but not limited to:

- Unique well and site information
- Groundwater elevations
- Surface water elevations

- Land surface elevations
- Water quality
- Precipitation
- Pumping

SGMA regulations do not specify any other functional requirements of the DMS; however, success of GSP development and implementation will depend on the DMS's ability to support GSP development and implementation activities and the basin's progress toward sustainability.

4.8.1.2 Data Management Success Criteria

The success of a DMS depends on its ability to support all activities needed to ensure basin sustainability, including monitoring, development and implementation of projects and management actions, modeling, water budget development, and outreach. A DMS for SGMA has the following success criteria:

1. **Seamless Coordination** - The DMS should facilitate seamless coordination and cooperation among participating agencies, stakeholders, and neighboring GSAs.
2. **Support for GSP development** – Project prioritization and selection tools of the DMS should support GSP development and identification of management actions.
3. **Centralized project information** – Centralized and integrated project tracking supports GSP implementation by tracking the status of project implementation, schedule, measurable objectives, and accrual of benefits.
4. **Transparency** – Web-based, integrated, transparent data management tools enables utilization of the same data and methodologies, enabling stakeholders and neighboring GSAs to use the same data and methods for tracking and analysis.
5. **Undesirable results tracking** – Integrated analysis tools allow GSAs to track undesirable results for different parameters and can also support identification of additional management actions.
6. **Threshold and impact evaluation** – Ability to define management areas within the basin provides a regional view to help GSAs evaluate local thresholds and impacts.
7. **Reliable total water budget** – The DMS should enable reliable estimates of total water budget with or without a model, where model results can be input and viewed in the DMS.
8. **Sustainability tracking** – Management dashboards support tracking of critical parameters and allow managers and the public to access published information.
9. **Data sharing** – Data sharing portals present information and map-based performance metrics from the DMS to share information with stakeholders.

4.8.2 Data Management Approach

A sound data management approach will include the following steps:

1. Assess current data management setting within the basin
    a. Local data management activities and databases
    b. State and federal databases
    c. Other databases

2. Identify DMS features that will help meet data management needs
3. Evaluate costs and timeline associated with different DMS options
4. Determine DMS platform
5. Develop implementation plan

Figure 5 provides a schematic demonstrating how these steps relate to DMS development; the following sections provide additional detail on these steps.

Figure 5: Data Management Approach

4.8.3 Current Data Management Setting

Many monitoring programs exist at both the local and state/federal levels and may have existing data management systems. A cross-sectional analysis should be conducted within the basin to document and assess the availability and usage of data management tools within the subbasin, as well as statewide or federal databases that provide data relevant to the subbasin and GSP development within the subbasin. The purpose of this analysis is to identify whether a local DMS could be used or expanded to meet the needs of the GSAs, as well as identify which state, federal, or other data management systems can be linked to view and analyze data from within the selected DMS.

4.8.3.1 Data Management in the Basin

An assessment should be completed to collect information on current and historical data management tools and processes used by stakeholders within the basin. This assessment should include information on the purpose and functionality of any data management systems, the data stored in the data management systems, the technology environment of the data management systems, and their applicability to meet the success criteria for supporting GSP development.

Generally, data management systems used by local agencies (not necessarily in this basin) include one or more of the following:

- Microsoft Excel documents
- File sharing applications or servers, including FTP and SharePoint
- Website or portals
- ArcGIS geodatabases
- Microsoft Access databases
- Off-the-shelf applications, including:
    - WISKI – a database that allows users to manage a monitoring network and various time series data, perform calculations and evaluations, run statistical analysis, generate reports, and manage users
    - HYDSTRA – a time-series data management system that provides users with the tools to build and maintain a time-series data archive
    - HydroDMS – a web-based tool that allows agencies to manage, visualize, analyze, and report on water resources data

    - RockWorks – a tool for subsurface data visualization, with maps, logs, cross sections, fence diagrams, solid models and volumetrics
    - WAMP (Water Accounting and Management Platform) – a cloud-based platform that supports water budgeting and accounting, reporting, data management, and billing and payments. This program was developed by Waterfind USA specifically for SGMA
- Custom developed applications, some using ESRI products to develop map-based interfaces

Many of these DMS platforms to not provide the ability to set user permission levels, provide for stakeholder outreach/communication, allow for multiple users or aid in data analysis. This assessment of available data management systems should identify whether or not an existing DMS will meet the success criteria, if an existing DMS may need to be modified, or if a customized DMS needs to be developed. Additionally, the assessment will identify the existing data management systems that could be linked to the GSA's DMS through an integration framework in order to view and analyze data from multiple sources in a single interface.

4.8.3.2 State and Federal Databases

The use of existing data established during implementation of statewide and local programs can provide a foundation for GSP development. Much of these data are managed and available in statewide databases and can be integrated into the local DMS. A description of selected state and federal databases is provided in Table 3.

Table 3: State and Federal Databases

Database Name	Description
CASGEM (California Statewide Groundwater Elevation Monitoring Program)	California Water Code (CWC) §10920 et seq. establishes a groundwater monitoring program designed to monitor and report groundwater elevations in all or part of a basin or subbasin. The CASGEM database can be accessed here: http://www.water.ca.gov/groundwater/casgem/online_system.cfm.
WDL (Water Data Library)	DWR maintains the State's WDL which stores data from various monitoring stations, including groundwater level wells, water quality stations, surface water stage and flow sites, rainfall/climate observers, and well logs. Information regarding the WDL can be found at: http://wdl.water.ca.gov/.
GAMA (Groundwater Ambient Monitoring and Assessment Program)	GAMA provides a comprehensive assessment of water quality in water wells throughout the State. GAMA has two main components, the California Aquifer Susceptibility (CAS) assessment and the Voluntary Domestic Well Assessment Project. Additional information on the GAMA program is available at: http://www.swrcb.ca.gov/gama.
SWAMP (Surface Water Ambient Monitoring Program)	The State Water Resources Control Board (SWRCB) has developed required standards for SWAMP. Any group collecting or monitoring surface water quality data, using funds from Propositions 13, 40, 50, and 84 must provide such data to SWAMP. More information on SWAMP is available at: http://www.swrcb.ca.gov/water_issues/programs/swamp.

Database Name	Description
eWRIMS (Electronic Water Rights Information Management System)	eWRIMS was developed by the State Water Resources Control Board (SWRCB) to track information on water rights in California. eWRIMS contains information on Statements of Water Diversion and Use that have been filed by water diverters, as well as registrations, certificates, and water right permits and licenses that have been issued by the SWRCB and its predecessors.
CEDEN (California Environmental Data Exchange Network)	CEDEN is a central location to find and share information on California's water bodies, including streams, lakes, rivers, and the coastal ocean. Many groups in California monitor water quality, aquatic habitat, and wildlife health to ensure good stewardship of our ecological resources. CEDEN aggregates this data and makes it accessible to environmental managers and the public. The CEDEN website is available here: http://www.ceden.org.
CEIC (California Environmental Information Clearinghouse)	The California Natural Resources Agency (CNRA) maintains the CEIC, which is a statewide metadata clearinghouse for geospatial data. The CEIC is accessible at: http://ceic.resources.ca.gov/. The online directory is used for reporting and discovery of information resources for California. Participants include cities, counties, utilities, State and federal agencies, private businesses, and academic institutions that have spatial and other types of data resources.
CERES (California Environmental Resources Evaluation System)	CERES is an information system developed by CNRA to facilitate access to a variety of electronic data describing California's rich and diverse environments. The goal of CERES is to improve environmental analysis and planning by integrating natural and cultural resource information from multiple contributors and by making it available and useful to a wide variety of users.
National Water Information System	The National Water Information System is managed by the United States Geological Survey (USGS) to publish data on the occurrence, quantity, quality, distribution, and movement of surface and underground waters and disseminates the data to the public, state and local governments, public and private utilities, and other federal agencies involved with managing water resources.

Many state and federal data management systems have web services that can be consumed to allow data to be displayed in the local DMS for viewing and analysis.

4.8.3.3 Other DMSs and Tools

In addition to storing and managing monitoring data, other data management systems and tools are used to facilitate outreach and track projects and benefits associated with implementation of planning activities, such as integrated regional water management, urban water management, and other county and city master planning activities. Some of the databases and tools include:

- Opti – an easy-to-use web-based project collaboration and communication tool that helps stakeholders share, track, and report project information

- TownSquare – a web-based communication solution that can be customized to meet specific project information collection needs
- Decision Support Tools such as WEAP, STELLA, and GoldSim

These data management systems and tools also have the potential to be linked to the DMS to show other information that support GSP development and implementation.

4.8.4 Features that Support Success Criteria

When assessing the DMS's ability to support GSP development and implementation, there are features that should be considered that meet both the procedural needs of the GSA as well as the data management success criteria described previously. The desired features should be identified and prioritized at the critical stage of DMS development. The key features that support the DMS success criteria and discussed below.

Table 4: DMS Features and Success Criteria

	Success Criteria								
Features that Support Success Criteria	1. Seamless Coordination	2. Support for GSP development	3. Centralized project information	4. Transparency	5. Ability to track undesirable results	6. Threshold and impact evaluation	7. Reliable total water budget	8. Sustainability tracking	9. Data sharing
User and Agency Security/Permissions	■	■							■
Data Entry and Validation		■	■				■	■	■
Visualization and Analysis	■	■		■	■	■	■	■	■
Management Planning and Actions		■	■						
Water Budget Development and Modeling		■					■	■	
Management Areas		■			■	■		■	
Reporting and Tracking of Critical Parameters				■	■	■		■	■
Outreach	■	■		■					■
Framework and Ability to Link to other Data Management Systems		■		■	■	■	■	■	■

User and Agency Security/Permissions

One of the most important features to consider is the ability for the DMS to manage user and agency access to data in a secure environment. The DMS should include user authentication and management protocols to manage users and their access to the database. User access should be tiered, allowing different user types to perform different functions (i.e., data entry, data validation, analysis). Additionally, there should be protocols and permissions associated with agency access to the database, allowing different participating agencies to control their data and who can access the data. This ensures that the agency can maintain the privacy of sensitive data while allowing that data to be used for basin-wide analysis if desired.

Data Entry and Validation

In order to encourage agency and user participation in the DMS, data entry and import tools should be easy-to-use, intuitive, web-based and accessible from anywhere, and help maintain data standardization. Mobile-friendly data entry tools using standardized field forms can allow field measurements to be input into the DMS from anywhere, reducing potential data quality issues. Validation tools allow a second person to review and validate the data which helps identify data entry errors or bad/inconsistent measurements.

In addition to manual data entry and import capabilities, the DMS should have the ability to link to data collected by data loggers if that data is stored in a centralized database. This reduces the amount of time required for processing data and importing to the database, and provides “real-time” access to the data

Visualization and Analysis

A DMS that contains a map-based view would allow stakeholders to view monitoring sites, analysis results, and project characteristics laid out geospatially in order to increase understanding of the basin, provide transparency, encourage collaboration, identify data gaps, and identify regions/locations that require additional actions. Data should be viewable based on privacy settings input by the participating agencies.

The DMS could also allow users to view specific information, such as hydrographs for one or multiple sites or lithologic information. The DMS could allow users, based on permissions, to perform analysis such as contouring, creating cross sections, or generating any other analytical outputs to support GSP development.

Management Planning and Actions

The ability to share, track, and view project progress during implementation allows management to verify that the projects and actions are leading to increased sustainability within the basin. The DMS should have the capability to overlie projects with data in a map-based view to help identify data gaps and needs for additional actions.

Water Budget Development and Modeling

The DMS should support water budget development and modeling by providing a single source of data to be used as input into the models and calculations. The DMS should be able to export the data in a format to be consumed by the other tools, or allow (through various protocols) the data to be accessed directly by the tools. In the case that the basin uses a data-based method for water budget development, the DMS should have the capability to support automation of some or all of the calculations.

The outputs of the models or water budget calculations should be imported to the DMS for visualization and further analysis, if needed.

Management Areas

The DMS should have the ability to aggregate and visualize data at a sub-basin level, providing a regional view within the basin in order to track sustainability indicators within management areas.

Reporting and Tracking of Sustainability Indicators

Based on the data and methods used to track the basin's critical parameters, the DMS should have the ability to consolidate and output graphical sustainability tracking reports to show progress towards goals as dashboards for either or both management and stakeholder consumption. Managers or the public should be able to drill-down by clicking on a critical parameter to access more information and data. Additionally, data sharing portals can roll-up data and information to show reliability, sustainability, and provide a knowledge base for stakeholders.

The DMS should also be able to export data and analysis at different levels of aggregation, and in different formats, for submission to various statewide and local programs (i.e., SGMA, CASGEM, GAMA, etc.).

Outreach

The DMS should support outreach and seamless coordination with stakeholders and neighboring GSAs through a portal that allows everyone to contribute by posting events, announcements, viewing recent DMS updates, and receiving weekly announcements.

Framework and Ability to Link to other Data Management Systems

The DMS should be web-based with an open architecture that provides a flexible framework to allow it to be connected to other databases (to both serve and consume data). The framework of the DMS should allow it to have the capability to be linked to other databases and allow that data to be displayed for visualization and inclusion in analysis as needed. This includes the ability (through various protocols) to link to statewide, federal, and local databases. This framework reduces the need to store data collected through other monitoring programs, while also giving participating agencies the ability to continue to maintain autonomy and use their already established data management systems.

4.8.5 Estimated Costs and Timeline

The estimated costs and timeline associated with DMS development and implementation vary with the DMS options (e.g., off-the-shelf vs custom). The following table provides some estimated costs and timelines associated with the development and implementation of a DMS. Often data conversion can be completed concurrently with DMS implementation and may be partially or fully completed by agency staff. Please note that these estimated costs may not include linkages to other state, federal, or local databases; these costs must be determined based on specific needs once an option is determined.

Table 5: Estimated Costs and Timelines Associated with DMS Options

DMS Options	Estimated Cost Range	Estimated Timeline
Option 1: Off-the-shelf DMS (no modification) Includes configuration with little or no modification and potential license fees	$5,000 - $30,000	1 – 2 months
Option 2: Off-the-shelf DMS (with modification) Includes configuration and modification to meet needs and potential license fees	$10,000 - $50,000	1 – 3 months
Option 3: Custom developed DMS Includes design and development of a customized DMS and implementation at agency's location	$100,000 - $250,000	6 – 12 months
Data Conversion (all Options) Includes data collection, conversion/QAQC, and upload to the DMS	$10,000 - $40,000	1 – 2 months

4.8.6 Next Steps

The previous sections have described a data management approach that will lead to identification of an appropriate DMS platform to meet the success criteria for GSP development and implementation. Once a DMS platform has been determined, a phased approach to implementation should be developed. The implementation plan should follow the standard software development lifecycle (SDLC) to ensure user-acceptance of the DMS. Depending on the DMS option selected, the implementation plan may include some or all of the different steps in the standard SDLC. This approach generally includes documenting user requirements, developing an inventory of data and databases, and defining reporting requirements. Input will be required from the participating stakeholders and managers to prioritize the user needs that will be included in the DMS. After prioritization is completed, a database and interface design should be developed, which includes use cases detailing the user interaction with the system. In order to maximize the return on investment of the DMS, high value tools and features (such as data analysis/contouring features, user controls, and mapping generation) should be developed first in order to meet the immediate needs of SGMA regulations. These high value tools/features should also be consistent with the priorities identified in the user requirements. During and after development/implementation, participating stakeholders and managers should be available for user acceptance testing and end-user training.

5. TOOLS

5.1 SUCCESS CRITERIA DEVELOPMENT

Success Criteria will be an important tool in establishing SGMA sustainability goals and measurable objectives, and in measuring progress toward attainment of those goals. In the *Strategic Plan for Sustainable Groundwater Management*, DWR presented a series of criteria for measurement of success in implementing SGMA. Recognizing that the criteria presented in DWR's Strategic Plan were developed for use by DWR in measuring its own performance, only a portion of those criteria might apply to DWR's measurement of success of individual GSPs. Criteria that might apply to measurement of individual GSPs include:

- Balanced water supply and demand
- Coordinated water management
- Regulatory oversight and enforcement
- Basin stabilization
- Improved data management
- Communication and outreach
- Plan for uncertainties

Recognizing that DWR will likely utilize some form of these criteria in its evaluation of the adequacy of a GSP, the following success criteria may be appropriate for development and implementation the Delta-Mendota GSP:

Table 6: Possible Success Criteria for Delta-Mendota GSP

Criteria	Discussion
Water Budget	Demonstrate that the overall surface and groundwater budget is in balance for the entire Basin.
Groundwater Balance	Establish a long-term basis for determining groundwater balance. Need to consider concept of conjunctive use, including increasing storage in wetter years and relying on banked groundwater in drier years.
Basin Stabilization	Evaluate the stability of the groundwater basin, and measure GSP performance through long-term monitoring of basin performance.
Monitoring and Reporting Effectiveness	Develop plan for total monitoring of water use, groundwater use, and changes in groundwater storage.
Inter-Agency Coordination	Monitor inter-agency coordination and cooperation. May include number of inter-agency exchanges, cooperative projects or programs, etc.
Oversight and Management Tools and Actions	Develop tools to understand individual landowner as well as agency-based water use, including groundwater pumping. Establish effective means of reporting and providing

	feedback to landowners, and providing basis for enforcement if necessary.
Data Accessibility	Monitor ability of all interested parties to have access, as appropriate, to available data.
Communication	Monitor outreach communications, and measure the effectiveness thru a feedback loop.
Plan for Uncertainties	Develop an emergency/drought response plan, including triggers for various management or other actions.

These success criteria should be evaluated and prioritized in the context of overall GSP development.

5.2 ANALYTICAL AND NUMERICAL MODELS

Per Section 352.4 of the GSP Emergency Regulations, groundwater and surface water models used for a GSP must have publically-available supporting documentation, be based on field or laboratory measurements or equivalent methods that justify the selected values, and be calibrated against site-specific field data. If the model is developed after the effective date of the regulations, the modeling platform must consist of public domain open-source software. The regulations do not mandate the use of models (numerical or otherwise) and do not specify or mandate any specific modeling platform. The Emergency Regulations do, however, note that DWR will be providing the California Central Valley Groundwater-Surface Water Simulation Model (C2VSim) and Integrated Water Flow Model (IWFM) for use by GSAs in developing water budgets, and have indicated that they (DWR) will be utilizing this modeling platform as their platform for 'rolling up' data and modeling results from the various GSAs.

Among the many groundwater flow simulation models used in the industry, there are two that have been used in the Central Valley most commonly: MODFLOW and IWFM. The Central Valley Hydrologic Model (CVHM) is a MODFLOW application. The California Central Valley Simulation (C2VSim) is a IWFM application. MODFLOW is a finite-difference numerical modeling code used predominantly by the U.S. Geological Survey [USGS] for groundwater modeling exercises. IWFM is a finite-element numerical modeling code that is also heavily used in the industry by DWR and many local agencies in the Central Valley. Both codes are publically-available open-source codes. While other numerical modeling codes are available, for the purpose of this section, only those two modeling codes will be discussed.

Following is a brief description of modeling platforms in Central Valley:

MODFLOW-OWHM and its predecessor, MODFLOW with the Farm Process (MODFLOW-FMP), are variants of MODFLOW that meet the definition of integrated hydrologic modeling codes as previously described. These codes calculate water demand based on user-specified parameters, including time-varying crop distributions, crop parameters (e.g., rooting depth, irrigation efficiency), and climate data. These demands, along with specified surface water deliveries, are used to dynamically calculate groundwater pumping in areas where pumping volume is unknown.

IWFM is a finite element model code capable of simulating integrated hydrologic processes, with particular strength in agricultural areas where crop water use drives a significant portion of the water budget. The IWFM code is developed and maintained by DWR's Bay-Delta Office.

The IWFM Demand Calculator (IDC) is the companion surface-layer process simulation tool for the IWFM groundwater model code described above. By design of the developers, IDC can also be used as a stand-alone tool for evaluating surface-layer processes in the absence of a groundwater model. The current

version of IDC is capable of simulating non-ponded and ponded crops, urban lands, element-based land use, and simulation of root uptake of groundwater.

As noted above, MODFLOW-FMP/-OWHM and IWFM model codes are the most widely used integrated hydrologic models used in agricultural areas of California. The California Water and Environmental Modeling Forum (CWEMF) recently reviewed the IWFM and MODFLOW-FMP codes, with a focus on their potential for application in irrigated agricultural groundwater basins (Harter and Morel-Seytoux 2013). The peer review concluded that both codes are technically sound, but that differences in how certain processes are simulated could lead to different results, even with the same input data. Based on the peer review, neither MODFLOW-FMP nor IWFM can be excluded from selection based on the technical merits of the code. Therefore, the decision of which code to use is driven by other factors, including ease of use and familiarity with the modeling team and consistency with current and future needs of the GSAs in the Delta-Mendota subbasin.

5.2.1 Existing Models

The **Central Valley Hydrologic Model (CVHM)** is a MODFLOW application developed by the USGS to simulate the historical hydrology of California's Central Valley (Faunt *et al*. 2009). CVHM simulates the historical period from October 1961 through September 2003 using a monthly time-step. CVHM uses a one square mile grid cell and is discretized into ten modeling layers. Hydraulic properties were assigned to the CVHM grid based on a lithologic texture analysis of available driller's logs (Faunt, Belitz, and Hanson 2009). In the Tracy/Delta-Mendota area, roughly 1,400 wells were used to develop the texture model. Much of the historical data for streamflows and diversions were obtained from DWR and the developers of C2VSim. Land use (i.e., water, urban, native vegetation, or crop type for agricultural areas) maps were developed for 1960, 1973, 1992, 1998, and 2000, based on data from California State University, Chico, USGS, North America, Land Class Data, and Gap Analysis.

The USGS is presently updating CVHM to extend the calibration period and to introduce new tools such as MODFLOW-OWHM. The updated model has not been published yet. However, a Beta version of the model has been provided to evaluation and review. Based on our review of the Beta version of the model, the following changes have been observed:

- Subregions on the west side of the model area (which covers the Delta-Mendota area) have been refined to the (water or irrigation) district level. Previously there were 21 subregions for the entire Central Valley. District-scale subregions allow for more accurate assignment of diversions and deliveries. Since diversions are assigned by subregion, the smaller scale allows for more accurate spatial representation.
- The model platform is being converted to MODFLOW-OWHM. One benefit of this updated platform is an improved subsidence package
- The model has been refined from 10 to 13 modeling layers
- Boundary conditions have been updated to better represent interactions with areas outside the model boundaries. Previously, the delta had been simulated using a general head boundary while the rest of the valley had no flux. These have been replaced with specified flux boundary conditions in order to better simulate inflow to the valley from boundary watersheds.
- The calibration period has been extended through September 2013. The model previously ended in 2003.

- Land use now changes every year. Previously, crop maps were developed for years (1960, 1973, 1992, 1998, and 2000), with everything in between remaining the same. It is unclear what methodology has been used to update the land use annually.

The **California Central Valley Simulation (C2VSim) Fine Grid** model is an IWFM model application developed by DWR as a tool to aid in water management planning in the Central Valley. C2VSim simulates the historical period of Water Year 1922 to 2009 using monthly time-steps. The model has an average element size of 0.688 square miles or 440 acres in the Delta-Mendota area. C2VSim currently contains monthly historical stream inflows, surface water diversions, precipitation, land use, and crop acreages from October 1921 through September 2009. Urban water supply is based on reported historical records. Agricultural water supply is based on historical records of surface water deliveries and estimated groundwater pumping. C2VSim dynamically calculates crop water demands; allocates contributions from precipitation, soil moisture, and surface water diversions; and calculates groundwater pumping required to meet the remaining demand. The model simulates the historical response of the Central Valley's groundwater and surface water flow system to historical stresses.

The C2VSim grid has more than 32,000 elements and 30,000 nodes, with an average element area of approximately 400 acres. C2VSim is vertically discretized into 6 modeling layers (3 aquifers, 3 aquitards) and 1 aquiclude with a generalized upper unconfined aquifer, a confined production zone, and a deep confined zone.

C2VSim is currently being updated to meet the needs of SGMA implementation throughout the Central Valley. This update includes the following features:

- The calibration period has been extended through 2015.
- The model layers are based in hydrogeologic units. As such, the model simulates the entire thickness of the Central Valley aquifer system down to the continental deposits, and includes 4 aquifer layers and 4 aquitard layers.
- Land use and crop acreage to be updated consistent with California Water Plan. Crop acreages are based on DWR land use surveys, Kern County crop survey data, historical urban footprint, and other data sources such as the most recent land use survey and maps that are currently being developed by LandIQ for the DWR, as well as the USDA CropScape, crop reports by the DWR Regional Offices, and updated land use data being developed by the ERA Economics for DWR, as well as county agricultural commissioner reports.
- Updated subregion level ETc, irrigation efficiency, irrigation period, and ag demand values based on California Water Plan, with statewide ET surveys to QA/QC the data. In addition, data from remote sensing throughout the Central Valley will be used to fine tune the estimates of ETc and agricultural demand.
- Spatial distribution of agricultural pumping will be by element based on agricultural acreage
- New diversion structure compatible with CalSim3 will be used, with updated time-series and missing diversions from the California Aqueduct and Delta-Mendota Canal
- Updated land subsidence package and refined calibration of land subsidence.
- Modifications to the IWFM code allowing for the development of water budgets by user-defined geographic zones, such as GSAs.

The following table is a comparison of the published versions of C2VSim and CVHM:

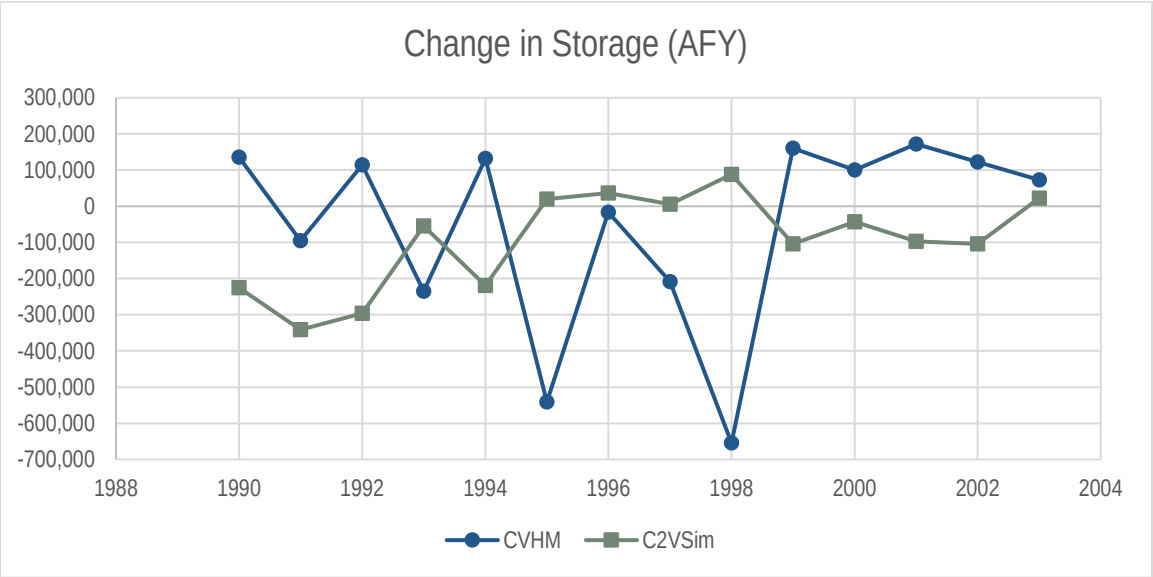
Table 7: Comparison of Published C2VSim (R374) and CVHM (USGS 1766)*

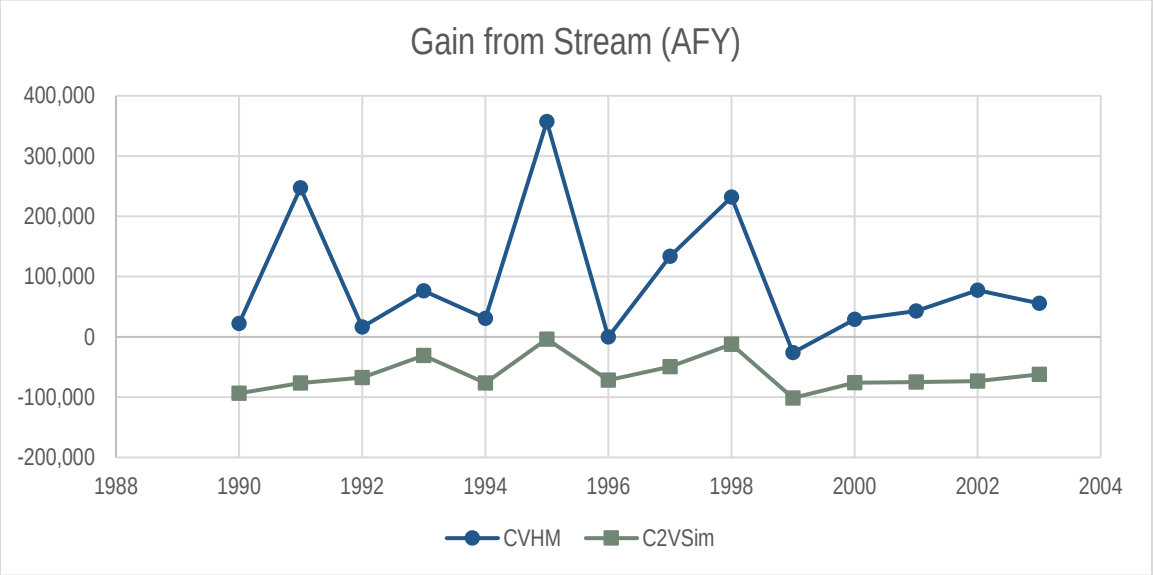
Key Feature	C2VSim	CVHM
Code Platform	IWFM	MODFLOW-FMP
Public Domain Code	Yes	Yes
Model Ownership	DWR	USGS
Availability	Available from DWR	Available on USGS website
Documentation	Available on DWR website	Available on USGS website
Integrated Model	Yes	Yes
Geographic Area	Central Valley	Central Valley
Simulation Period (Water Years)	1921 - 2009	1961 – 2003
Number of Model Layers	6	10
Geologic Formations Represented in the Model	Generalized upper unconfined aquifer, confined production zone, deep confined zone	Layers not explicitly tied to hydrogeologic units except for Corcoran Clay in the San Joaquin Valley; remainder based on uniform division of aquifer system for modeling purposes
Agricultural Demand Estimation Method	Integrated methodology using IDC	Integrated methodology using the Farm Process
Stream-Aquifer Interaction Method	Integrated methodology using IWFM Stream Package	Integrated methodology using MODFLOW Streamflow Routing Package
Elements	32,537	20,533
Average Grid Size	407 acres (0.64 square miles)	640 acres (1 square miles)
Time Step	Monthly	Monthly

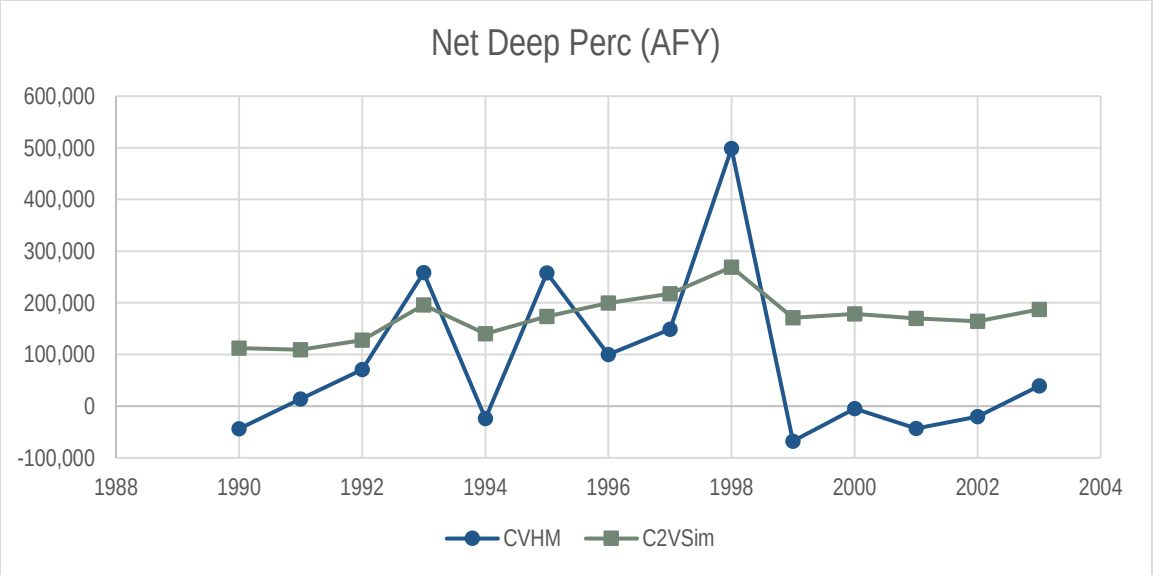
*Both the CVHM and C2VSim models are being updated and this table does not reflect the updated features not yet published.

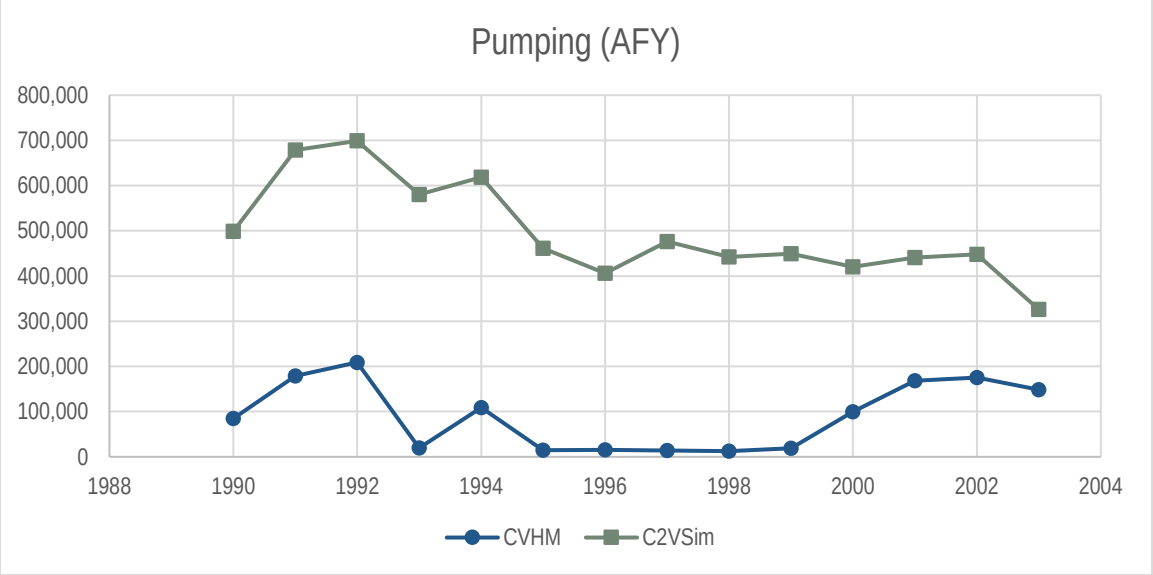
With the anticipated refinements, the SLDMWA has the option to use either CVHM or C2VSim to support SGMA implementation. It should be noted that, although the large and basin scale models (neither CVHM nor C2VSim) were originally not designed to be used for detailed SGMA implementation, it is expected that with the current updates for both models, both models could be used to support SGMA implementation at the large scale. However, the spatial resolution of these models may be insufficient to accurately evaluate water budgets at a water district level and therefore either model, if selected, may require refinements to provide the necessary resolution for GSP development and implementation.

In order to have additional information on the current state of each model for the SLDMWA area, a set of model results reflecting components of a groundwater budget are prepared and presented below.









Based on the water budget comparisons above, it is clear that the two models are showing very different results. Previous comparisons of C2VSim and CVHM also showed differences between the models at both regional and subregional scales. In general, smaller differences are observed at the regional scale.

Other factors that may influence a decision on the model choice include the following:

Interface/Ease of Use. The ability to relatively quickly generate and modify input data, run models, and view output data is an important consideration for model selection, especially one to be used to evaluate multiple future scenarios. The core version of MODFLOW is well-supported by several commercially- and freely-available graphical user interfaces (GUI). Each GUI varies in its capabilities, but they generally all allow for rapid generation and modification of input data, running the model, and generation of output data (e.g., maps of groundwater levels, hydrographs comparing observed and simulated groundwater levels, charts representing the water budget, and tables of calibration statistics). None of the GUIs support all capabilities and versions of MODFLOW, and most lack the latest developments in the MODFLOW code. Importantly, there is very limited support for the integrated

versions of MODFLOW (i.e., MODFLOW-OWHM/FMP). In contrast to MODFLOW, IWFM has a limited ArcMap-based GUI that allows users to view some portions of the model input data in a map view. DWR has also published several supporting tools, including an ArcMap-based grid generator, a set of Microsoft Excel plugins for analyzing outputs, and tools to process soils and land-use data.

Because there are now full-featured GUIs available to support development of an integrated hydrologic model, input data will have to be prepared in text files. Generally, the more complex the model, the more cumbersome it is for modeler to prepare and maintain these input text files manually. However, the developers of IWFM have made a significant effort to give users input file templates and formats that make the process easier (e.g., through the ability to perform unit conversions, provide extensive comments, and enter time-series formatted data). IWFM also has the ability to read input data from HEC-DSS databases.

Consistency with Other Regional Models. There are numerous applications using the IWFM code throughout California, ranging from DWR's Central-Valley-wide C2VSim model to numerous locally-developed, county-scale water resources models in the Central Valley. The USGS also has a Central-Valley-wide MODFLOW-FMP model (CVHM), and one application of MODFLOW-OWHM in the Modesto Area. Additionally, MODFLOW is the source code for the Mendota Pool Group and Westlands Water District models. The USGS also has a handful of applications outside the Central Valley (e.g., in Pajaro Valley).

Overall, differences in ease of use between the two models are likely to be minimal. IWFM is more widely used than MODFLOW-OWHM/FMP in the Central Valley for simulating hydrologic conditions in areas with large percentages of irrigated agriculture.

Consistency with the Sustainable Groundwater Management Act. IWFM is developed by DWR, the State agency responsible for evaluating plans developed by the GSAs. DWR will be using IWFM-based models to look at groundwater conditions in the region, and having a IWFM model will allow for an ease of data sharing that might not be afforded by a MODFLOW-based model.

Additionally, based on conversations with GSAs and potential GSAs in groundwater subbasins adjoining the Delta-Mendota Subbasin, it appears that most adjoining subbasins are planning to utilize IWFM (building off C2VSim) as the basis for their groundwater flow modeling in support of GSP development. These include Stanislaus County, Merced County and groundwater basin, San Joaquin County and Eastern San Joaquin Groundwater Basin, and Fresno County and Kings Groundwater Basin.

5.2.2 Potential Refinements to CVHM or C2VSim

Regardless of the model choice for use in the Delta-Mendota Subbasin, certain model input data and water budget components will need to be checked against local data available. As such, the following data could potentially be verified and/or improved using local data:

- Annual land use
- Crop Demand
    - Agricultural Pumping
    - Irrigation Efficiency
    - Applied Water
- Evapotranspiration
- Urban demand
- Aquifer Parameters
    - Conductivity
    - Storativity

- Specific Storage

Other aspects of the models, such as grid size and layering, cannot be changed without significantly impacting the structural integrity the models.

Local land use data and knowledge of irrigation practices will dictate changes in the land use and crop demand input data. The most likely improvement is a more accurate representation of local crop variability, and pumping and applied water. Urban demand can be improved with local data as the regional models use estimates for these values. Diversions in the latest versions of CVHM and C2VSim are based on Calsim model, DWR's model for evaluating surface water deliveries. Calsim should be utilizing the latest data from local agencies and the data in the model can be checked against local agency data.

Information related to physical aquifer parameters relies on well logs and adjustments during calibration within the acceptable range of values. The level of effort necessary to modify the parameters depends on the initial calibration. The CVHM texture model is used as the basis for many local models and typically accepted. Small adjustments can be made to this or other models to better calibrate smaller sections of the model.

5.2.3 Cost Implications

Regardless of whether CVHM or C2VSim is selected for use in GSP development, the models will need to be verified against local data and information. In general, the cost of refining and verifying data and parameters for a regional model that is already in place, is less than that for development of a new and stand-alone model.

Development and calibration of a local model from scratch can cost a minimum of $500,000 or more. While there are still substantial costs associated with refining a regional model, there could be significant savings. Between CVHM and C2VSim, it would be beneficial to use C2VSim for SGMA support. While CVHM has been refined in the Delta-Mendota Subbasin, additional changes would need to be made to make it suitable for use with SGMA and GSP development. Based on initial assessments, the level of effort to refine CVHM would be comparable to that of updating C2VSim for the area.

5.3 CHOICE OF MODEL

As discussed, there are two primary choices for model use to support the Delta-Mendota Subbasin SGMA implementation, CHVM and C2VSim. (Development of a new model is not considered as either of the two existing Central Valley models are a good starting point for model development and developing a new model from scratch will be costly.) Given the status of these two models, we recommend use of C2VSim as there are benefits to choosing a model on an IWFM platform, including:

- Many of the basins adjoining Delta-Mendota Subbasin are using IWFM in their SGMA efforts. The Eastern San Joaquin Subbasin and the Merced Subbasin are each using their own respective IWFM models, with a grid more refined than C2VSim. Stanislaus County is in the process of developing a stand-alone model based on C2VSim that covers the Modesto and Turlock Subbasins.
- With IWFM models, it becomes much easier to use local data from a neighboring agency than it would be to convert MODFLOW data for the same purpose. Moving forward and updating the model during the GSP development phase, transfer of knowledge between neighboring GSAs will be crucial to maintaining consistent results.

- C2VSim can provide a consistent set of inter-basin flows with the neighboring basins. Inter-basin groundwater flows play a major role in groundwater budgets.
- C2VSim and the IWFM platform have been named in the water code as the models that are being supported by the DWR for SGMA implementation. As such, selecting C2VSim will continue to provide consistent support and updates by the DWR for SGMA implementation in the region.

5.4 PROJECT PRIORITIZATION & MANAGEMENT SYSTEM

The development of a GSP will likely include assessment of numerous alternative water management scenarios – projects, programs and management actions or strategies - for providing a balanced basin. Some of these projects and management strategies may benefit more than one GSA, while others may provide benefits to a single GSA. It will be helpful to prioritize each of the identified projects and management strategies. To this end, decision tools such as WEAP, GoldSim, and others, can be used to assist in developing a basis for prioritizing the projects and management strategies. These DSS strategies are discussed further in Section 5.5, below.

5.5 ADAPTIVE MANAGEMENT

Adaptive management is a key component of the long-term implementation of SGMA. At a minimum, the GSP will have to be updated every five years to reflect current basin conditions and to correct or improve upon programs and management actions put into place to achieve sustainability. How this adaptation may occur will vary by basin and GSA.

Adaptive management can be defined as the integration of design, management, and monitoring to systematically try different actions to achieve a desired result. Rather than a random trial and error method, it involves developing a set of assumptions based on the situation and implementing actions to see how the results differ from assumptions. The key is to develop an understanding of why actions do or do not work. Adaptation means planning for and taking actions to improve the projects based on results of monitoring. It involves changing assumptions to respond to new information obtained through previous efforts.

Adaptive management is broken into five phases:

1. *Decision Making*

Decisions made at each point in time should reflect the current level of understanding and anticipate future consequences of decisions. Decisions should consider management objectives, resource status, and knowledge of consequences of potential actions.

2. *Follow-up Monitoring*

Monitoring information to estimate resources status, underpin decision making, and facilitate evaluation and learning after decisions are made. Monitoring is an ongoing activity.

3. *Assessment*

Data produced through monitoring is used along with other information to evaluate effectiveness of previous actions, understand resource status, and reduce uncertainty about management effects. Model generated predictions are compared with data based estimates.

4. Learning and Feedback

Understanding gained from monitoring and assessment helps select future actions. The iterative cycle of decision making, monitoring, and assessment gradually leads to a better understanding of resource dynamics and adjusted management strategy moving forward.

5. Institutional Learning

Periodically, it is useful to interrupt the technical cycle in order to reconsider project objectives, management alternatives, and other elements of the setup phase. This constitutes an institutional learning cycle that complements but differs from the cycle of technical learning.

SGMA requires GSAs to establish an adaptive management strategy of plan, do, evaluate, and respond to guide a GSA toward maximizing benefits of the GSP and achieving the sustainability goals. Specifically, SGMA requires GSAs to demonstrate progress toward the goal of sustainability, taking corrective action to address deficiencies. To promote desired outcomes, plan development and implementation will need to be dynamic and responsive to many changing factors.

As an integrated plan, development of a GSP will require the identification and prioritization of management actions, corrective programs and projects. As with any master planning activity, the projects that provide the greatest benefits for the money spent will most likely be implemented and will have to be identified in a transparent manner in order to maximize stakeholder acceptance of the planned course of action. Additionally, should the planned course of action not achieve the sought-after results (groundwater basin sustainability), the groundwater basin manager(s) will have to prepare for alternative actions or, in essence, have a "Plan B" be prepared.

One way to achieve both of these objectives (prioritizing projects and management actions in an un-biased, transparent manner and evaluating 'what if' scenarios) is through the use of Decision Support Systems (DSSs). DSSs are a type of computerized information system that support decision-making activities. DSS models are typically interactive computer-based systems intended to help decision makers solve problems that have multiple possible solutions, and that may be too complex for humans to solve alone but too qualitative for computers alone.

Decision Support Systems can typically be placed into one of five categories:

Communication-driven DSS

Most communications-driven DSSs are targeted at internal teams, including partners. They are designed to help conduct a meeting or for users to collaborate. Communication-driven DSSs support communication between two or more people, facilitates information sharing, and enables communication between groups of people. Examples of communication-driven DSS include use of common web-based spaces, online collaboration (such as the use of Google Documents) and web-meeting systems such as Skype.

Data-driven DSS

Most data-driven DSSs are targeted at those managing, analyzing or using the data. Often referred to as Data Management Systems (DMS), these systems are used to query a database to seek specific answers for specific purposes. Examples of these types of systems include DWR's GSA interactive map and table.

Document-driven DSS

Document-driven DSSs are more common, targeted at a broad base of user groups. The purpose of such a DSS is to search web pages and find documents on a specific set of keywords or search terms.

Document-driven DSSs consolidate and organize information in a multitude of electronic formats such as html pages, pdf, image files, video files, etc.

Knowledge-driven DSS:

Knowledge-driven DSSs covers a broad range of systems typically used to management advice or to choose products/services. It provides problem solving expertise stored as rules procedures and algorithms.

Model-driven DSS

Model-driven DSSs are complex computer-based systems that help analyze decisions or choose between different options. In these models, information is processed using quantitative models. These DSSs can be deployed via software/hardware in stand-alone PCs, client/server systems, or the web and can be linked to common groundwater models. Example of this type of model includes the Water Evaluation And Planning (WEAP) model, Stella, and GoldSim.

5.6 OUTREACH, COMMUNICATION AND FACILITATION

Successful implementation of a GSP will depend on efficient outreach, communication, and facilitation between GSA(s) and locals/stakeholders. Stakeholder engagement is defined as efforts made to understand and involve stakeholders and their concerns in the activities and decision-making of an organization or group. The idea is that those impacted by a decision have a right to be involved in the decision making process; stakeholder acceptance of projects and management actions included in the GSP will forestall the potential for lawsuits and will aid in achieving basin sustainability.

SGMA has numerous public noticing requirements for both GSAs and the State to ensure stakeholders are aware of all local actions.

- During GSA formation
    a. Agencies electing to be a GSA must hold a public hearing.
    b. A list of interested parties must be developed along with an explanation of how their interests will be considered.

- During GSP development and implementation
    a. A GSA must provide written notice to DWR prior to initiating development of a GSP. This notice must provide general information about the GSA's process for developing the GSP, including the manner in which interested parties may contact a GSA and participate in the development and implementation process. This notice must also be made publically available by posting on the GSA's website.
    b. A GSA may only adopt or amend a GSP after a public hearing is held.
    c. Prior to imposing or increasing a fee, GSAs must also hold at least one public meeting.
    d. GSAs must establish a list of persons interested in receiving notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents.
    e. Any federally-recognized Indian Tribe may voluntarily participate in the preparation or administration of a GSP. The participating tribe shall be eligible to participate fully in planning, financing, and management.
    f. GSA shall make available to the public and DWR a written statement describing the manner in which interested parties may participate in the development and implementation of the GSA.

- Throughout SGMA implementation
    a. GSA shall consider interests of all beneficial uses and users of groundwater.
    b. GSA shall encourage active involvement of diverse social, cultural, and economical elements of the population within the groundwater basin.

As part of the SGMA Strategic Plan, DWR published guidelines regarding communication and outreach. Per the Strategic Plan, DWR seeks to accomplish the following:

- Engage public participation in SGMA implementation
- Maintain cooperation between DWR and other agencies and stakeholders
- Educate stakeholders, water users, and citizens on SGMA requirements and water management sustainability objectives, as well as the role and responsibility of each party.
- Provide easy access to informative materials, data, reports, and DWR's technical experts
- Report on progress and accomplishments in implementing and provide transparency about DWRs implementation activities.

Proactive outreach and engagement of partners and stakeholders is essential to achieving sustainable groundwater management at the local and regional level. To achieve this, local and regional agencies must proactively reach out to keep local citizens, groundwater users, and stakeholders informed, and should use a range of activities, events, and venues for public and stakeholder briefings. Adaptive, practical, and two-way communication is essential to establishing and maintaining the partnerships needed. To facilitate communication, DWR created a suite of tools and resources, including DWR and SWRCB websites containing outlines of project-specific actions and implementation status, as well as links to other websites with technical information relevant to SGMA. Taking advantage of the resources provided by DWR and the State Board and utilizing their technical resources can reduce some of the burden placed on the GSA.

GSAs are expected to play a large part in facilitation with stakeholders. While the statutory requirements lay the foundation for stakeholder engagement, many of the details regarding how to engage stakeholders remains in the hands of GSAs. In implementing discussions with stakeholders, it is recommended that work be done to find neutral territory to begin conversations. If familiar and trusted structures for communication between regional actors already exists, GSAs can build upon these relationships. Although all stakeholders have an important role in SGMA, it is not practical to reach out to all entities. Stakeholders to be actively included in the GSP preparation and implementation process can be assessed using the following questions:

- What are their interests, concerns, and priorities?
- How do they rely on groundwater now and how will they in the future?
- What are the best tools for communicating with them?
- To what extent and how would they like to be involved?
- What would they like their GSA or GSP to look like?
- What barriers might they face to participating?
- Who else do they believe should be involved?

Additionally, regardless of how stakeholders are engaged, it is important to consider whether or not the proposed GSP has the support of all necessary parties, is the proposed plan is flexible enough to include new potential agencies and stakeholders in the future, and what formal mechanisms exist for facilitating participation of beneficial users. For stakeholders not given a formal role in decision making, advisory boards serve as a way to promote broader stakeholder participation.

During GSP development and implementation, roundtables and other traditional meetings can be conducted to facilitate communication with more active and easily reached stakeholders. For those who face more barriers to participation, alternative opportunities for participation may be necessary. Evening meetings, translation, and targeted outreach and communication take more work to conduct but are ultimately more successful at including these stakeholders. Regional public stakeholder workshops can be held to obtain stakeholder input. Interviews of select stakeholders can be held to gain further understanding of input from previous workshops. Web-based surveys and data requests can be used obtain input from stakeholders on specific topics not covered during in-person workshops. When appropriate, web-based meetings such as webcasts and webinars can be used to disseminate information related to draft documents or other project information. Existing conferences and meetings can be used to present progress and results.

A number of tools exist for building shared understanding on technical subject matter:

Joint fact finding
In joint fact finding, scientists and stakeholders come together to frame research questions, consider methodologies, contact independent parties to conduct studies, and interpret results to support the scientific inquiry and ultimately policy and decision-making. This is particularly useful for science intensive decision making in which uncertainty is prevalent and widespread support and understanding of scientific findings is needed.

Establishing a representative technical advisory committee
This committee would oversee and provide input on technical aspects of decision-making and is helpful for promoting broader support. Technical advisory committees should include diverse representative and not exclude or devalue certain stakeholders.

Web-based tools
Searchable databases, GIS mapping platforms, and online document libraries greatly increase access to data and information in a highly useable form. Communication methods such as emails, newsletters, and public workshops play a key role in publicizing these resources.

Third-party neutral researchers
Third-party neutral researchers can be contracted to build confidence in the scientific process. Input and collaboration will be required to identify researchers to ensure they can be considered neutral.

Collaborative models and decision-support tools
Collaborative models and decision-support tools take existing or newly developed data or models and guides stakeholders through a wide array of scenarios and options. This method is helpful at building a shared understanding and providing stakeholders with a forum where they can test their concerns and preferences with others. These tools are described briefly in Sections 5.3 and 5.4, above.

In conclusion, to obtain buy-in and build good will, it is vital that all aspects of the plan and implementation truly consider and respond in more meaningful way to stakeholder concerns and needs. The more opportunities for assessment, feedback, alteration, and improvement that a GSA pursues, more effective stakeholder engagement will be. GSAs need to plan for stakeholder engagement, considering the interests of all beneficial users.

6. FUNDING OPTIONS

There are multiple funding options available for SGMA-related work, including near-term activities such as GSP development, monitoring, data collection and analysis, and associated outreach, as well as long-term activities such as funding for GSP updates, tool development and project/program implementation. A significant source of available outside funding Statewide for water resources planning efforts and project implementation is Proposition 1 (Prop 1), also referred to as the Water Quality, Supply, and Infrastructure Improvement Act of 2014. California voters passed Prop 1 in 2014 which authorized $7.5B in general obligation bonds for state water supply infrastructure projects which is allocated to various funding programs administered by multiple agencies. The primary administering agencies include the California Department of Water Resources (DWR), the California State Water Resources Control Board (SWRCB), and the California Water Commission (CWC). Funding opportunities that would be applicable to SGMA-related activities and projects include the Water Recycling Funding Program (WRFP) / Clean Water State Revolving Fund (CWSRF) Program, Drinking Water State Revolving Fund (DWSRF) Program, the Groundwater Sustainability Program, the Integrated Regional Water Management (IRWM) Program, the Sustainable Groundwater Planning Grants, and the Water Storage Infrastructure Program (WSIP). Many of the available outside funding sources that would be available to SLDMWA for SGMA-related activities, both near- and long-term, would be the same. These are summarized in Table 8 and described in more detail in the following sections.

Table 8: SGMA-Related Near- and Long-Term Funding Opportunities

Funding Opportunity	
Sustainable Groundwater Planning Grant Program	
IRWM Implementation Grants	
Groundwater Sustainability Grant Program	
WRFP/CWSRF	
DWSRF	
WSIP	

In addition to Prop 1 funding, SGMA (Chapter 8, Financial Authority, Section 10730) allows GSAs to impose fees, including, but not limited to, permit fees and fees on groundwater extraction or other regulated activities to fund the costs of a groundwater sustainability program, including but not limited to, preparation, adoption, and amendment of a groundwater sustainability plan, and investigations, inspections, compliance assistance, enforcement, and program administration, including a prudent reserve. Additionally, GSAs that adopt a GSP may impose fees on the extraction of groundwater from the basin to fund costs of groundwater management, including but not limited to, the costs of the following:

- Administration, operation, and maintenance, including a prudent reserve.
- Acquisition of lands or other property, facilities, and services.
- Supply, production, treatment, or distribution of water.
- Other activities necessary or convenient to implement the plan.

All of these fees may be subject to Prop 26 and/or Prop 218 process requirements and/or other statutory requirements, depending on the entity implementing the fee.

6.1 FUNDING OPPORTUNITIES FOR NEAR-TERM ACTIVITIES

Near-term funding options would be for activities such as developing the GSP, conducting groundwater monitoring, collecting and analyzing data (including development of data management systems and/or groundwater flow models), and performing SGMA-related outreach. Outside funding opportunities would include those described in the following sections. Other funding avenues would include regulatory fees and/or assessments that would be assessed per California Water Code Section 10730 and federal funding opportunities and agreements such as USGS Grants and cooperative agreements, also described below.

Sustainable Groundwater Planning Grant Program (SGP)

The Sustainable Groundwater Planning Grant Program is a Prop 1-funded program administered by DWR and is intended to support development of GSPs and other programs related to SGMA implementation. Key items of interest relating to this funding program include:

- Prop 1 includes $900M for grants and loans for projects that prevent or cleanup contamination of groundwater that serves or has served as a source of drinking water. This program includes:
    - $800M administered by SWRCB through the Groundwater Sustainability Grant Program (discussed below).
    - $100M administered by DWR for projects that develop and implement groundwater plans.
- The DWR Sustainable Groundwater Planning Grant Program has $93M remaining, after awarding $7M to Counties with Stressed Basins during a prior solicitation in 2016. Of this, it is anticipated that $86M will be awarded under this funding program. (The remainder will be used for program administration.)
- DWR has yet to release details as to application requirements for the SGP Program. The draft Proposal Solicitation Package (PSP) is expected to be released in the Spring of 2017, with the final PSP to be released in the summer of 2017.

Although, at present, no other details are available about how this program will be administered or how the funding will be awarded, based on direct conversations with DWR, it is anticipated that one award will be made per groundwater basin, with possible funding awards of $1M to $2M. Per Prop 1 requirements, a 50% local match will be required, however, a full or partial funding match waiver may be awarded by demonstrating a direct benefit to DACs in the groundwater basin. These waivers would be proportional to the DAC area benefitted by the GSP.

SGMA Facilitation Support Services

DWR currently provides (through contracted consultants) free facilitation support services upon request for GSA formation. At present, it is anticipated the DWR will extend these facilitation support services to GSAs to aid in the preparation of GSPs. To qualify, GSAs must meet the following requirements:

- Demonstrate commitment to work collaboratively to meet SGMA requirements
- Identify clear and defined need for professional facilitation support services
- Demonstrate commitment to meet regularly and work diligently toward clear, defined goals
- Commit to providing logistical and administrative support

Upon qualification, GSAs will have access to the following resources:

- Strategic planning
- Stakeholder identification and outreach
- Stakeholder assessment
- Stakeholder liaison and mediation
- Meeting facilitation
- Governance assessment
- Public outreach

At present, it is expected that DWR will continue to offer these same services for supporting GSP preparation and adoption. No other details regarding this program are currently available.

IRWM Implementation Grants (DWR)

DWR administers the Integrated Regional Water Management (IRWM) Grant Program, providing planning and implementation grants for the preparation and updates of IRWM Plans, and for construction and implementation of water resources-related projects, respectively. Under Prop 1, DWR has released one round of IRWM planning grant funding, and is anticipated to be releasing two rounds of IRWM implementation grant funding.

Prop 1 allocated $510M to the IRWM program, $31M of which was specifically for the San Joaquin River Funding Area (the funding area that includes the Delta-Mendota Subbasin). Of the overall $510M, $367.3M has been allocated for IRWM implementation grants. Details regarding release of the implementation grant funding are as follows:

- Anticipated timing of future implementation grant solicitations
    - FY17/18: Implementation Round 1
    - FY19/20: Implementation Round 2
- Prop 1 requires a 50% outside funding match for the entire proposal (which typically includes multiple projects).
- In order for a project to receive IRWM grant funding, it must be included in an IRWM Region's IRWM Plan. Funding match waivers can sometimes be obtained for projects that directly benefit Disadvantage Communities (DACs) or Economically Distressed Areas (EDAs).
- To be eligible for funding, IRWM Plans must comply with new Prop 1 Guidelines and Plan Standards in order to be eligible for implementation grant funding. Thus, Regions will be updating their IRWM Plans in the next couple of years.

IRWM implementation grant funding can be used to fund a wide variety of water-related projects including distribution/collection system upgrades, ecosystem restoration, stormwater projects and groundwater projects.

Groundwater Sustainability Grant Program

As previously noted, Prop 1 provided $800M for projects that prevent or cleanup contamination of groundwater that serves or has served as a source of drinking water. Administered by the SWRCB, the $800M to be awarded through the Grant Program includes $160M for DACs and EDAs, and at least $80M for severely DACs. In order to be eligible for this funding, a project must:

- Achieve at least one of the following:

    - Prevent the spread of contamination (both natural and human made) in an aquifer that serves or has served as a source of drinking water.
    - Accelerate the cleanup of contamination in an aquifer that serves or has served as a source of drinking water.
    - Protect an aquifer that serve as a source of drinking water.
    - Provide clean drinking water to DACs or EDAs.
- Be identified as a high priority by the applicable State or federal regulatory agencies (e.g. RWQCB, SWRCB, Department of Toxic Substances Control, USEPA).
- Have adequate funding match (50%) and applicant must have capability to pay O&M costs.
- Have a useful life of at least 20 years.

Eligible project types for this funding program include planning projects such as site assessment and characterizations, groundwater modeling, feasibility studies, remedial investigations, monitoring and reporting plans, and preliminary engineering design. Implementation projects that can be funded by this program include wellhead treatment, installation of extraction wells combined with treatment systems, centralized groundwater treatment systems, groundwater recharge projects to prevent or reduce contamination of municipal or domestic wells and groundwater injection projects to prevent seawater intrusion.

Under this Groundwater Sustainability Grant Program, the minimum planning grant amount is $100,000 with a maximum planning grant amount of $1M. For implementation grants, the minimum grant amount is $500,000 with no maximum award, except for DAC projects (which may receive a maximum construction grant of $5M). The application process for this program is as follows:

- Applicant fills out pre-application through FAAST.
- SWRCB reviews pre-application to identify "best" funding for the project (i.e. Groundwater Grant Program, DWSRF, etc.). Note: projects that are primarily drinking water treatment projects (i.e. treatment of natural contaminants or contaminants that are not amenable to source area cleanup) will be administered through the DWSRF program. The Groundwater Sustainability Grant Program can be used to support drinking water treatment projects if there is a need for grant funds and there are insufficient funds through the DWSRF to support the project.
- The appropriate SWRCB division will follow up with the applicant.
- Applicant submits final application, if invited back. Final applications due ~45 days after the invitation letter is sent to the applicant.
- SWRCB scores applications and release draft awards

SWRCB intends to have two solicitations each year: one targeted at DAC and EDA projects and the other for general solicitations. The SWRCB will be speaking with regulators as part of project selection process. Specifically, they said they would work with local Regional Boards to confirm that the proposed project is in fact a priority in the area; therefore, if you are going to pursue these funds, it is highly suggested that coordination with local Regional Boards be conducted to identify a Regional advocate for the project.

USGS Cooperative Agreements

The USGS participates in cooperative agreements with public organizations (such as cities, water districts and irrigation districts) to support efforts for research and data collection. Under this program, the USGS provides support and research for data collection and examination of the geological structure, water, mineral, and biological resources, and include efforts such as well installation and monitoring and

groundwater modeling. Awards are typically supported by funding from internal projects and programs, and funds are not separately budgeted or reserved for external projects or proposals under this entry.

SGMA Authorities for GSAs

As previously noted, Chapter 8, Financial Authority of the SGMA regulations provides GSAs with various powers and options for developing financing for SGMA-related programs. Specifically, Section 10730 allows for the levying of fees before GSP adoption to be used for GSP preparation, including investigations and data collection and analysis. Fees may be levied as a "regulated activity" to cover the "reasonable regulatory costs" for program development. To access a fee under Section 10730, the GSA must comply with the requirements of Prop 26. These include giving notice of the fee via newspaper publication and websites, providing data as to how the "reasonable regulatory costs" were estimated and how the fees were calculated, and by holding a hearing on the fees.

6.2 FUNDING OPPORTUNITIES FOR LONG-TERM ACTIVITIES

Long-term funding opportunities for GSP implementation would be generally the same as those described in Section 6.1, above, plus a few additional programs. For projects and programs included in the GSP for implementation, potential funding opportunities include those previously described as well as the WRFP/CWSRF Program, DWSRF Program, ISRF Program, Non-Point Source Grant Program, Small Community Wastewater Grant Program, Rural Development Water and Waste Disposal Program, Community Development Block Grant Program, Storm Water Grant Program, Water Desalination Grant Program, WaterSMART, Water Use Efficiency Grant Program, and WSIP. These programs are described below and vary in terms of the types of projects funded and size of potential funding award. There is also the potential to utilize permit fees, groundwater extraction fees, regulatory action fees, other fees, fees collected as taxes, assessments, and charges or tolls to fund long-term activities and projects; this is also described below.

WRFP/CWSRF Program

SWRCB administers the Clean Water (CW) State Revolving Fund (SRF) Program offering, low-interest loans to eligible applicants for construction of publicly-owned facilities including wastewater treatment, local sewers, sewer interceptors, water reclamation facilities, and stormwater treatment; expanded use projects (including implementation of nonpoint source projects or programs); and development and implementation of estuary comprehensive conservation and management plan. The Water Recycling Funding Program (WRFP) is a subprogram that falls under the purview of the CWSRF Program and promotes beneficial use of treated municipal wastewater (water recycling) in order to augment fresh water supplies in California by providing technical and financial assistance to agencies in support of water recycling projects and research. In addition to the approximately $200 to $300M of available funding through the CWSRF Program, Prop 1 provides $625M for planning and construction of water recycling projects. Other WRFP/CWSRF key points are as follows:

- CWSRF loans typically have a lower interest rate than bonds, at half of the General Obligation bond (typically 2.5% to 3%, currently 1.6%) at the time of the financing agreement.
- Loans are paid back over 20 or 30 years. Repayment begins one year after construction is complete.
- Historically, SWRCB has offered principal forgiveness (i.e. grants) to applicants if the project directly benefits a small, disadvantaged community. Guidelines for the amounts of principal forgiveness/grants available to DACs are outlined in the annual Intended Use Plan released by SWRCB each year.

- For a recycled water project, a CWSRF application is submitted in addition to necessary water recycling project-specific application items, including recycled water user assurances and a user connection schedule.
- The application process can take up to nine months to complete. Projects must comply with the California Environmental Quality Act (CEQA) and additional federal requirements (collectively referred to as CEQA-Plus). Other eligibility requirements include certification for compliance with water metering, certification for maintaining a Fiscal Sustainability Plan, complying with RWQCB requirements, and approval of an Urban Water Management Plan (UWMP) by DWR.
- Annually, the CWSRF program disburses $200 million to $300 million to agencies in California. SWRCB funds projects on a readiness-to-proceed basis. It is important to be aware that funding through the CWSRF Program may be limited in the near future due to an oversubscription of funds. SWRCB staff has stated that, unlike the past, if an applicant applies for a CWSRF loan, there is no guarantee that they will receive one. They continue to encourage agencies to apply, but have recommended applicants have a back-up plan for project financing should CWSRF financing not be available.
- Applications are submitted through SWRCB's online submittal system, FAAST.
- SWRCB may award a grant and/or low-interest loan financing.
    - One CWSRF application would be submitted through FAAST (consisting of General, Technical, Environmental, and Financial Packages) and SWRCB would then provide the best, available packaging of financing and grants at the time of finance agreement execution (could consist of Prop 1 grant, typical SRF financing, and/or principal forgiveness, if available).
    - A project may receive $15M or 35% of project costs for construction, whichever is less.
    - If WRFP construction grants are exhausted, a water recycling project would be eligible for the CWSRF low-interest loan, as well as principal forgiveness (i.e. grant monies) through the CWSRF Green Project Reserve (GRP). The eligible amount for principal forgiveness is 50% of the eligible GPR project cost or $2.5M, whichever is less. The maximum loan forgiveness amount per project is $2.5M.

DWSRF Program

The Drinking Water (DW) SRF Program is also administered by the SWRCB and provides drinking water grants and low-interest loans for public water system infrastructure improvements and related actions to meet safe drinking water standards and to ensure affordable drinking water. The application process for the DWSRF program similar to that for the CWSRF Program. Key points relating to this program are as follows:

- Eligible projects include water treatment systems, water distribution systems, interconnections, and consolidations, pipeline extensions, water sources, water meters, and water storage.
- Maximum loan amount based on borrowing capability of applicant.
- Interest rate is half the General Obligation bond (typically 2.5% to 3%, currently 1.6%) at the time of the financing agreement. A 0% interest rate may be available to public water systems serving small DACs.
- Loans are repaid over 20 or 30 years, or the useful life of the project for water systems serving DACs. Repayment begins one year after project completion.

- Principal forgiveness may be available to publicly owned water systems or non-profit mutual water companies serving DACs.
- Applications are submitted through SWRCB's online submittal system, FAAST.
- The application consists of the General, Technical, Financial, and Environmental packages. Application review and financing agreement execution can take up to 9 months.

ISRF Program

The Infrastructure SRF Program is a program administered by the California Infrastructure and Economic Development Bank (I-Bank) to provide financing for public infrastructure projects. Eligible projects include, but are not limited to, drainage, water supply and flood control, environmental mitigation measures, sewage collection and treatment, and water treatment and distribution. Similar to the DWSRF and CWSRF program, funding of amounts in the range of $50,000 - $25M are available for up to a 30-year term. Because the ISRF program is a state-run program, compliance with CEQA (rather than CEAQ-Plus) is required.

Non-Point Source Grant Program

Non-Point Source Grant Program is a program administered by the SWRCB to provide Clean Water Act funds for projects or programs that will help reduce non-point source pollution within the State. Projects that qualify for funding must be conducted within the state's NPS priority watersheds. Project proposals that address total maximum daily load implementation and those that address problems in impaired waters are favored in the selection process. There is also a focus on implementing management activities that lead to reduction and/or prevention of pollutants that threaten or impair surface and ground waters. Funding under this program varies based on availability (the most recent solicitation allows for projects ranging from $250,000 to $800,000), and a 25% match is required. As with other state funding programs, a DAC waiver can be applied for to meet or reduce the required funding match). Shorter concept proposals are typically first submitted under this program, outlining in program by providing a brief project description and answer short questions. The SWRCB then reviews the concept proposals submitted and invites the most competitive eligible proposals to submit full proposals to a level of at least 125% of available grant funds.

Small Community Wastewater Grant Program

Another SWRCB funding program is the CWSRF Small Community Grant Fund. This program provides financial assistance to small (i.e., with a population of 20,000 persons, or less) communities for planning, design, and construction of publicly-owned wastewater treatment and collection facilities. Eligible entities include public agencies, non-profits, and tribes. At present, $260M is available through Prop 1. Similar to the CWSRF program, this program provides both design and construction grants. Applications for this program are submitted via the SWRCB FAAST system.

Rural Development Water and Waste Disposal Program

The Rural Development Water and Waste Disposal Program is a funding program managed by the U.S. Department of Agriculture (USDA). This program provides loans and grants to develop and rehabilitate small community water systems in rural areas (population less than 10,000). Under this program, the USDA offers several funding opportunities including the Communities Facilities Direct Loan and Grant Program and the Water & Waste Disposal Loan Grant Program.

The Communities Facilities Direct Loan and Grant Program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that

provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings. This funding is only available for rural areas, defined as cities, villages, townships and towns including Federally Recognized Tribal Lands with no more than 20,000 residents according to the latest U.S. Census Data are eligible for this program. Funds received under the program can be used to purchase, construct, and/or improve essential community facilities, including utility services. Funding can be received as low interest direct loans, grants, or a combination of the two. Direct loan repayment terms may not be longer than the useful life of the facility, state statutes, the applicants' authority, or a maximum of 40 years, whichever is less. Interest rates are set by the USDA. Grant assistance is limited to:

- A maximum of 75% of eligible costs when the proposed project is located in a rural community having a population of 5,000 or fewer and the median household income of the proposed service area is below the higher of the poverty line or 60 percent of the State nonmetropolitan median household income.
- A maximum of 55% when the proposed project is located in a rural community having a population of 12,000 or fewer and the median household income of the proposed service area is below the higher of the poverty line or 70 percent of the State nonmetropolitan median household income.
- A maximum of 35% when the proposed project is located in a rural community having a population of 20,000 or fewer and the median household income of the proposed service area is below the higher of the poverty line or 80 percent of the State nonmetropolitan median household income.
- A maximum of 15% when the proposed project is located in a rural community having a population of 20,000 or fewer and the median household income of the proposed service area is below the higher of the poverty line or 90 percent of the State nonmetropolitan median household income.

The proposed project must meet both percentage criteria. Additional requirements of the program include the following:

- Applicants must have legal authority to borrow money, obtain security, repay loans, construct, operate, and maintain the proposed facilities
- Applicants must be unable to finance the project from their own resources and/or through commercial credit at reasonable rates and terms
- Facilities must serve rural area where they are/will be located
- Project must demonstrate substantial community support
- Environmental review must be completed/acceptable

The Water & Waste Disposal Loan Grant Program provides funding for clean and reliable drinking water systems, sanitary sewage disposal, sanitary solid waste disposal, and storm water drainage to households and businesses in eligible rural areas. Eligible areas include rural areas and towns with fewer than 10,000 people (check eligible addresses), tribal lands in rural areas, and colonias. The program provides long-term, low-interest loans and may be used to finance the acquisition, construction or improvement of:

- Drinking water sourcing, treatment, storage and distribution
- Sewer collection, transmission, treatment and disposal
- Solid waste collection, disposal and closure
- Storm water collection, transmission and disposal

Loans have a fixed interest rate, based on the need for the project and the median household income of the area to be served, and must be repaid within 40-years, based on the useful life of the facilities financed. Other requirements of the program are similar to those described above for the Communities Facilities Direct Loan and Grant Program.

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) is a voluntary program run by the USDA Natural Resources Conservation Science (NRCS) that provides financial and technical assistance to agricultural producers to plan and implement conservation practices that improve soil, water, plant, animal, air and related natural resources on agricultural land and non-industrial private forestland. The program is open to owners of land in agricultural production or persons who engage in livestock, agricultural or forest production on eligible land and that have a natural resource concern on that land may apply to participate in EQIP. Eligible land includes cropland, rangeland, pastureland, non-industrial private forestland and other farm or ranch lands. Under this program, financial assistance payments through EQIP are made to eligible producers to implement approved conservation practices on eligible land or to help producers develop Conservation Activity Plans (CAP) to address specific land use issues. Payments are made on completed practices or activities identified in an EQIP contract that meet NRCS standards. Payment rates are set each fiscal year and are attached to the EQIP contract when it is approved.

Community Development Block Grant Program

The Community Development Block Grant Program is managed by the Department of Housing and Community Development. Under this program, grants are available to cities and counties for public infrastructure projects that benefit low income persons/households and address a health and safety problem. Funding limits are set annually, and typically run around $1,500,000.

Storm Water Grant Program

The SWRCB's Storm Water Grant Program promotes the beneficial use of storm water and dry weather runoff by providing financial assistance for projects that provide multiple benefits while improving water quality. Approximately $200M in grants is available for multi-benefit storm water management projects. Currently, all planning funding and Round 1 of implementation funding under this program have been awarded; the date by which Round 2 implementation grant funding ($86M) will be released is not yet available.

Under this program, implementation grants will only be awarded to projects that are included and implemented in an adopted IRWM Plan and are included in a Storm Water Resource Plan. Projects need to respond to climate change, contribute to regional water security, and contain a minimum of two benefits as listed in Section III.G. – Storm Water Management Benefits of the program guidelines. Management Benefits. In order to improve regional water self-reliance security and adapt to the effects on water supply arising out of climate change, the purposes this funding are to:

- Help water infrastructure systems adapt to climate change, including, but not limited to sea level rise.
- Provide incentives for water agencies throughout each watershed to collaborate in managing the region's water resources and setting regional priorities for water infrastructure.
- Improve regional water self-reliance consistent with Water Code section 85021.

Specific types of eligible projects include green infrastructure, rainwater and storm water capture, storm water treatment facilities, and demonstration or pilot projects that are consistent with the eligibility requirements of Prop 1, Chapter 7, meet all requirements identified in these Guidelines, and are designed to lead to widespread implementation of the practice throughout the watershed. Proposed projects may be located on either public or private lands and may be located within urban or agricultural areas. Projects should be designed to infiltrate, filter, store, evaporate, treat, or retain storm water or dry weather runoff, and preference will be given to projects that capture and "re-purpose" storm water for a variety of potential benefits, including (but not limited to) water supply, flood control, habitat enhancement/restoration, and creating green spaces. Preference will also be given to projects that include partnerships between the organizations that are responsible for or have a role in realizing the multiple benefits identified in the project application. Applicants should look for new and innovative technologies or practices to meet the aforementioned goals.

All proposed projects, regardless of funding source, must be included in a Storm Water Resource Plan to be eligible for funding. The Storm Water Resource Plan must be submitted to the local IRWM group and the IRWM group must include the plan(s) in the IRWMP. The applicant must show proof that the local IRWM group has received the plan(s) to incorporate into their IRWMP. The only exceptions where a Storm Water Resource Plan is not required are: (1) per Water Code section 10563(c)(2)(B), the requirement for a Storm Water Resource Plan does not apply to a DAC with a population of 20,000 or less that is not a co-permittee for an MS4 permit issued to a municipality with a population of more than 20,000, and (2) for projects that are in an area of biological significance (ASBS) and are covered under an approved ASBS Compliance Plan. If an applicant or project is exempt from the Storm Water Resource Plan requirement, the project must still be included and implemented in an adopted IRWMP.

Specifics regarding the timing of funding availability and maximum funding amounts are not presently available; however, Prop 1 does require a 50% local funding match for grants. Funding match waivers are available for projects that directly benefit DACs and EDAs.

WaterSMART

The WaterSMART (Sustain and Manage American Resources for Tomorrow) funding program is a funding program operated by the U.S. Bureau of Reclamation (USBR). WaterSMART grants provide cost-shared funding for the following types of projects: Water and Energy Efficiency Grants, System Optimization Review Grants, Advanced Water Treatment and Pilot and Demonstration Project Grants, and Grants to Develop Climate Analysis Tools. Projects are selected through a competitive process and the focus is on projects that can be completed within 24 months that will help sustainable water supplies in the western United States. Funding awards range from $300,000 to $1M, depending on the WaterSMART subprogram, and require a 50% local cost share. Projects funded under these programs should seek to conserve and use water more efficiently, increase the use of renewable energy, protect endangered species, or facilitate water markets. The timing and availability of funding is set annually by the USBR and varies based on project and funding availability.

Water Use Efficiency Grant Program

DWR's Water Use Efficiency Grants Program provides funds to implement promising water use efficiency projects, including urban and agricultural implementation projects that result in water savings and other benefits to the state; technical assistance, training, education, and public outreach; and planning, feasibility studies, research and development, and pilot projects. By financially assisting local agencies in implementing their water use efficiency projects and programs, the funding program helps reduce the need for additional water supplies, reduce diversions, save energy, and improve water

supply reliability. This funding program was awarded $70M under Prop 1 and provides on-going revolving loan funding (through the CalConserve program) and grants to implement promising water use efficiency projects throughout the State that are primarily not locally cost-effective. This financial assistance program is for local agencies, joint powers authorities, public water/irrigation districts, federally recognized and state NAHC-listed Indian tribes, nonprofit organizations, other political subdivisions of the state involved with water management. The timing of the funding rounds varies by funding availability and grant program, as do grant requirements and eligible projects.

The CalConserve Revolving Fund Loan Program solicitation is available on a first-come, first-served basis until funds are exhausted. The 2015 Guidelines and PSP are currently used for this continuous solicitation, and projects will be reviewed and scored based on the scoring criteria in the guidelines. Approximately $6 million from Proposition 1 is available first come, first served until funds are exhausted. Of this funding, $1.75M is to be loaned out for water use efficiency upgrades and $5M is to be loaned out for fixing expensive and difficult to repair customer leaks. Projects that can be funded under the CalConserve program may include pilot project for local agencies to provide water efficiency upgrades to eligible residents at no upfront costs, and monies to local agencies to provide low-interest loans to customers to finance the installation of onsite improvements to repair or replace, as necessary, cracked or leaking water pipes to conserve water.

WSIP

The Water Storage Infrastructure Program (WSIP) is a program implemented by the California Water Commission (CWC) in conjunction with DWR. For this program, Prop 1 appropriated $2.7B for investments in water storage projects that provided provide measurable benefits to the Delta ecosystem or its tributaries. In evaluating proposals for this program, only public benefits will be funded (such as restored ecosystems, recreation, flood control, emergency response, and water quality), of which 50% must be ecosystem benefits. The program will also fund surface storage projects and groundwater management projects, and may include:

- Surface storage projects identified in the CALFED Record of Decision (with the exception of projects that are prohibited by the California Wild and Scenic Rivers Act);
- Groundwater storage projects and groundwater contamination prevention or remediation projects that provide storage benefits;
- Conjunctive use and reservoir reoperation projects;
- Local and regional surface storage projects that improve the operation of water systems in the state and provide public benefits.

In September 2016, CWC released revised draft regulations for the WSIP, as well as a 430-page technical reference document that provides specific information to applicants about the analysis of without-project and with-project conditions, benefits, and impacts required. Public comments were due October 3, 2016. CWC released revised documents in November 2016 with finalized documents released in December 2016. The funding program solicitation is to begin in 2017 and it is anticipated that DWR will release a Proposal Solicitation Package (PSP) or similar application-specific instructions and guidelines for the Program in early 2017. Project analyses required for this program include modeling to calculate physical changes and demonstrate anticipated benefits and extensive economic analyses that include monetization of benefits, where possible.

SGMA Authorities for GSAs

As previously noted, Chapter 8 of the SGMA legislation provides GSAs with necessary powers for collecting permit fees, groundwater extraction fees, regulatory action fees, other fees, and fees collected as taxes,

assessments, charges or tolls. Section 10730 of the California Water Code allows GSAs to collect taxes levee assessments and charge property-related and regulatory fees, some of which can be collected prior to GSP adoptions, and some of which may only be collected after plan adoption. In general, there are two type of fees that can be collected: those associated with regulatory activities and those associated with operations. Section 10730, as described above in Section 6.1, provides for funding for regulatory activities. These activities may be initiated prior to GSP adoption and may continue post adoption.

California Water Code Section 10730.2 provides funding for operations. These fees may only be levied after GSP adoption and are intended to be used to fund operations and maintenance, provide for reserves, facilities, water supply and distribution and other activities. These fees are levied on groundwater extractions and are typically subject to the Prop 218 process. Section 10730.2 revenues may not exceed the cost of service, revenue may only be used for service costs, and fees on a parcel must be proportional to the cost of providing service to that parcel. Approved fee types under Section 10730.2 include fixed fees, fees based on volumetric production, and fees estimated using annual production volumes, the year groundwater production started in a basin, and impacts to the basin. Fees provided under this section must, for the most part, follow a process similar to a municipal rate-making process.

7. GSP DEVELOPMENT

7.1 GSP REQUIREMENTS

7.1.1 Outline

Appendix B contains a recommended outline for the Delta-Mendota GSP. This outline is based on the approved SGMA Emergency Regulations (California Code of Regulations [CCR], Title 23, Division 2, Chapter 1.5, Subchapter 2 – Groundwater Sustainability Plans) and DWR's *Groundwater Sustainability Plan (GSP) Emergency Regulations Guide*.

7.1.2 Adoption

SGMA requires the GSA(s) to adopt their GSP prior to implementation. Section 10728.4 of the SGMA regulations contains minimum requirements for that adoption; these include requiring that GSA(s) hold a public hearing, held at least 90 days after providing notice to a city or county within the area of the proposed plan, prior to adoption. GSA(s) are also required to review and consider all comments that from entities that receive the notice and consult with any city or county that requests consultation within 30 days of receipt of the notice.

Section 10728.6 of the SGMA regulations specifically states that CEQA is not applicable to GSP preparation and/or adoption, and states that "Division 13 (commencing with Section 2100) of the Public Resources Code does not apply to the preparation and adoption of plan…"

7.1.3 Implementation

GSPs are to be implemented following adoption. As previously noted, annual reporting (demonstrating movement toward achieving interim milestones) and 5-year updates are required, in addition to the implementation of management actions, programs and projects to ultimately achieve the sustainability goal.

Per SGMA Regulations, GSPs must be fully implemented within 20 years and achieve the sustainability goal and measurable objectives stated in the plan. In developing the plan and preparing for implementation, it is important to remember that, under SGMA, the planning and implementation horizon for the GSP is a 50-year time period, which means that long-term planning for coordination with adjacent GSAs and subbasins, in addition to fiscal self-sufficiency, must be considered and planned for 50 years. Additionally, SGMA regulations notes that "Sustainability groundwater management is part of implementation of the California Water Action Plan", so that the objectives of this State Plan should be considered in GSP development and implementation, both from the standpoint of providing consistency with State goals and in anticipation of the availability of outside funding from the State to support achievement of those goals.

DWR may grant up to two 5-year extensions on development and implementation of a GSP if requested by the GSA and upon demonstrating a need for that extension.

7.2 SCHEDULE

A draft schedule for GSP development has been prepared and is included as Appendix C. This schedule, presented as a Gantt chart in elapsed time, shows the interrelationships between varying GSP sections and shows that it will take approximately 18 months for preparation of the GSP, including outreach activities and adoption. This schedule could (and will likely) be extended as the subbasin's sustainability

goal, minimum thresholds and measurable objectives are developed, as a numerical groundwater model is updated and to seek stakeholder buy-in for the proposed programs and management actions to be included in the GSP.

7.3 LEVEL OF EFFORT AND BUDGET

The estimated level of effort and cost associated with GSP preparation is going to vary depending on a number of factors, including:

- Availability and quality of data
- Data management system (DMS) platform selected
- Numerical groundwater flow model selected
- Status of models (CVHM and C2VSim) in released, updated versions
- Stakeholder outreach and consensus-building success
- Website selection and management (e.g. in-house vs consultant)
- Level of support required for GSP adoption
- Number and types of funding applications prepared

The following table summarizes relative requirements for manpower, costs, specialties required, and coordination and outreach for key work item related to GSP preparation. These items are also mirrored in the schedule included in Appendix C.

Based on the table shown below, GSP preparation could cost in the ballpark between $1M and $2.5M. On a per acre basis (assuming there are 764,247 acres in the Delta-Mendota Subbasin), these costs would range from $1.30/acre to $3.28/acre. On a per management area basis (assuming four management areas), these costs would range from $250,000 to $625,000 per management area.

Table 9: GSP Preparation Level of Effort

Work Item	Manpower	Cost	Specialties/ Contracting	Coordination with other GSAs	Stakeholder Outreach/Buy-in	Estimated Cost
GSP Front Sections (Introduction, Plan Area and Governance)		$	✓	☎	👍	$10,000 - $20,000
Data Collection and Review		$$	✓	☎☎☎		$30,000 - $50,000
Data Management System Construction		$$$	✓✓✓	☎	👍	$15,000 - $250,000
Data Analysis and Data Gap Identification		$$$	✓	☎	👍	$20,000 - $50,000
Identification of Groundwater Dependent Ecosystems		$$	✓✓	☎	👍👍	$10,000 - $20,000
Hydrologic Conceptual Model – including summarizing current and historical groundwater conditions		$	✓✓	☎☎☎	👍👍👍	$20,000 - $100,000
Model Refinement (including calibration and		$$$	✓✓✓	☎☎☎	👍👍	$500,000 - $1,000,000

Work Item	Manpower	Cost	Specialties/ Contracting	Coordination with other GSAs	Stakeholder Outreach/Buy-in	Estimated Cost
sensitivity analyses)						
Basin Water Budget		$$	✓✓✓	☎	👍👍👍	$20,000 - $50,000
Sustainability Goal and Criteria		$$	✓	☎	👍👍👍	$40,000 - $100,000
Identify Projects/Programs/Management Actions		$	✓	☎	👍👍👍	$15,000 - $30,000
Develop Monitoring Program		$	✓✓	☎☎☎	👍👍	$30,000 - $75,000
Alternatives Evaluation and Prioritization		$$	✓	☎	👍👍👍	$40,000 - $60,000
Develop Implementation Plan		$	✓	☎	👍👍👍	$30,000 - $50,000
Website Development		$	✓✓			$5,000 - $15,000
Prepare GSP		$	✓	☎	👍	$100,000 - $250,000
Outreach and Facilitation Support		$$$	✓✓	☎☎	👍👍👍	$50,000 - $100,000
Program Management and Communication		$$	✓	☎	👍👍	$50,000 - $100,000
GSP Adoption Support		$	✓	☎	👍👍👍	$15,000 - $30,000

Work Item	Manpower	Cost	Specialties/ Contracting	Coordination with other GSAs	Stakeholder Outreach/Buy-in	Estimated Cost
Sustainable Groundwater Planning Grant Application		$	✓✓	☎		$20,000 - $50,000
Other Funding Applications		$$	✓✓	☎		TBD*
					Range of Estimate	$1M - $2.5M
					Potential Grant Funding (requiring 50% local match)	$1M - $2M

* To Be Determined (TBD) based on the particular funding program application requirements.

7.4 ALLOCATION OPTIONS

One immediate question relating to GSP preparation is how to allocate costs moving from the current state of GSA adoption to completion of a GSP. In most cases, such cost allocations strive to equate cost proportional to benefit received. This simple concept may not be simple to implement for GSP development.

The Water Authority has spent considerable time identifying and discussing alternative GSP development cost allocation scenarios. The following table presents a range of potential cost allocation scenarios. The Water Authority provided the first six scenarios; the remaining scenarios are presented for consideration by the participating agencies.

Table 10: GSP Cost Allocation Alternatives

	Allocation Basis	No. Participants	Discussion
1	Gross Acreage	5	Simple division of cost by acreage in each GSA.
2	Equal Shares by GSA	5	Each GSA pays an equal share. May not represent value received by GSA.
3	50% by GSA, 50% by Acreage	5	50% cost split based on acreage and number of GSAs.
4	50% by Acreage, 50% by Seat at Table	13	50% of costs paid based on acreage served, with remaining 50% paid based on having a decision making role in the GSP development.
5	50% by Acreage per GSAs with > 10% of Acreage, 10% by Areas with < 10% of acreage	3	Allocates 10% of the cost to each of the GSAs with less than 10% of the acreage, with the remaining cost allocated to the remaining GSAs based on acreage.
6	Total Pumping within each GSA	TBD	Would allocate cost strictly on average annual groundwater pumping.
7	Total Average Annual Water Use by GSA	TBD	Would allocate cost strictly on total average annual water use.
8	50% by Total Annual Pumping, 50% by Acreage	TBD	Would allocate cost with 50% of cost based on average annual groundwater pumping and 50% based on acreage served.
9	50% by Total Annual Water Use, 50% by Acreage	TBD	Would allocate cost with 50% by total annual water use and 50% by acreage served.
10	Independent Formula Development	TBD	A new formula for cost allocation would be independently developed specifically for GSP preparation

A facilitated discussion regarding a cost allocation methodology will likely be required and, as shown above, may result in a composite methodology for GSP preparation. As part of this discussion, a two-part process will likely be required. For the first part, a list of possible factors (e.g. acreage, groundwater pumping, water use, number of votes) to be used in the allocation strategy should be identified. Additionally, other components to consider in development of allocation formulas are measures of need, fiscal capacity, and effort. Need refers to how much a given party is dependent on a given

allocation whereas fiscal capacity is the ability of those receiving aid to pay for the services on their own. Most formulas combine at least two or more factors.

Once potential allocation factors are identified, weights or percentages can be attributed to each to develop a consensus-built formula for cost allocation. This formula should also consider the frequency and timing of allocations and distributions, measures of need and fiscal capability, and likelihood of obtaining outside funding. Regardless of the formula, results will be dictated by the variables used for the inputs.

In developing the formula, additional considerations to be incorporated include the following:

- Does the choice of factors provide a good conceptual fit that may improve the initial and ongoing credibility of the allocation process?
- What level of geographic detail does the data come in?
- How much time as elapsed between the reference period for the estimates and the period for which allocations are being made.
- What level of sampling variability and bias is present? What effect does this have on initial distributions and year to year changes in allocations?

In addition to providing a mechanism for addressing changes in need and other formula components, formula-based allocations help build consensus and credibility by creating a transparent means of allocating funds, creating a solid foundation for negotiation, separating the question of how to distribute funds from why they are needed, creating appearance of a sound analytic process, and providing a starting point for the reallocation process.

There are various ways that allocation formulas can be developed. On one end of the spectrum, the GSAs would lay out the goals and intentions, and allows the member agencies to specify the allocation formula. On the other end of the spectrum, the GSAs leave out the member agencies entirely and comes up with its own allocation formula. While there are pros and cons to both sides, it is advised that the resultant formula consider giving some flexibility to the member agencies, especially in determining what data sources and procedures should be used to produce estimates of the components of allocation formulas. Furthermore, periodic evaluations are necessary to maintain and improve the allocation process. With that comes the tradeoffs between stability of funding and adjustments to meet shifting needs. Evaluations should consider whether or not the program is working as intended, and study how formula inputs and outputs are impacted by special provisions.

Special features included in allocation formulas can also result in unintended consequences. Hold harmless provisions are meant to limit disruptions in program administration and service delivery at state and local levels. However, they can also delay response to changing patterns of need. With thresholds, a small change, whether true or from a statistical variation, can substantially affect the funding received. The only way to address the impacts of these special features is to evaluate beforehand and make adjustments as needed throughout the process.

An example of an allocation formula used to determine contributions comes from the United Nations (UN). While not directly applicable to the situation at hand, the parameters or factors used by the UN in its allocation formulation provides some insights into possible factors to consider for the Delta-Mendota GSP preparation.

The United Nations operates a formula-based assessment system based primarily on gross national product but takes into account debt burden, per capita income, a ceiling for the least developed countries, and other adjustments. The underlying principle follows that expenses should be apportioned

according to capacity to play. It is difficult to measure such a capacity strictly using statistics and no definitive formula could be reached. Therefore, other factors are also taken into consideration.

- Income was used as a measure of capacity to pay. Comparative estimates of income are determined to be the fairest guide in measuring this capacity.
- Low per capita income allowance. Comparative income per head of population is factored into the formula through the application of the low per capita income allowance. This embodies the principle that citizens of a rich country contribute a larger share of their taxes to the UN than those of a poorer country who need to allocate a larger part of their income to basic necessities. "Assessable income" that reduces the assessable income of members with large populations by the percentage difference between capita income and a per capita income threshold corresponding to the average per capita income.
- Maximum and minimum rates of assessment. Maximum rate was instituted as a means of reducing the financial dependence of the organization on a single member. Minimum floor is based on the premise that the collective financial responsibility of an organization is borne by every member of the organization.
- Per capita ceiling specifies per capita contribution of any member state not exceed that of the highest paying contributor.
- An allowance to ease the burden of heavily indebted member state who devote a large portion of foreign earnings toward the servicing of external debt
- A cap of 0.01 percent of total expenditures on the assessment rates of the least developed countries
- A scheme of limits designated to mitigate extreme variations in assessments between two successive scales
- A mitigation proves whereby the resulting scale derived from the step by step application of the methodology is adjusted in order to take account of relevant factors.

Factors such as these may be used in developing the GSP allocation formula.

Appendix A – Summary of Potential Databases for Use in GSP Development

Appendix A

BASIN SPECIFIC REPORTS				
Management Area	**Agency**	**Title**	**Author**	**Year**
North	San Luis & Delta-Mendota Water Authority	Groundwater Management Plan for the Southern Agencies in the Delta-Mendota Canal Service Area	AECOM	2014
Central	San Luis & Delta-Mendota Water Authority	Groundwater Management Plan for the Northern Agencies in the Delta-Mendota Canal Service Area	AECOM	2011
Eastern	San Joaquin River Exchange Contractor Water Authority	Groundwater Management Plan	KDSA	2008
All	San Luis & Delta-Mendota Water Authority	Review of 2012-2013 Depth to Groundwater Readings	P&P	2013
All	San Luis & Delta-Mendota Water Authority	Westside-San Joaquin Intergrated Water Resources Plan - Draft	RMC	2014
Multiple	San Luis & Delta-Mendota Water Authority	Delta-Mendota Canal Groundwater Pumping Analysis	Stoddard	1995
Multiple	San Luis & Delta-Mendota Water Authority	Water Needs Analysis for the Delta-Mendota Canal Service Area Water Contractors Undergoing Contract Renewal	Stoddard	1994
Multiple	San Luis & Delta-Mendota Water Authority	DMC Turnout Monthly Deliveries	SLDMWA	On-going
All	Western San Joaquin River Watershed	Groundwater Quality Management Plan	LS	2016
All	Western San Joaquin River Watershed	Groundwater Quality Assessment Report	LS	2015
All	USGS	Groundwater-Quality Data in the Wester San Joaquin Valley Study Unit, 2010: Results from the California GAMA Program	USGS	2010
Multiple	USGS	Land Subsidence along the Delta-Mendota Canal in the Northern Part of the San Joaquin Valley, California, 2003–10	USGS	2013
All	UGSS	Geology, Hydrology, and Water Qualit of the Trace-Dos Palos Area	USGS	1972
All	San Luis & Delta-Mendota Water Authority	Groundwater Overdraft in the Delta-Mendota Subbasin	KDSA	2015
Central	Kings River Conservation District	Groundwater Mangaement Plan (Tranquillity)	WRIME	2008
Multiple	DWR	San Joaquin Drainage Program	DWR	On-going
All	San Luis & Delta-Mendota Water Authority	Detla-Mendota Subbasin Groundater Monitoring Program (CASGEM Report)	SLDMWA	2015
Multiple	County of Merced	General Plan	County of Merced	2012
Multiple	County of Stanislaus	General Plan	County of Stanislaus	2015
Multiple	County of Fresno	General Plan	County of Fresno	2000
East	County of Madera	General Plan	County of Madera	1995
North	County of San Joaquin	General Plan	County of San Joaquin	2010
East	City of Los Banos	General Plan	City of Los Banos	2009
East	City of Los Banos	Urban Water Management Plan	P&P	2016
East	City of Firebaugh	General Plan	Collins & Schoettler	2010
South	City of Mendota	General Plan	City of Mendota	2009
North	City of Gustine	General Plan	City of Gustine	2002
North	City of Newman	General Plan	DCE	2007
North	City of Newman	Urban Water Management Plan	Gouveia Engr	2015
North	City of Patterson	General Plan	City of Patterson	2010
North	City of Patterson	Urban Water Management Plan	RMC	2015
North	Del Puerto Water District	Ag Water Management Plan	Del Puerto Water District	2011
North	Patterson Irrigation District	Ag Water Management Plan	Patterson Irrigation District	2014
North	West Stanislaus Irrigation District	Ag Water Management Plan	West Stanislaus Irrigation District	2014
East	Grassland Water District	Ag Water Management Plan		
East	Central California Irrigation District	Ag Water Management Plan	Central California Irrigation District	2014
East	Firebaugh Canal Water District	Ag Water Management Plan	Firebaugh Canal Water District	2014
East	San Luis Canal Co.	Ag Water Management Plan	San Luis Canal Co.	2014
East	Aliso Water District	Groundwater Management Plan	KDSA	2014
Central	Pacheco Irrigation District	Ag Water Management Plan	Pacheco Irrigation District	2010
Central	San Luis Water District	Ag Water Management Plan	San Luis Water District	2016
Central	Tranquillity Irrigation District	Ag Water Management Plan	P&P	2011
Central	Fresno Slough Water District	Groundwater Management Plan jointily with TID	P&P	2009
Central	Tranquillity Irrigation District	Groundwater Management Plan jointly with FSWD	P&P	2010
South	Mendota Pool Group	Annual Report	Various	On-going
East	Columbia Canal Company	Ag Water Management Plan	Columbia Canal Company	2012

Appendix A

GENERAL REFERENCES				
Management Area	**Agency**	**Title**	**Author**	**Year**
All		California Data Exchange Center Database	DWR	On-going
All		Public Water System Drinking Water Quality Database	SWRCB-DDW	On-going
All		Groundwater Information Center GIS	DWR	On-going
All		Groundwater Information Center	DWR	On-going
All		CIMIS Database	DWR	On-going
All		Groundwater Availability of the Central Valley Aquifier	USGS	2009
All		Progress Report: Subsidence in the Central Valley, California	NASA JPL	2016
All		Groundwater Conditions and Storage Capacity in the San Joaquin Valley	USGS	1959
Multiple		Crop Usage Data Reports	USBR	On-going
All	The Nature Conservancy	Groundwater Dependent Ecosystems mapping	TNC	pending
All	CalFed	Watershed Map	California Department of Conservatio	On-going
All		Calfiornia State Legislature Districts	State of California	On-going

Appendix B – Recommended Outline for Delta-Mendota GSP

Recommended Outline for Delta-Mendota GSP

Executive Summary (§354.4)

1. Introduction – summary of SGMA, purpose of GSP, and organization of GSP
2. Plan Area (§354.8) – including maps of the basin and areas covered, jurisdictional boundaries, existing land use designations, identification of water use sector and water source type, and density of wells per square mile
   - 2.1. Plan Area Description (including description of individual Management Areas (§354.20) and any adjudicated areas)
   - 2.2. Land use elements
     - 2.2.1. Applicable general plans
     - 2.2.2. Description of how implementation of these plans may affect basin management
     - 2.2.3. Description of how Plan implementation may affect General Plan implementation
     - 2.2.4. Well permitting process
     - 2.2.5. Impacts of land use plans outside of Plan area
   - 2.3. Identification of existing water resource monitoring and management programs – including description of programs and who's implementing them; whether they will be incorporated into the Plan monitoring and/or management program and if they limit operational flexibility in the basin (including how the Plan will adapt to those limits)
   - 2.4. Description of conjunctive use programs in the basin
   - 2.5. Description of additional plan elements
     - 2.5.1. IRWM Plans
     - 2.5.2. Habitat Conservation Plans
     - 2.5.3. Other Plans
3. Governance
   - 3.1. Description of GSA – including organization and management structure and legal authority under which it operates (§354.6)
   - 3.2. Contact Agency Information (§354.6)
   - 3.3. Intra-Agency Coordination Agreements (§357.4) – describe required coordination agreements (required where there is more than one GSP to be implemented in a groundwater basin)
   - 3.4. Inter-basin Agreements (§357.2) – describe any inter-basin agreements (optional agreements between GSAs implementing GSPs in neighboring groundwater basins)
4. Outreach and Communication
   - 4.1. Description of beneficial uses and users in Plan Area (§354.10)
   - 4.2. Plan Development
     - 4.2.1. Noticing and Public Meetings (§354.10)
     - 4.2.2. Comments received regarding the plan (§354.10)
   - 4.3. Outreach (§354.10)
     - 4.3.1. Decision-making process
     - 4.3.2. Opportunities for public engagement
     - 4.3.3. Outreach to diverse social, cultural and economic areas of the population
     - 4.3.4. Methods for disseminating information
5. Basin Setting (Subarticle 2) – present for Plan Area as whole, and for individual Management Areas, if applicable (§354.20)

5.1. Overview
5.2. Hydrogeologic Conceptual Model (§354.14) (including identification of data gaps and maps/cross-sections) – including justification for individual Management Areas (§354.20)
5.2.1. Regional Setting (both geologic and structural)
5.2.2. Basin Boundaries (including lateral boundaries, geologic features that impede flow, and definable bottom)
5.2.3. Principal Aquifers and Aquitards (including formation names, physical and structural properties, water quality, and primary uses)
5.2.4. Identification of Data Gaps and Uncertainty
5.3. Current and Historic Groundwater Conditions (§354.16) (description, maps, and graphs)
5.3.1. Groundwater Elevations
5.3.2. Groundwater Storage
5.3.3. Seawater Intrusion
5.3.4. Groundwater Quality
5.3.5. Land Subsidence
5.3.6. Interconnected Surface Water Systems
5.3.7. Groundwater Dependent Ecosystems
5.4. Water Budget (§354.18) – include description of model(s) used if applicable
5.4.1. Current
5.4.2. Historical
5.4.3. Projected Future
5.5. Management Areas (if applicable)

6. Sustainable Management Criteria (Subarticle 3)
6.1. Sustainability Goal (§354.24) – include description of how model(s) were used to develop this (if appropriate)
6.2. Undesirable Results (§354.26) – for each section (as appropriate) and for individual Management Areas, if applicable (§354.20), define what an undesirable result looks like and the criteria used to determine when and where the effects of groundwater conditions would cause said result; and describe the potential effects on beneficial uses/users that are or may occur from undesirable results
6.2.1. Chronic Lowering of Groundwater Levels
6.2.2. Reduction of Groundwater Storage
6.2.3. Seawater Intrusion
6.2.4. Degradation of Water Quality
6.2.5. Land Subsidence
6.2.6. Depletion of Interconnected Surface Water
6.3. Minimum Thresholds - present a minimum threshold for each undesirable result to determine if such a result is occurring (§354.28) and justify if not applicable; describe the cause of groundwater conditions that have or would lead to the undesirable results
6.3.1. Groundwater Levels
6.3.2. Groundwater Storage
6.3.3. Seawater Intrusion
6.3.4. Water Quality
6.3.5. Land Subsidence

6.3.6. Interconnected Surface Water

7. Measurable Objectives (§354.30) – for each undesirable result and for individual Management Areas as appropriate (§354.20), establish a measurable objective and present interim milestones in 5 year increments to achieve that objective
   - 7.1. Management of Groundwater Levels
   - 7.2. Management of Groundwater Storage
   - 7.3. Prevention of Seawater Intrusion
   - 7.4. Protection of Water Quality
   - 7.5. Prevention of Land Subsidence
   - 7.6. Protection of Interconnected Surface Water
8. Implementation
   - 8.1. Monitoring (Subarticle 4)
     - 8.1.1. Monitoring Objectives – including how the network will be developed and implemented to monitor groundwater and related surface conditions and interconnections.
     - 8.1.2. Monitoring Networks (§354.34) – describe for Plan Area as whole and for individual Management Areas as appropriate (§354.20). Include information regarding how network will be developed and implemented with regards to each sustainability indicator. Describe how the network is capable of collecting sufficient data to demonstrate short-term, seasonal and long-term trends and yield representative information about groundwater conditions to evaluate plan implementation; describe existing data gaps (if they exist).
     - 8.1.3. Representative Monitoring Program (§354.36) – if applicable
     - 8.1.4. Monitoring Protocols (§354.34) – description of technical standards, data collection methods, and other procedures or protocols pursuant to CWC §10727.2(f). Address monitoring frequency and density of monitoring sites (map) to demonstrate sufficient in showing short-term, seasonal and long-term trends (§354.38). Demonstrate consistency with data and reporting standards.
     - 8.1.5. Data Analysis and Reporting (§354. 40)
       - 8.1.5.1. Data Analysis – for each undesirable result, describe how implementation of the program will demonstrate progress towards achieving the measurable objectives, monitor impacts to beneficial users of groundwater, monitor changes in groundwater conditions and quantify annual changes in water budget components.
       - 8.1.5.2. Data Management
       - 8.1.5.3. Reporting – including reporting to public and to DWR (included in Annual Report)
     - 8.1.6. Monitoring Network Review and Improvement (§354.38)
       - 8.1.6.1. Monitoring Program Review – describe how monitoring program will be reviewed every 5 years and improved, including a determination of uncertainty and whether there are data gaps.
       - 8.1.6.2. Data Gaps - If data gaps are identified, present a plan for addressing those data gaps
   - 8.2. Projects and Management Actions (Subarticle 5)
     - 8.2.1. Methods for Identifying and Criteria for Evaluating Projects – including methods for noticing public and other agencies regarding project or action being considered for implementation (§354.44)

8.2.2. List of Projects and Management Actions – provide summary list and describe how the projects/actions will ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods. (§354.44)

8.2.2.1. Project 1 – For each project included in the list, provide including description of measurable objective addressed and expected benefits, regulatory and permitting processes required, status, schedule for implementation and benefits accrual, explanation of how project/action will be accomplished, description of legal authority required, estimated cost (§354.44)

8.2.3. Uncertainty Associated with Projects/Actions Relative to Achieving Basin Objectives (§354.44)

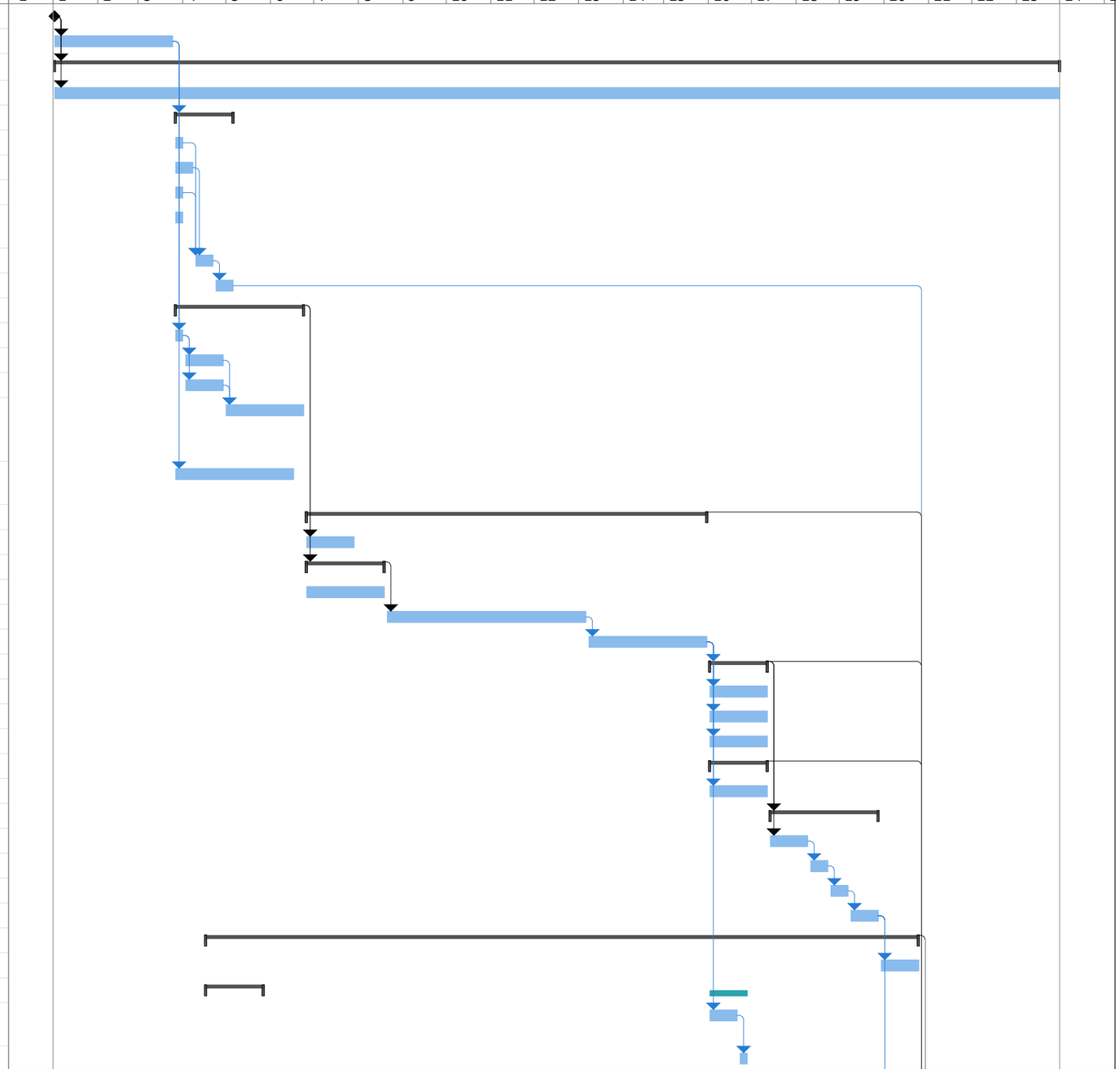
9. Plan Implementation
   - 9.1. Reporting
     - 9.1.1. Annual Reporting to DWR (§356.2)
     - 9.1.2. Reporting to Stakeholders and the Public
   - 9.2. Financing
     - 9.2.1. Estimated cost of plan implementation (§354.6)
     - 9.2.2. Methods for financing plan implementation (§354.6)
   - 9.3. Schedule for Implementation
   - 9.4. Plan Update (§356.4) – Describe program for regularly (min every 5 years) updating the GSP.
10. References and Technical Studies Used (§354.4)

Appendices:

- Contact information for Plan Manager and GSA
- List of Public Meetings and Outreach Activities
- Interagency Agreements
- Technical Appendices
- Groundwater Model Documentation
- GSP Adoption Activities – public review, comments and responses, adoption resolutions

Appendix C – Schedule for GSP Preparation

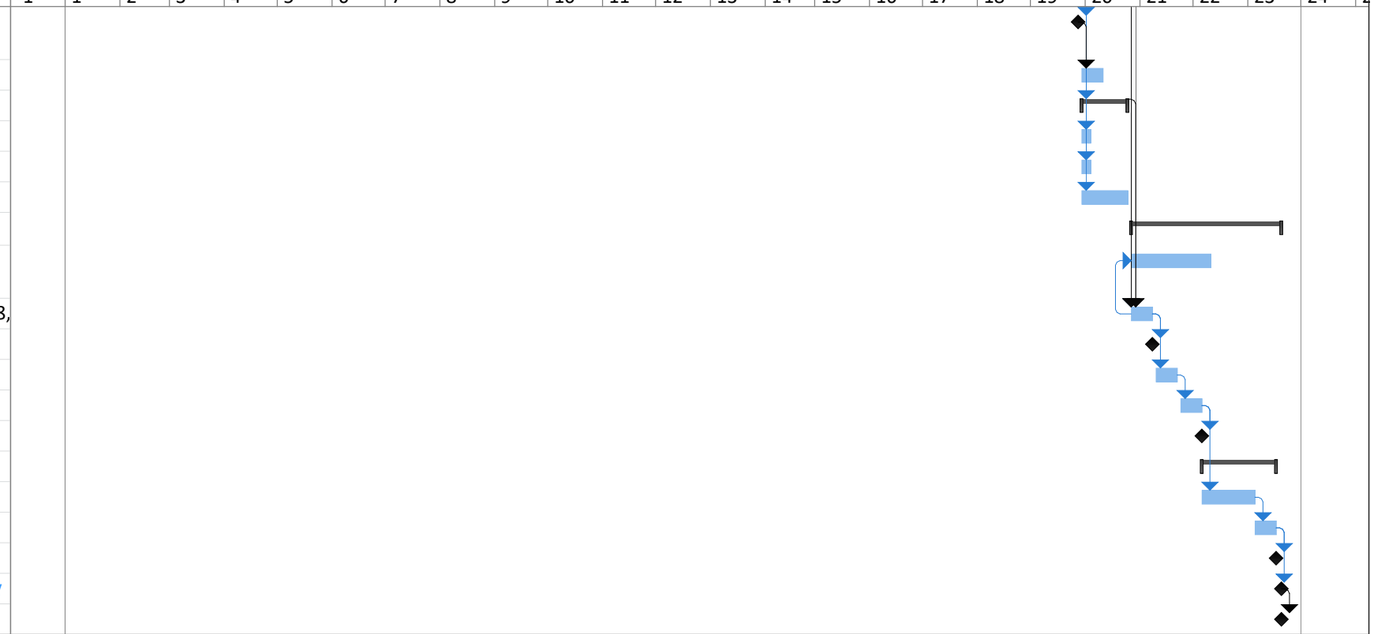
ID	Ta M	Task Name	Duration	Start	Finish	Predecessor
1		Notice to Proceed	0 days	Mon 1/2/17	Mon 1/2/17	
2		Establish GSAs	60 days?	Mon 1/2/17	Fri 3/24/17	1
3		**GSP Preparation**	**500 days**	**Mon 1/2/17**	**Fri 11/30/18**	**1**
4		**Chapter 4: Outreach and Communication**	**500 days**	**Mon 1/2/17**	**Fri 11/30/18**	**1**
5		**General Front End Sections**	**30 days**	**Mon 3/27/17**	**Fri 5/5/17**	**2**
6		Chapter 1: Introduction	5 days	Mon 3/27/17	Fri 3/31/17	
7		Chapter 2: Plan Area	10 days	Mon 3/27/17	Fri 4/7/17	
8		Chapter 3: Governance	5 days	Mon 3/27/17	Fri 3/31/17	
9		GSA Description, Inter-Agency Agreements, Inter-Basin Agreements (Assume done and in place)	5 days	Mon 3/27/17	Fri 3/31/17	
10		Review Draft Chapters	10 days	Mon 4/10/17	Fri 4/21/17	6,7,8
11		Revise Draft Chapters	10 days	Mon 4/24/17	Fri 5/5/17	10
12		**Data Collection and Update of Basin Conditions**	**65 days**	**Mon 3/27/17**	**Fri 6/23/17**	
13		Comparison of GWMP with SGMA legislation	5 days	Mon 3/27/17	Fri 3/31/17	2
14		Update historical data	20 days	Mon 4/3/17	Fri 4/28/17	13
15		Update Projected water demands and supplies from 2015 UWI	20 days	Mon 4/3/17	Fri 4/28/17	13
16		Use new data to update Introduction, Water Resource Conditions, and Water Requirements and Supplies draft chapters of GMP to meet GSP regulations	40 days	Mon 5/1/17	Fri 6/23/17	14,15
17		Collect data on IRWM Plans, Habitat Conservation Plans, and others in the region	60 days	Mon 3/27/17	Fri 6/16/17	2
18		**Chapter 5: Basin Setting**	**200 days**	**Mon 6/26/17**	**Fri 3/30/18**	
19		Hydrologic Conceptual Model	25 days	Mon 6/26/17	Fri 7/28/17	12
20		Data Collection and Analysis	40 days	Mon 6/26/17	Fri 8/18/17	12
21		Groundwater data, other plans	40 days	Mon 6/26/17	Fri 8/18/17	
22		Update Existing Groundwater Model	**100 days**	**Mon 8/21/17**	**Fri 1/5/18**	**20**
23		Develop Basin Water Budget	60 days	Mon 1/8/18	Fri 3/30/18	22
24		**Chapter 6: Sustainable Management Criteria**	**30 days**	**Mon 4/2/18**	**Fri 5/11/18**	**23**
25		Establish Sustainability Goals	30 days	Mon 4/2/18	Fri 5/11/18	23
26		Undesirable Results	30 days	Mon 4/2/18	Fri 5/11/18	23
27		Minimum Thresholds	30 days	Mon 4/2/18	Fri 5/11/18	23
28		**Chapter 7: Measurable Objectives**	**30 days**	**Mon 4/2/18**	**Fri 5/11/18**	
29		Measurable Objectives	30 days	Mon 4/2/18	Fri 5/11/18	23
30		**Identify Management Actions**	**55 days**	**Mon 5/14/18**	**Fri 7/27/18**	**24**
31		Solicit Projects	20 days	Mon 5/14/18	Fri 6/8/18	24
32		Review Projects	10 days	Mon 6/11/18	Fri 6/22/18	31
33		Prioroitize Projects	10 days	Mon 6/25/18	Fri 7/6/18	32
34		Communication and Buy-in	**15 days**	**Mon 7/9/18**	**Fri 7/27/18**	**33**
35		**Chapter 8:Implementation**	**355 days**	**Mon 4/17/17**	**Fri 8/24/18**	
36		Develop Implementation Plan	20 days	Mon 7/30/18	Fri 8/24/18	34
37		**Monitoring Update**	**30 days**	**Mon 4/17/17**	**Fri 5/26/17**	
38		Modification of existing monitoring network to comply with GSP regulations	15 days	Mon 4/2/18	Fri 4/20/18	23
39		Draft Updated Monitoring text	5 days	Mon 4/23/18	Fri 4/27/18	38



Project: SLDMWA SGMA Schedule
Date: Thu 1/26/17

Task | Milestone | Summary | Manual Progress

ID	Ta M	Task Name	Duration	Start	Finish	Predecessor
40		Workshop: Update implementation measures and implementation schedules)	0 days	Fri 7/27/18	Fri 7/27/18	34
41		Development of draft implementation chapters	10 days	Mon 7/30/18	Fri 8/10/18	40
42		**Chapter 9: Plan Implementation**	**20 days**	**Mon 7/30/18**	**Fri 8/24/18**	**34**
43		Projects/Management Actions	5 days	Mon 7/30/18	Fri 8/3/18	34
44		Reporting and Updates	5 days	Mon 7/30/18	Fri 8/3/18	34
45		Financing Plan	20 days	Mon 7/30/18	Fri 8/24/18	34
46		**GSP Plan Compilation**	**61 days**	**Mon 8/27/18**	**Mon 11/19/18**	
47		Statement of how interested parties may participate in GSP development/ implementation	33 days	Mon 8/27/18	Wed 10/10/18	48SS
48		Develop Admin Draft	10 days	Mon 8/27/18	Fri 9/7/18	11,18,24,28,
49		Administrative Draft GSP	0 days	Fri 9/7/18	Fri 9/7/18	48
50		Review by Agencies	10 days	Mon 9/10/18	Fri 9/21/18	48
51		Develop Draft for Public Review	10 days	Mon 9/24/18	Fri 10/5/18	50
52		Draft GSP	0 days	Fri 10/5/18	Fri 10/5/18	51
53		**Review Period**	**30 days**	**Fri 10/5/18**	**Fri 11/16/18**	
54		Public Review	30 edays	Fri 10/5/18	Sun 11/4/18	51
55		Edits following public review	10 days	Mon 11/5/18	Fri 11/16/18	54
56		Final GSP for DWR Adoption	0 days	Fri 11/16/18	Fri 11/16/18	55
57		Public hearing to adopt GSP	0 days	Mon 11/19/1	Mon 11/19/18	55FS+1 day
58		Adopt GSP	0 days	Mon 11/19/1	Mon 11/19/18	57



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Task | Milestone | Summary | Manual Progress