

MADERA SUBBASIN

Sustainable Groundwater
Management Act (SGMA)

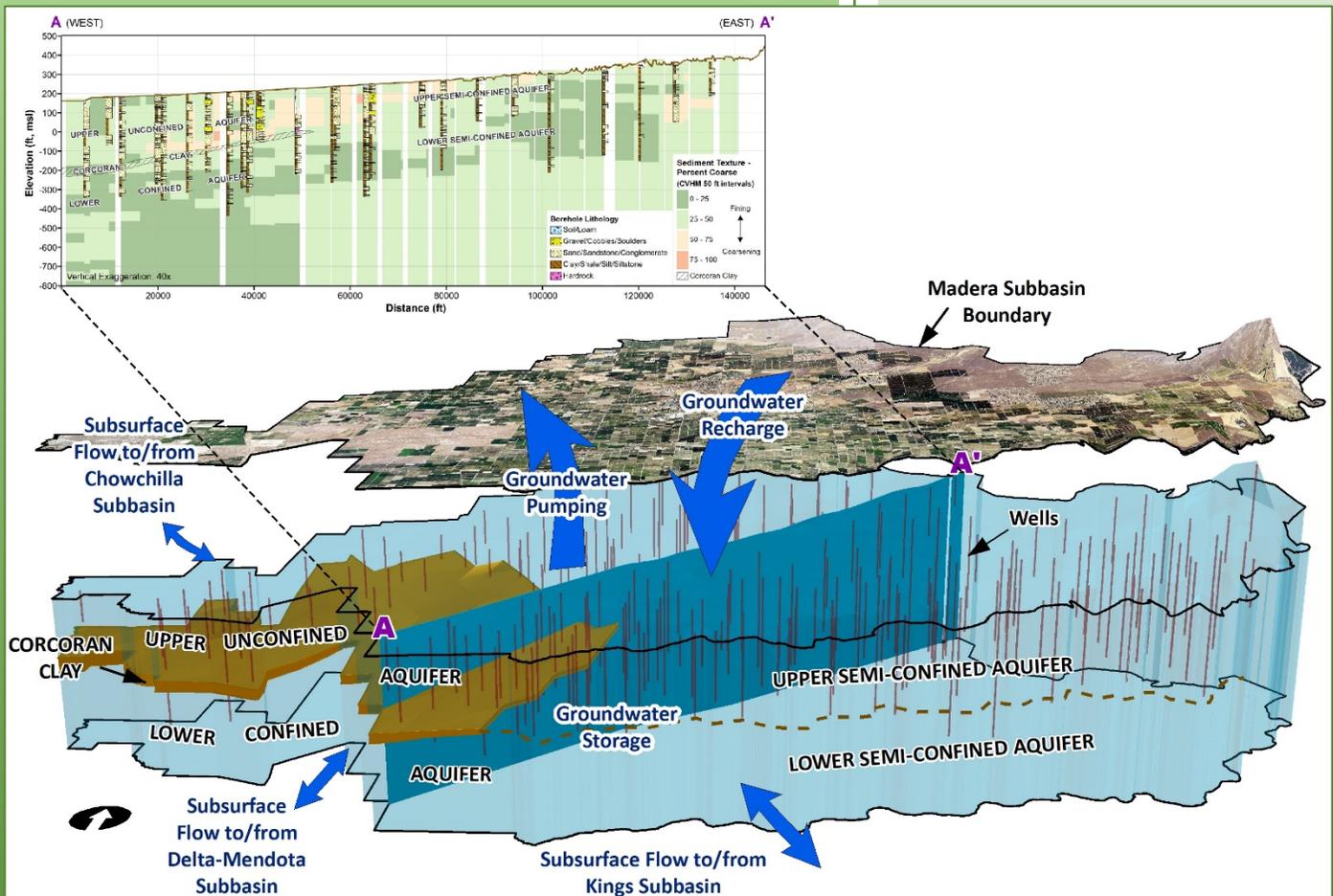
*Joint Groundwater Sustainability
Plan
Chapter 5*

January 2020



Prepared by

Dauids Engineering, Inc
Luhdorff & Scalmanini
ERA Economics
Stillwater Sciences and
California State University, Sacramento



PUBLIC REVIEW DRAFT

Madera Subbasin

**Sustainable Groundwater
Management Act**

**Joint Groundwater Sustainability Plan
Chapter 5**

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Prepared For

Madera Subbasin Coordination Committee

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LIST OF ABBREVIATIONS

AFY	acre-feet/year	eWRIMS	Electronic Water Rights Information Management System
AG	Agricultural Land		
AGR	agricultural supply		
AN	above normal	Flood-MAR	Flood Managed Aquifer Recharge
AWMPs	Agricultural Water Management Plans	FTE	full-time-equivalent
AWS	Automatic Weather Stations	GAMA	Groundwater Ambient Monitoring and Assessment
BMP	Best Management Practice		
BN	below normal	GDEs	groundwater dependent ecosystems
C	critical		
C2VSim	California Central Valley Groundwater-Surface Water Simulation Model	GFWD	Gravelly Ford Water District
		GIS	geographic information system
		GMP	Groundwater Management Plan
C2VSim-CG	published coarse-grid version of C2VSim, Version R374	GRF	Gravelly Ford
CCR	California Code of Regulations	GSA	Groundwater Sustainability Agencies
CDEC	California Data Exchange Center		
cfs	cubic feet per second	GSP	Groundwater Sustainability Plan
CIMIS	California Irrigation Management Information System	GWE	Groundwater Elevation
		GWS	Groundwater system
CM	City of Madera	HCM	hydrogeologic conceptual model
CSUS	California State University, Sacramento	HGL	hydraulic grade line
		IDC	Integrated Water Flow Model Demand Calculator
CVHM	Central Valley Hydrologic Model		
CVP	Central Valley Project	ILRP	Irrigated Lands Regulatory Program
CWC	California Water Code		
CWD	Chowchilla Water District	IND	industrial service supply
D	dry	IWFM	Integrated Water Flow Model
DDW	Division of Drinking Water	K	hydraulic conductivity
DE	Dauids Engineering	K _h	horizontal hydraulic conductivity
DMS	Data Management System		
DQO	data quality objectives	K _v	vertical hydraulic conductivity
DTW	depth to water	LDC	Little Dry Creek
DWR	California Department of Water Resources	LSCE	Luhdorff & Scalmanini Consulting Engineers
ERA	ERA Economics, LLC	MA	management actions
ET	evapotranspiration	maf	millions of acre-feet
ET _a	actual ET	MC	Madera County
ET _{aw}	ET of applied water	MCDEH	Merced County Department of Public Health, Division of Environmental Health
ET _c	crop ET		
ET _o	grass reference ET		
ET _{pr}	ET of precipitation	MCL	maximum contaminant level
ET _r	alfalfa reference ET	MCWPA	Madera-Chowchilla Water and Power Authority
ET _{ref}	reference crop evapotranspiration	Merced	Merced Irrigation District

mg/L	milligrams/liter	SEBAL	Surface Energy Balance
MID	Madera Irrigation District		Algorithm for Land
MO	measurable objectives	SGMA	Sustainable Groundwater
MSL	mean sea level		Management Act of 2014
MT	minimum thresholds	SJRRP	San Joaquin River Restoration
MUN	Municipal and domestic supply		Program
MWD	Madera Water District	SJV	San Joaquin Valley
MWEO	Model Water Efficient Landscape Ordinance	SLDMWA	San Luis Delta-Mendota Water Authority
NOAA NCEI	National Oceanic and Atmospheric Administration	SMC	Sustainable Management Criteria
	National Centers for Environmental Information	SOPs	Standard Operating Procedures
NSWD	New Stone Water District	SS	Stillwater Sciences
NV	Native Vegetation Land	SWRCB	State Water Resources Control Board
NWIS	National Water Information System	SWS	surface water system
O&M	operation and maintenance	Sy	specific yield
ORP	oxidation-reduction potential	T _a	air temperature
pCi/L	picocuries per liter	TDS	total dissolved solids
PRO	industrial process supply	TM	Technical Memorandum
PV	Present Value	TMWA	Truckee Meadows Water Authority
Q _b	Quaternary flood-plain deposits	UR	Urban Land
QT _{cd}	Quaternary continental rocks and deposits	USACE	United States Army Corps of Engineers
RCWD	Root Creek Water District	USBR	U.S. Bureau of Reclamation, or Reclamation
Reclamation	United States Bureau of Reclamation	USDA	U.S. Department of Agriculture
redox	reduction-oxidation	USEPA	U.S. Environmental Protection Agency
RFP	Request for Proposals		
RH	relative humidity	USGS	United States Geological Survey
RMS	Representative monitoring sites	UWMPs	Urban Water Management Plans
RPE	Reference Point Elevation		
R _s	solar radiation	W	wet
SAGBI	Soil Agricultural Groundwater Banking Index	WCRs	well completion reports
SB	Senate Bill	WDL	Water Data Library
SCADA	Supervisory Control and Data Acquisition	W _s	wind speed
SCS-CN	SCS curve number	WYI	Water Year Index
		YCWA	Yuba County Water Agency
		Yield	net groundwater benefit
		µg/L	micrograms per liter

5 PLAN IMPLEMENTATION

To achieve the Subbasin sustainability goal by 2040 and avoid undesirable results through 2090 as required by SGMA and the GSP regulations, a range of projects and management actions will be developed and implemented by the GSAs. Chapter 4: Projects and Management Actions describes each GSAs projects and management actions, gross benefit, and operations. In addition, Chapter 4 provides an estimate of the project-specific capital and operating costs for the projects and management actions. This chapter describes:

- Costs for GSAs to administer GSP activities (not including the project-specific costs described in Chapter 4), as required by GSP Regulation § 354.6(e)
- Financing approaches.
- Timeline and roadmap for implementing all GSA projects and management actions between 2020 and 2040.
- Monitoring and reporting, including the contents of annual reports and five-year periodic evaluations that must be provided to the California Department of Water Resources (DWR) (GSP Regulation § 356.2 and §356.4)
- and data management.

5.1 Estimate of GSA Implementation Costs

Total GSP implementation costs include both project-specific costs and costs for GSA's to administer and operate all other aspects of the GSP. The four GSAs implementing the Madera Subbasin GSP will incur costs for managing the GSP, planning and studies, monitoring implementation, and providing general administration. Projected capital and operating costs of projects and management actions are summarized in Chapter 4 and are not repeated in this chapter. For the purposes of this chapter, each GSAs implementation costs are aggregated into six (6) categories including GSA administration, GSP studies, GSP implementation and updates, project planning, monitoring, and contingency to cover any unanticipated costs. The following subsections describe the general types of costs that could fall under each category. In practice, each GSA will allocate GSP implementation costs to cost categories that are consistent with its internal bookkeeping and accounting practices.

5.1.1 GSA Administration

Administration of the GSP will be conducted by the four GSAs working together and with GSAs for other GSPs under the Subbasin coordination agreement (as required under GSP Regulation §357.4). Administrative costs generally include coordination meetings, reporting, record keeping, bookkeeping, legal advice, continued outreach to stakeholders, and government relations. GSAs will also need to continue to monitor projects and management actions to assess their benefit, economic feasibility, and coordinate with stakeholders and other GSAs if modification of projects and management actions is necessary to ensure the Subbasin meets sustainability objectives.

The four GSAs implementing the Madera Subbasin GSP anticipate that significant coordination of administrative tasks will be required. Many GSP projects require coordination between one or more GSAs, and overall Subbasin sustainability depends on continued coordination, planning, and evaluation of groundwater conditions. In general, it is anticipated that most administrative tasks will have a lead GSA. The lead GSA for each administrative task will keep the other GSAs informed through periodic updates to stakeholders and other GSAs.

Each GSA will conduct public outreach/engagement to provide timely information to stakeholders regarding GSP progress and Subbasin conditions. Most GSAs will develop and maintain a website that will be used to post data, reports, and meeting information. In addition, each GSA will conduct general business administration including record keeping, bookkeeping, and general management.

5.1.2 GSP Studies

GSP implementation will require various planning, technical, and economic/fiscal studies. These are additional costs that are not covered by the cost of specific projects and management actions (see Chapter 4), including for example, more detailed evaluation of proposed projects and assessment of overall cost-effectiveness of GSP implementation strategies.

Planning Studies. GSAs will continue to develop planning studies to integrate the GSP with other regional water management efforts, monitor Subbasin conditions, and update the GSP to ensure that the Subbasin meets all sustainability objectives. GSAs will continue to evaluate Subbasin conditions and adjust short- and long-term Subbasin planning efforts accordingly. Other planning studies may include evaluating projects and developing other programs to support sustainable management.

Technical Evaluations. Subbasin GSAs are required to prepare annual updates and five-year periodic evaluations for DWR (§354.2 and §354.4). These reports will require additional technical analysis. GSAs will continue to monitor groundwater levels in the Subbasin to document progress toward sustainability objectives. Additional monitoring wells may be installed, and GSAs will evaluate and report groundwater conditions, water use, and change in groundwater storage as required by DWR. GSAs will continue to evaluate data gaps and implement programs to improve data availability.

Economic/Fiscal Analyses. GSAs will develop economic and fiscal studies to support implementation of projects and managements and the overall GSP. This may include cost-effectiveness assessments and preliminary investigations of proposed projects. Fiscal analyses are expected to include rate studies and other analysis required to implement fees or assessments, willingness to pay, and ability to pay studies. GSAs will engage legal and technical experts to help develop the required studies. Economic impact studies will be developed to evaluate GSP implementation, understand distribution of costs to different stakeholder groups, and identify methods for reducing those costs during the implementation period.

5.1.3 GSP Implementation and Updates

GSP implementation costs include internal GSA coordination, meetings, and document preparation. This cost category includes costs not covered by GSA Administration and GSP Studies, in addition to costs incurred to comply with annual updates and five-year periodic evaluations.

Annual reports. GSP Regulation §356.2 requires GSAs to prepare and submit annual reports to DWR. GSAs will prepare any required technical analysis, data, summary material, and provide a report on sustainable management objectives. GSAs expect that annual reports will also require inter- and intra-GSA coordination as well as stakeholder outreach.

Periodic evaluations. GSP Regulation §356.4 requires GSAs to prepare and submit five-year evaluation reports. In contrast to the annual report, this report requires additional evaluation of sustainability conditions, objectives, monitoring, and documentation of new information that is available since the last update to the GSP. GSAs expect that periodic evaluations will also require significant inter- and intra-GSA coordination and stakeholder outreach.

5.1.4 Project Planning

GSAs will incur additional costs for project planning. Project capital and operating and maintenance costs for projects that are included in the GSP are already summarized in Chapter 4. However, GSAs expect to evaluate other project ideas proposed by stakeholders, assess cost-effectiveness of proposed projects, and evaluate the joint implementation of multiple projects to ensure the GSP continues to meet sustainability objectives. Technical studies may include feasibility assessments, environmental studies, water rights evaluations, coordination with permitting agencies, and other project planning efforts. GSAs may evaluate land acquisition and easements, pursue grant applications, administer grants, and engage other legal and technical services.

As needed, the GSAs will coordinate on the specific studies and analyses necessary to improve understanding of Subbasin conditions. The GSAs will use new information on Subbasin conditions to improve projects and management actions to achieve sustainability. Evaluations and updates will occur annually (annual report) and every five-years (periodic evaluation) as required by GSP Regulations, but GSAs anticipate that planning, coordination, and studies will be continuous and ongoing during the 2020 to 2040 implementation period.

5.1.5 Monitoring

GSAs will implement programs to monitor groundwater extractions, measure elevations, and track total water use. Monitoring activities will include data management, installing and measuring monitoring wells, maintaining existing wells, and deploying other technology.

GSAs will oversee monitoring programs outlined in Chapter 3. This will include tracking Subbasin conditions and sustainability indicators. Data from the monitoring programs will be routinely evaluated to ensure progress is being made toward sustainability and to identify whether undesirable results are occurring.

5.1.6 Contingency

An additional contingency cost is included for planning purposes. This may include actions needed to respond to critically dry years or if Subbasin conditions start trending towards minimum threshold levels in any area.

5.2 GSA Implementation Costs

The following subsections summarize estimated costs for each GSA to implement non-project-specific costs of the GSP. Costs are presented for each of the six cost categories identified above. However, GSAs manage costs and expenses in different ways and as such may record costs in different categories. In addition, some GSAs are still developing operating budgets and expect to issue requests for proposals to engage additional consultant technical services, but these costs are not known at this time.

This GSP covers the Madera County GSA, Madera Irrigation District GSA, City of Madera GSA, and Madera Water District GSA. Other GSAs in the Madera Subbasin include Gravelly Ford Water District, Root Creek Water District, and New Stone Water District. Implementation costs for these GSAs can be found in the separate GSPs being developed by these GSAs.

5.2.1 Madera Irrigation District GSA

The Madera Irrigation District GSA (MID) estimates that annual implementation costs (excluding the costs of specific projects) will be approximately \$560,000 per year over the next five years. Most (approximately half) of the annual budget is allocated to project planning. These costs do not include the cost of annual reports (costs for the 5-year periodic evaluation are included) or for development of additional projects or management actions that may be required if MID determines that its sustainability objectives are not being met.

MID will recover GSP implementation costs through grants and local revenues that are yet to be determined. MID is currently evaluating options. Section 5.3 provides a general description of how MID and other GSAs may recover GSP implementation costs.

Table 5-1. Madera Irrigation District GSA Implementation Costs

Cost Category	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
GSA Administration	\$70,000	\$70,000	\$70,000	\$70,000	\$70,000	\$70,000
GSP Studies	\$20,000	\$150,000	\$150,000	\$20,000	\$20,000	\$20,000
GSP Implementation and Updates	\$130,000	\$30,000	\$30,000	\$30,000	\$30,000	\$130,000
Project Planning	\$300,000	\$300,000	\$300,000	\$300,000	\$300,000	\$300,000
Monitoring	\$0	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
Contingency	\$52,000	\$57,000	\$57,000	\$44,000	\$44,000	\$54,000
Total	\$572,000	\$627,000	\$627,000	\$484,000	\$484,000	\$594,000

5.2.2 Madera County GSA

The Madera County GSA estimates that its implementation costs for the Madera Subbasin (excluding the costs of specific projects) would total \$13.3 million through 2024, or an average of about \$2.2 million per year. GSA administration will include administration of the GSP, Subbasin coordination, communications, and government relations. Studies will include rate studies, Proposition 218 processes, and legal and technical support. Implementation and updates will include preparing and implementing the initial GSP, internal GSA coordination, meetings, guidance document preparation, costs for periodic updates to the GSP, and coordination and agreements for future updates. Project planning would include, as needed, feasibility and environmental studies, costs to plan any new programs or projects not included in Chapter 4, and grant applications. Monitoring costs include equipment costs and maintenance for well monitoring, and data management. Contingency costs would cover cost overruns and unanticipated activities such as litigation.

Table 5-2. Madera County GSA Implementation Costs

Cost Category	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
GSA Administration	\$0	\$456,000	\$456,000	\$456,000	\$456,000	\$456,000
GSP Studies	\$0	\$865,000	\$472,000	\$472,000	\$472,000	\$472,000
GSP Implementation and Updates	\$1,652,000	\$79,000	\$79,000	\$79,000	\$79,000	\$79,000
Project Planning	\$315,000	\$393,000	\$393,000	\$393,000	\$393,000	\$393,000
Monitoring	\$0	\$590,000	\$590,000	\$590,000	\$590,000	\$590,000
Contingency	\$0	\$197,000	\$197,000	\$197,000	\$197,000	\$197,000
Total	\$1,967,000	\$2,580,000	\$2,187,000	\$2,187,000	\$2,187,000	\$2,187,000

5.2.3 City of Madera GSA

The City of Madera GSA estimates that its implementation costs for SGMA (excluding the capital and O&M costs of specific projects discussed in Chapter 4) would total less than \$1 million through 2024, with a range of about \$73,000 to \$180,000 per year depending on the activities anticipated to occur. GSA administration will include administration of the GSP, Subbasin coordination, communications, and government relations. Studies will include engineering reports, Proposition 218 processes if needed, and legal and technical support. Implementation and updates will include preparing and implementing the initial GSP, internal GSA coordination, meetings, costs for periodic updates to the GSP, and coordination and agreements for future updates. Project planning would include, as needed, new feasibility studies to plan any new programs or projects as well as the environmental/engineering processes for existing proposed projects. Monitoring costs include setting up the monitoring systems, twice annual monitoring of groundwater levels, sensor equipment costs for well monitoring, and data management. Contingency costs would cover cost overruns and unanticipated activities that may occur.

Table 5-3. City of Madera GSA Implementation Costs

Cost Category	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
GSA Administration	20,000	20,000	20,000	20,000	20,000	20,000
GSP Studies	10,000	50,000	50,000	50,000	10,000	10,000
GSP Implementation and Updates	50,000	15,000	15,000	15,000	15,000	15,000
Project Planning	25,000	50,000	50,000	50,000	50,000	5,000
Monitoring	5,000	30,000	3,000	3,000	3,000	3,000
Contingency	20,000	20,000	20,000	20,000	20,000	20,000
Total	130,000	185,000	168,000	168,000	118,000	73,000

5.2.4 Madera Water District GSA

The Madera Water District GSA estimates that its implementation costs for SGMA (excluding the capital and O&M costs of specific projects discussed in Chapter 4) would total almost \$1.1 million through 2024, with a range of about \$61,000 to \$250,000 per year depending on the activities anticipated to occur. GSA

administration will include administration of the GSP, Subbasin coordination, communications, and government relations. Studies will include engineering reports, Proposition 218 processes if needed, and legal and technical support. Implementation and updates will include preparing and implementing the initial GSP, internal GSA coordination, meetings, costs for periodic updates to the GSP, and coordination and agreements for future updates. Project planning would include, as needed, new feasibility studies to plan any new programs or projects as well as the environmental/engineering processes for existing proposed projects. Monitoring costs include setting up the monitoring systems, twice annual monitoring of groundwater levels, sensor equipment costs for well monitoring, and data management. Contingency costs would cover cost overruns and unanticipated activities that may occur (15% assumed).

Table 5-4. Madera Water District GSA Implementation Costs

Cost Category	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
GSA Administration	20,000	20,000	20,000	20,000	20,000	20,000
GSP Studies	10,000	50,000	50,000	50,000	10,000	10,000
GSP Implementation and Updates	100,000	15,000	15,000	15,000	15,000	15,000
Project Planning	25,000	100,000	100,000	100,000	100,000	5,000
Monitoring	5,000	30,000	3,000	3,000	3,000	3,000
Contingency	24,000	32,250	28,200	28,200	22,200	7,950
Total	184,000	247,250	216,200	216,200	170,200	60,950

5.3 GSP Financing

Administering the GSP and monitoring and reporting progress is projected to cost between \$3 and \$5 million per year across the four Subbasin GSAs that are jointly preparing this GSP. This does not include the capital and annual operating cost of projects and management actions (see Chapter 4).

Development of this GSP was funded through a Proposition 1 Grant, and contributions from individual GSAs (e.g. through in-kind staff time, or separately contracted consulting services). Individual GSAs are also funding additional, ancillary studies and implementation efforts. To fund GSA operations and GSP implementation, GSAs are developing a financing plan that will include one or more of the following financing approaches:

- **Grants and low-interest loans:** GSAs will continue to pursue grants and low interest loans to help fund planning studies and other GSA activities. However, grants and low-interest loans are not expected to cover most GSA operating costs for GSP implementation.
- **Groundwater extraction charge:** A charge per acre-foot pumped would be used to fund GSP implementation activities.
- **Other Fees and charges:** Other fees may include permitting fees for new wells or development, transaction fees associated with contemplated groundwater markets, or commodity-based fees, all directed at aiding with sustainability objectives. Depending on the justification and basis for a fee, it may be considered a property-related fee subject to voting requirements of Article XIII D of the California Constitution (passed by voters in 1996 as Proposition 218) or a regulatory fee exempt from such requirements.

- **Assessments:** Special benefit assessments under Proposition 218 could include a per-acre (or per-parcel) charge to cover GSA costs.
- **Taxes:** This could include general property related taxes that are not directly related to the benefits or costs of a service (ad valorem and parcel taxes), or special taxes imposed for specific purposes related to GSA activities.

GSA's are pursuing a combined approach, targeting available grants and low interest loans, and considering a combination of fees and assessments to cover operating and program-specific costs. As required by statute and the Constitution, GSA's would complete an engineer's report, rate study, and other analysis to document and justify any rate, fee, or assessment. For example, Madera County has initiated two separate rate studies in 2019. In the first-rate study, an engineering report is being produced to adequately fund an existing flood control and water conservation agency, which would allow for the agency to adequately control flood flows with existing infrastructure. In the second rate study, an engineering report is being produced for the ongoing costs associated with running the three County GSA's, which would include administration as well as sufficient planning funds for eventual project implementation.

Some cost recovery approaches will affect the cost of water for specific uses in the Subbasin. This will affect business (farm) income and incentivize changes in cropping decisions and farming practices in the Subbasin. As cropping and other land use adjusts, GSA's will monitor and adjust fees/assessments, and modify the GSP accordingly.

5.4 Schedule for Implementation

The GSP implementation schedule allows time for GSA's to develop and implement projects and management actions and meets all sustainability objectives by 2040. While some sustainability projects began immediately after SGMA became law and are already contributing to Subbasin goals, the GSA's will begin implementing all other GSP activities in 2020, with full implementation of projects and management actions to achieve sustainability by 2040. Figure 5-1 illustrates the GSP implementation schedule for projects and management actions that have already been implemented by each GSA (including GSA's not covered under this GSP but within the Madera Subbasin). Figure 5-2 illustrates the GSP implementation schedule for projects and management actions that will be implemented by each GSA. The GSP implementation schedule also shows mandatory reporting and updating for all GSA's, including annual reports and five-year periodic updates (evaluations) prepared and submitted to DWR.

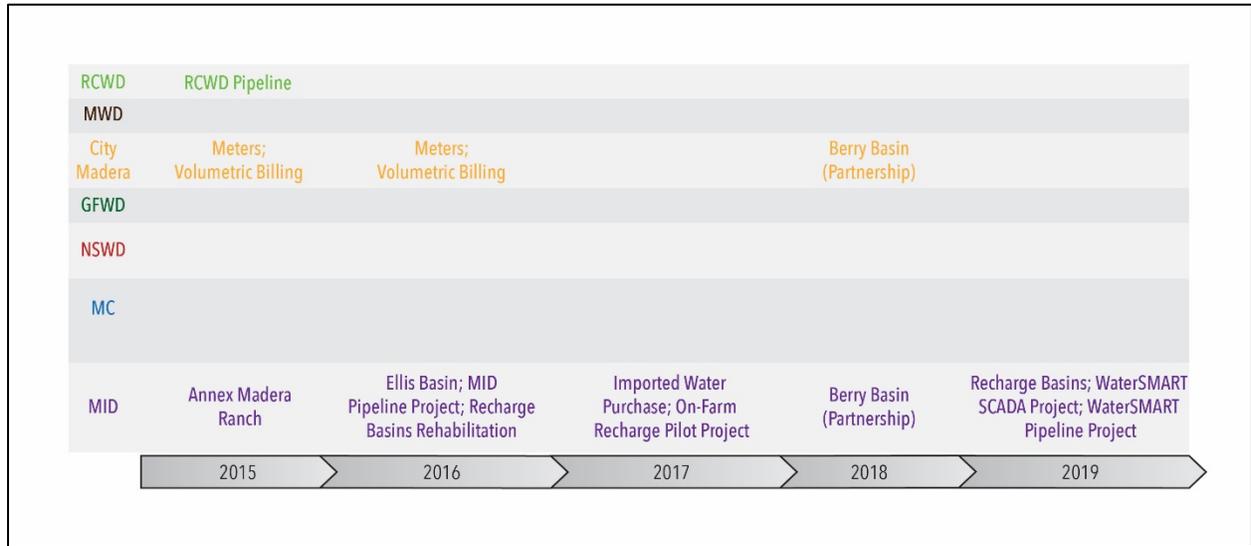


Figure 5-1. Madera Subbasin GSP Completed Projects, 2015 – 2019

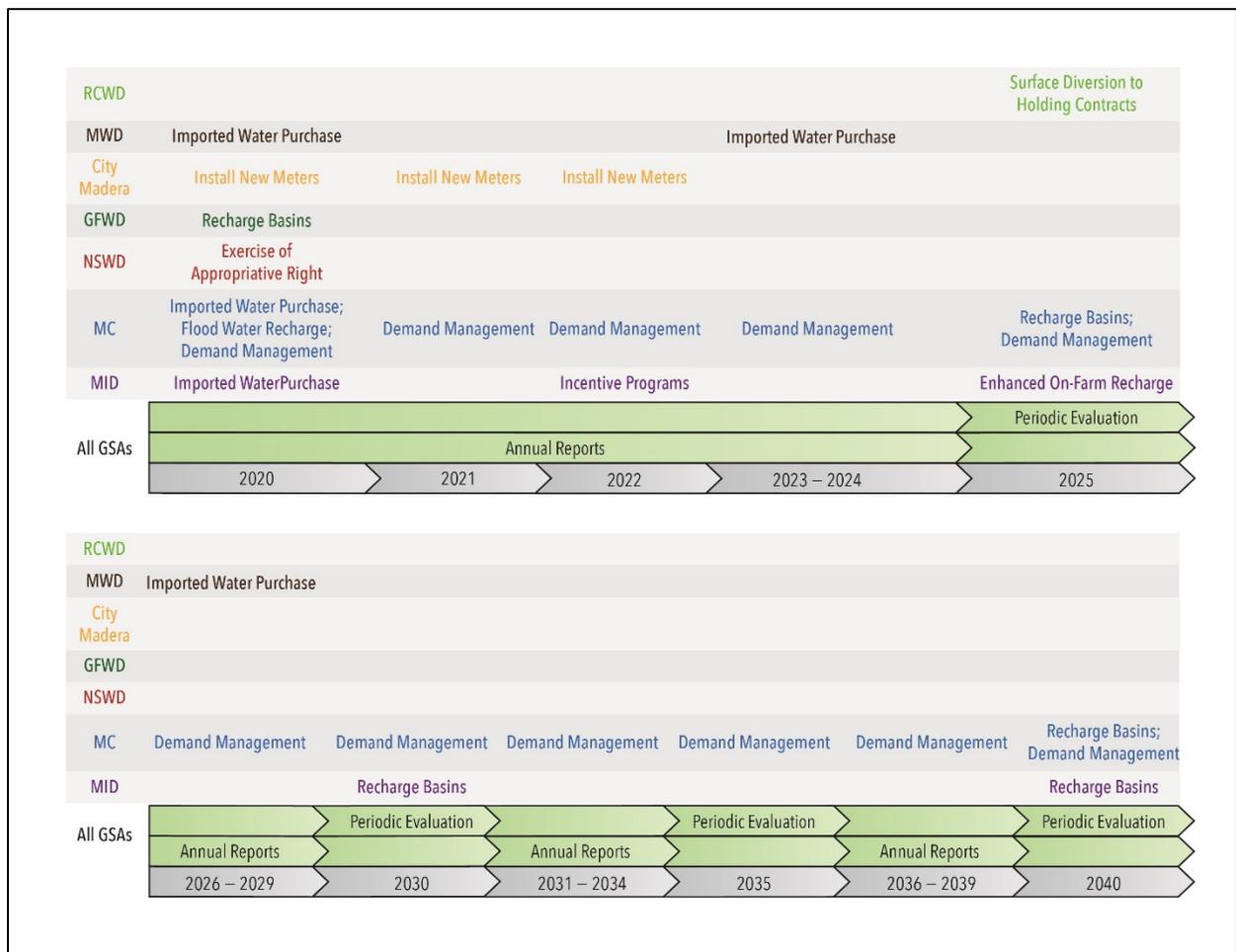


Figure 5-2. Madera Subbasin GSP Implementation Schedule, 2020 - 2040

The Madera Subbasin GSP implementation plan for projects and management actions recognizes that projects will take several years to plan and develop, and planned demand reduction programs will incrementally expand until reaching planned targets by 2040. The Subbasin economy, which is heavily reliant on agriculture, needs time to adjust to sustainability. Important adjustments include higher water costs and limited water supplies in some areas that will result in cropping changes and land idling and affect farming, linked agricultural industries, and all residents in the county. The implementation plan is phased in order to lessen impacts to businesses, individuals, and disadvantaged communities in Madera County.

Implementing projects and management actions to achieve the sustainability objectives specified in the GSP will increase irrigation water costs and limit the quantity of water available for farming in some parts of the Madera Subbasin. This will impact agriculture and create ripple effects across all sectors of the Madera County economy, including County tax revenues and jobs that support many of the County’s disadvantaged communities. The GSP implementation schedule, especially for the Madera County GSA’s planned demand management program, allows time for the Madera County economy to adjust in order to minimize economic impacts to disadvantaged communities, businesses, and other individuals in the region.

Figure 5-3 illustrates the conceptual GSP implementation plan, showing the gross benefit (measured in average acre-feet per year) of projects and the County’s demand management program to meet the Subbasin sustainability objective by 2040. Many GSAs have already started to implement projects and management actions. The gross annual benefit to the basin from the projects described in Chapter 4 is expected to equal approximately 38,000 acre-feet in 2020, increasing to around 200,000 acre-feet by 2040 when the Subbasin will achieve all sustainability objectives. Gross benefit values shown in Figure 5-3 include the demand management program implemented by the Madera County GSA, which anticipates an additional 90,000 acre-feet of benefit (demand reduction) by 2040 – nearly double the benefit of other planned projects and management actions.

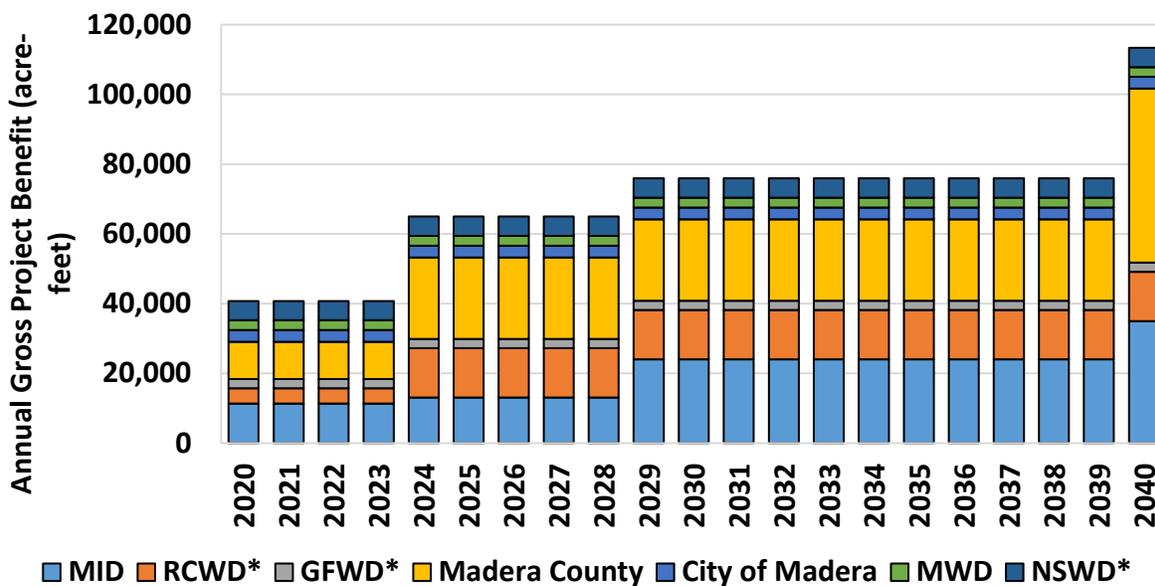


Figure 5-3. Madera Subbasin Project Gross Benefit Timeline (* indicates GSAs not covered by this GSP)

In addition to funding GSA activities, GSP updates, and ongoing monitoring and reporting, GSA’s will develop and implement projects and management actions to provide groundwater benefits for the Subbasin (see Figure 5-3). The annual gross benefit increases until it nearly reaches the projected shortfall in 2039 and then in 2040 additional projects come online. Progress will be evaluated in 2035 and each following year and the additional projects adjusted to meet the sustainability objective. Thus, the 2040 annual gross project benefit will be revised to meet the sustainability objective. The capital cost of each project and management action is summarized in Chapter 4. Figure 5-4 illustrates the capital outlay required to implement all of the projects specified in the GSP. The figure indicates the year that the projects would be completed and begin operation, not when all the capital cost would be incurred. The total capital cost of all projects equals approximately \$250 million. The GSP implementation plan includes significant outlays in 2025 and 2040, when large recharge projects are planned for development by multiple GSAs. The need for the large recharge projects planned for 2040 will be reviewed during the 2035 GSP update to determine their required size. These capital costs do not include the cost of developing the Madera County GSA demand management program or the cost to growers and the economy of demand management (economic impacts from land idling and crop switching) under that program.

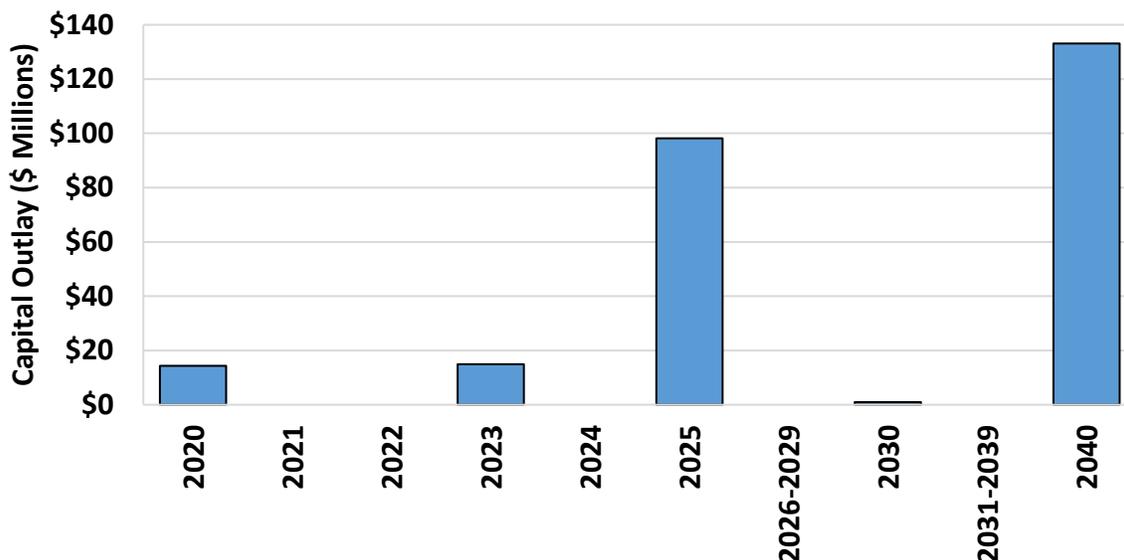


Figure 5-4. Madera Subbasin Estimated Capital Outlay for Projects Only

As projects are implemented, GSAs will incur additional operation and maintenance (O&M) costs. Figure 5-5 illustrates the estimated annual O&M costs (in current dollars) for all GSP projects described in Chapter 4 and the annual costs of GSA implementation described in Section 5.2. This figure does not include the cost that the Madera County GSA demand management program would impose on growers and the County economy. Average annual operating costs for projects increase from \$0.5 million per year in 2020 to over \$15 million per year by 2040. Project costs will be refined by GSAs as the GSP is implemented. GSA implementation costs total about \$3.1 million per year.

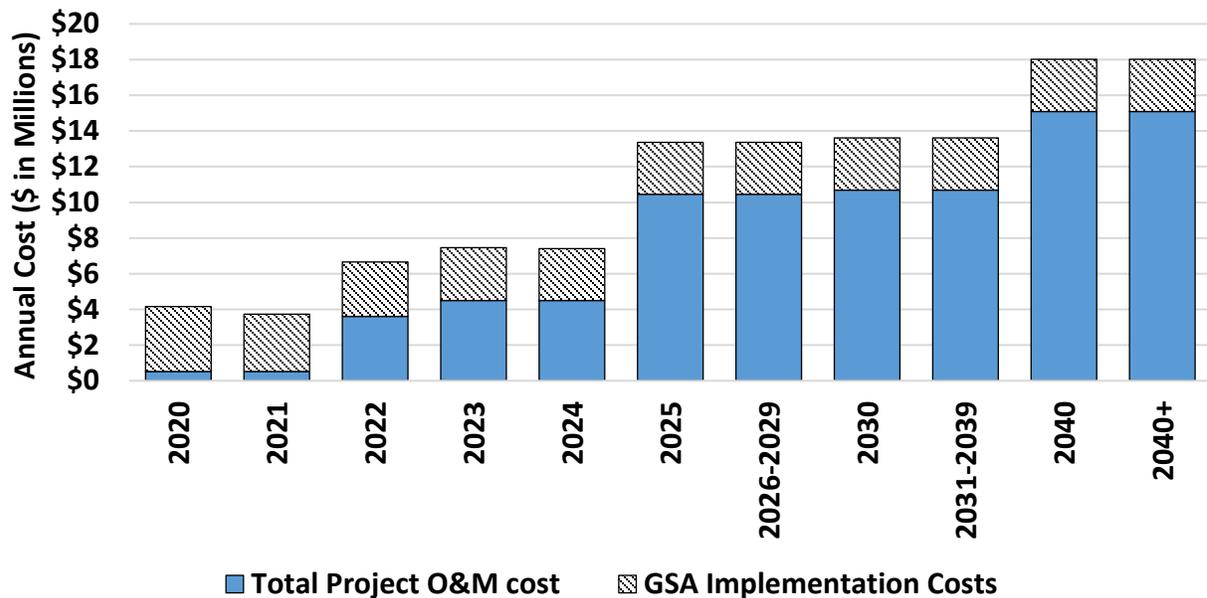


Figure 5-5. Madera Subbasin Estimated Annual Costs for Project O&M and GSA Implementation

5.5 Annual Reports

GSP Regulation §356.2 requires annual reports to be submitted to DWR by April 1 of each year following the adoption of the GSP. GSAs will prepare annual reports that comply with all requirements of §356.2. It is anticipated that GSAs will need to develop independent analyses and data (e.g. for surface water use by a particular GSA) as well as joint analyses (e.g. estimating the Subbasin-wide change in groundwater storage) in order to develop annual reports. GSAs will work together under the Subbasin coordination agreement to complete annual reports. Annual reports must provide basic information about the Subbasin in addition to technical information including:

- Groundwater elevation data from monitoring wells
- Hydrographs of groundwater elevations
- Total groundwater extractions for the prior year
- Surface water supply used in the prior year, including for groundwater recharge or other in-lieu uses
- Change in groundwater storage
- Progress towards implementing the GSP

The following subsections provide a general outline of what information will be provided in the annual report. The annual report provided to DWR will fully comply with the requirements of §356.2.

5.5.1 General Information (§356.2(a))

General information will include an executive summary that highlights the key content of the annual report. This will include a description of the sustainability goals and provide a description of GSP projects, an updated implementation schedule, and a map of the Subbasin. Any important changes or updates since the last annual report will be noted and described.

5.5.2 Subbasin Conditions (§356.2(b))

The subbasin conditions section of the annual report will provide an update on groundwater and surface water conditions in the Subbasin.

Current groundwater conditions with respect to the sustainability goals in the Subbasin will be described. GSAs will summarize the groundwater monitoring network data and report current and change in groundwater elevation. This will include groundwater elevation contour maps for each aquifer in the Subbasin tailored to specific hydrogeologic conditions across the region. This will show seasonal high and low conditions within the current season and show historical data from at least January 1, 2015.

Total groundwater extractions will be summarized (in tabular and map form) by water use sector and the method of measurement will be identified (e.g. metering, satellite analysis, crop-based ET estimates, etc.). All data and methods used to characterize extractions and levels will follow best practices and be described in the annual report.

Total ET_{aw} in the Subbasin will be summarized and parsed into ET_{aw} of surface water and ET_{aw} of groundwater using the information on applied surface water. Surface water data will show whether it was used for direct or in-lieu recharge and identify all sources for each GSA.

The groundwater system balance will be used to estimate the change in groundwater storage. Change in storage will be summarized in tabular form and as a map for each aquifer in the Subbasin. A graph will show the water year type, groundwater use, change in storage, and cumulative change in storage for the Subbasin using historical data from no later than January 1, 2015.

5.5.3 Plan Implementation Progress (§356.2(b))

The annual report will summarize GSP implementation of projects and management actions and other GSA-related activities and describe progress toward established interim milestones and planned sustainability objectives. It will summarize sustainability conditions in the Subbasin.

5.6 Periodic Evaluation (Five-Year Updates)

DWR will review the GSP's progress toward meeting its sustainability goals at least every five years. GSAs will prepare the periodic evaluation to summarize GSP implementation, whether the GSP is meeting sustainability goals, and summarize implementation of projects and management actions. An evaluation will also be made whenever the GSP is amended. A summary of the general information that will be included in the five-year periodic evaluation required by §356.4 is provided in the following subsections.

5.6.1 Sustainability Evaluation (§356.4(a) - §356.4(d))

The evaluation will summarize current groundwater conditions for each sustainability indicator and describe overall progress towards sustainability. A summary of interim milestones and measurable objectives will be included, along with an evaluation of groundwater elevations in relation to minimum thresholds. If any minimum thresholds are found to be exceeded, the GSAs will investigate probable causes and implement actions to correct conditions, as warranted. However, exceedance of a minimum threshold does not automatically trigger corrective action, as the exceedance may be due to factors beyond the control of the GSA.

Implementation of all projects and management actions will be documented and used to adaptively manage the Subbasin. This will include a summary of actual implementation timelines compared to the proposed timeline (Figure 5-1 and Figure 5-2) and implementation schedule described in Chapter 4, and

evaluation of the project contribution to improving conditions. If conditions are improving faster or slower than projected, the reason for the difference from the projection will be evaluated. If conditions are improving slower than projected because any projects or management actions are not implemented according to the specified timeline, the deviation from the original plan will be documented and to the extent possible, corrective actions to speed implementation will be taken. This may include imposing limits on groundwater pumping more broadly than described in Chapter 4, or at a more rapid rate. Similarly, if conditions are improving faster than projected, the scale or timeline of some projects or management actions (notably demand management) may be re-evaluated and revised.

The evaluation will analyze and describe the effect of projects and management actions on Subbasin sustainability indicators and compare that to the estimated gross benefits of the projects and management actions presented in Chapter 4. If differences are identified, these will be described in the periodic evaluation. If projects or management actions are not performing as expected, the update will describe steps the GSAs will take to implement additional projects or reduce pumping, if warranted. Any changes to the implementation schedule of projects and management actions will be described in the periodic evaluation.

As GSP projects and management actions are implemented, monitoring data may indicate unanticipated effects. Also, land uses and economic conditions will change in ways that cannot be anticipated at this time. For example, the GSP has not developed an economic analysis to consider the effect of higher water costs and lower water supply availability on farm profitability and regional crop mix. As such, it may be necessary to revise the GSP to account for these changes. The elements of the GSP including the basin setting, management areas, undesirable results, minimum thresholds, and measurable objectives will be reconsidered by the GSAs during the periodic evaluations. Any proposed revisions will be documented in the periodic evaluation.

5.6.2 Monitoring Network Description (§356.4(e))

Chapter 3 details the planned monitoring network and protocols. The effectiveness of the monitoring network and overall GSP implementation depends on timely, accurate, and comprehensive data. The GSP includes Data Management System (DMS) protocols, as well as expanded monitoring wells and data collection. However, as described in Chapter 3, data gaps still exist in the Subbasin that will require expanding the network. If data gaps are identified, a plan will be developed to improve the monitoring network, consistent with §354.38 of the GSP regulations.

GSAs expect that additional data gaps may be identified in future GSP updates. The periodic evaluations of the GSP will assess changes to the monitoring program needed to acquire additional data sources, and how the new information will be used and incorporated into any future GSP updates. The installation of new data collection facilities and analysis of new data will be prioritized in the GSP.

5.6.3 New Information (§356.4(f))

GSAs are continuing to monitor Subbasin conditions and additional monitoring wells are being installed under a Proposition 1 grant. In addition, the DMS will allow GSAs to identify additional data gaps and implement procedures to secure additional data. Land use and economic incentives for farming and other water uses in the Subbasin will continue to change as the GSP is implemented. GSAs expect that new information about groundwater conditions, projects and management actions, and sustainability objectives will continue to be available. An adaptive management approach will be applied to identify, review, and incorporate all new information into the GSP. Periodic evaluations will indicate whether new

information warrants changes to any aspect of the GSP, including the basin setting, measurable objectives, minimum thresholds, or undesirable results.

5.6.4 GSA Actions ((§356.4(g) - §356.4(h))

GSA's are continuing to monitor, manage, and collaborate to meet the sustainability goals specified in the GSP. Within their allowed authorities, GSA's are evaluating new regulations or ordinances that could be implemented to help achieve sustainability objectives. Any changes in regulations or ordinances will be summarized in the periodic update. The effect on any aspect of the GSP, including the basin setting, measurable objectives, minimum thresholds, or undesirable results will be described.

The five-year periodic evaluation will include a summary of state laws and regulations or local ordinances related to the GSP that have been implemented since the previous periodic evaluation and address how these may require updates to the GSP. Enforcement or legal actions taken by the GSA's in relation to the GSP will be summarized in this section along with how such actions support sustainability in the Subbasin.

5.6.5 Plan Amendments, Coordination, and Other Information (§356.4(i) - §356.4(k))

Any proposed or completed amendments to the GSP will be described in the periodic evaluation. This will also include a summary of amendments that are being considered or developed at that time. This may include changes to the basin setting, measurable objectives, minimum thresholds, or undesirable results.

Any changes to the GSA coordination agreement, or other Subbasin coordination agreements will be documented and summarized. GSA's will summarize any other information deemed appropriate to support the GSP and provide required information to DWR for review of the GSP.

5.7 Data Management System (§352.6)

The Madera Subbasin Data Management System (DMS) has been developed as an integrated network of databases and linked programs and tools. Each element is directly or indirectly linked to the central water budget database, which organizes and calculates the subbasin water budget (Figure 5-6). Inputs to the water budget database are organized into inputs that are managed and implemented at the subbasin-level and inputs that are managed at the GSA-level. Subbasin-level inputs include:

- **Timeseries:** timeseries data managed in a database structure and used to quantify surface water inflows/outflows and groundwater levels
 - USGS and USACE station data
 - DWR-compiled data (WDL and CDEC)
- **Weather:** weather data managed in a database structure and used to quantify reference evapotranspiration and precipitation, and to support root zone water budget calculations (crop evapotranspiration, infiltration, runoff)
 - CIMIS station data
 - NCEI (NOAA) station data
 - PRISM data
- **eWRIMS:** water rights diversions records managed publicly in a database structure and used to quantify surface water supply utilized for irrigation
- **GIS:** spatially-defined geographic data managed in GIS and used to support land use analyses and spatial water use by sector

- DWR spatial data (subbasin boundaries, GSA boundaries, land use survey spatial coverages, Land IQ land cover classification and analysis)
- DWR interpolation tool results (spatial and temporal interpolation of spatial coverages, using Ag Commission reports)
- Local land use data comparison and validation
- **IWFM IDC:** daily root zone water budget results estimated by the IWFM IDC program and used to quantify crop evapotranspiration, infiltration, runoff, and change in SWS storage (see Section 2.2.3.3)

Inputs to the subbasin water budget that are managed at the GSA-level include:

- **Timeseries:** timeseries data relating to GSA-specific inflows that are managed in a database structure and used to quantify surface water inflows/outflows
- **Local Data:** local data managed in spreadsheets and used to quantify GSA-specific inflows/outflows (diversions and deliveries not recorded in subbasin-level data sources)
- **Deliveries:** Water district delivery data managed in a database structure and used to quantify surface water supply utilized for irrigation

All GSAs will manage data related to GSP project implementation within their boundaries. GSAs are continually working to refine data, identify data gaps, and incorporate additional information characterizing groundwater conditions in the Subbasin.

GSAs are currently developing a Request for Proposals (RFP) to secure a database development contractor to develop a database system to store, manage, and retrieve data. This will formalize the DMS, which will be developed to meet the requirements in the GSP Regulations, including § 352.4, § 352.6, and § 354.4. As described previously, the data will be managed so that appropriate tables, graphs, and maps supporting the GSP annual reports and periodic evaluations can be queried and provided to DWR.

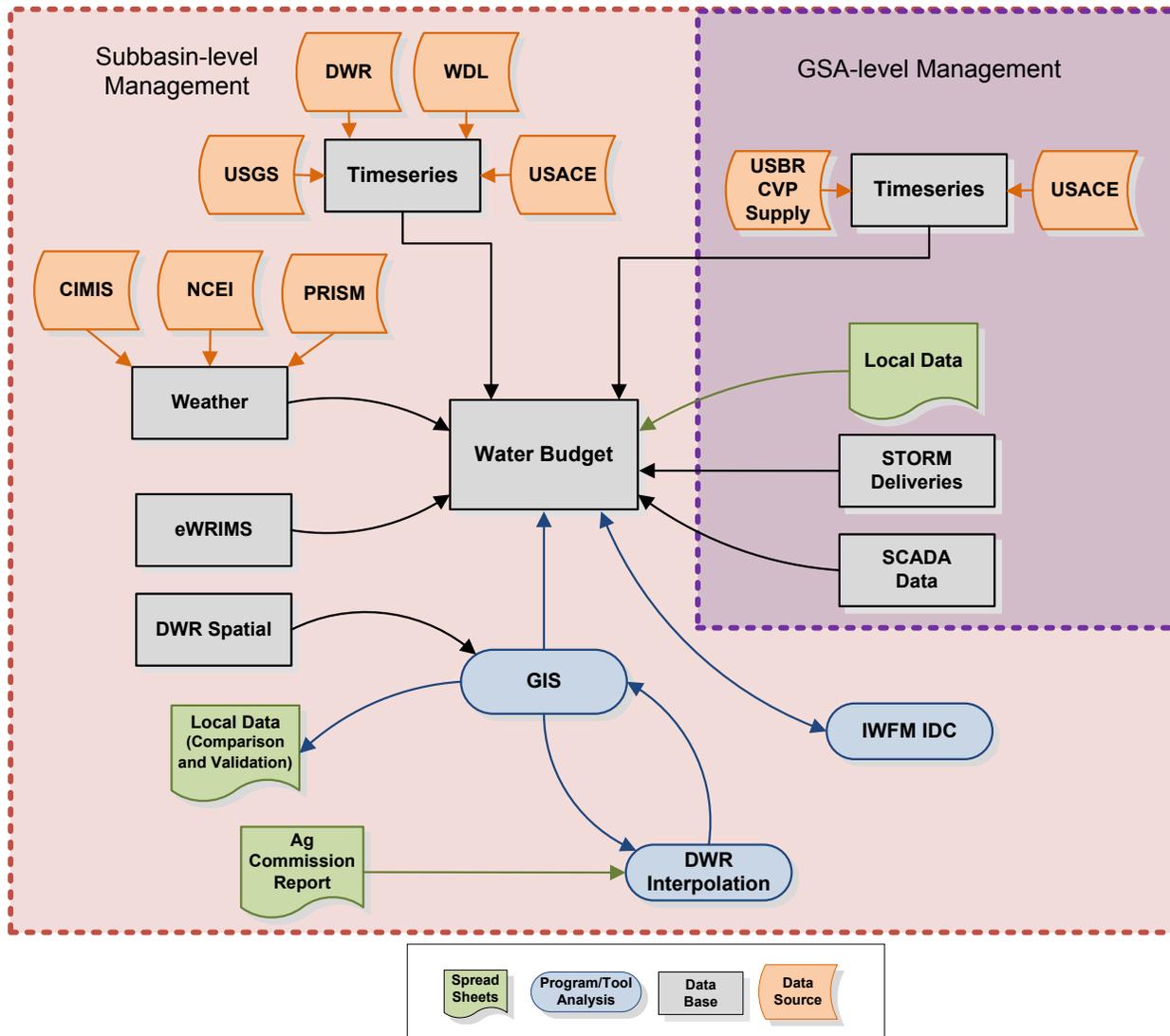


Figure 5-6. Madera Subbasin Data Management System Structure