4 SUBBASIN PROJECTS AND MANAGEMENT ACTIONS

To achieve the Madera Subbasin sustainability goal by 2040 and continue to manage sustainably to 2090, as required by GSP regulations, various projects and management actions have been developed and will be implemented by the GSAs between 2020 and 2040. This chapter describes the types of projects and management actions that have been and are expected to be implemented by each GSA in the Madera Subbasin to meet sustainability objectives. "Projects" generally refer to structural features that supplement and expand available water supplies, whereas "management actions" are typically programs or policies designed to reduce groundwater use – with both integrated into the Subbasin's sustainable water management.

Subbasin project and management actions are described in accordance with §354.42 and §354.44 of the GSP regulations. For projects, the estimated groundwater recharge benefit along with capital, operating, and maintenance costs for each project is shown. Project cost information is limited for many projects because a detailed feasibility assessment has not been completed. Other projects have cost estimates that were developed several years ago and may not reflect current conditions. To the extent possible, project costs are adjusted and reported on a consistent basis. For example, a consistent water purchase price is applied across all projects that would purchase and import water from other Subbasins (unless a specific cost is already provided in an existing agreement). All costs are indexed using an appropriate index (the Implicit Price Deflator or Engineering News Report Construction Cost Index) and reported in current (2019) dollars. GSAs will further develop projects during the GSP implementation period and refine estimated costs.

Costs to acquire water for projects are based on the following assumptions. Water available as local surplus or flood flow has no direct acquisition cost[69]. Water received as CVP Section 215 delivery is assumed to cost $38.54 per acre-foot, based on Reclamation's 2019 Special Water Rates for irrigation 215 water that includes charges for conveyance, water marketing, restoration fund, and Friant surcharge. The cost to purchase water from other water users or from new projects elsewhere in the Central Valley assumes market purchase prices. These acquisition costs per acre-foot, by water year type and region, were developed in the Technical Reference for the Water Storage Investment Program (California Water Commission, 2016) and range from $270 per acre-foot in wet years to over $1,100 in critical years. Cost to deliver water using existing district facilities is assumed to be $25 per acre-foot[70]. For water delivered to farms for recharge on fields (On-Farm Recharge, or Flood-MAR), a cost of $25 per acre-foot is assumed for farmers to manage the water.

GSAs will identify sources of funding to cover project development, capital, and operating costs, including but not limited to, groundwater extraction fees, increasing water rates, grants, low interest loans, and other assessments. The exact funding mechanism will vary by project and the legal authority of each GSA. A general description of how each GSA expects to cover the cost of all projects and management actions it will implement is presented after the description of projects and management actions for each GSA.

The GSAs have prioritized implementing projects that provide additional surface water supply, thereby reducing groundwater pumping. The GSAs also are committed to adaptive management of projects and

[69] Surplus water can have costs associated with it, depending on the timing and source of the supply. These costs will be assessed in detail as part of future GSA project planning.

[70] Actual delivery costs vary by GSA and will be assessed as part of future project planning. For example, MID's current wheeling rate is around $160 per acre-foot.

management actions. As projects are implemented and monitored, the project timelines and volume of demand management necessary will be reviewed. If adjustments are needed to meet the sustainability objective, first project timelines will be evaluated and adjusted.

Projects and management actions are summarized for all GSAs in the Madera Subbasin. This GSP covers Madera Irrigation District, Madera County, City of Madera, and Madera Water District and projects and management actions for these GSAs are described in accordance with §354.42 and §354.44 of the GSP regulations. Gravelly Ford Water District, Root Creek Water District, and New Stone Water District are preparing separate GSPs. The operation and gross benefit of projects and management actions for these GSAs are summarized in this chapter because the sustainability of the Subbasin depends in part on these projects and management actions. More detailed project descriptions, costs, and uncertainties are described in each of those GSA's respective GSP.

Two types of projects are included for implementation in the Madera Subbasin GSP: recharge and conveyance (Table 4-1). Recharge projects are designed to support sustainability by diverting floodwater or other available surface water for direct infiltration in constructed basins or spreading onto fields. Conveyance projects facilitate the delivery of additional water supplies for increased recharge or for direct use for irrigation, thereby reducing groundwater pumping (in-lieu recharge). Conveyance projects may include structural improvements, operational changes, or both. A section at the end of this chapter describes and quantifies available water from the potential sources.

Several GSAs in the Madera Subbasin have developed and will implement management actions. Gravelly Ford Water District will implement a program to monitor groundwater extractions and use that data to more efficiently manage its water supply. Madera Irrigation District will develop incentive structures to encourage its growers to use more surface water and reduce groundwater pumping. A demand management (water use reduction) program is described for the Madera County GSA, though the other GSAs within the Subbasin may implement similar programs if needed to attain sustainability. The Madera County GSA's demand management program provides groundwater users a flexible way to meet any future pumping restrictions.

The cost, timing, and groundwater benefit (yield) of the projects and management actions included in the GSP vary by GSA. Table 4-2 lists all the projects and management actions, by GSA or subregion, and the estimated implementation timeline, capital cost, operating cost, and gross benefit of the projects. Recharge basins, a common project, may also provide environmental benefits that are not quantified in the table. Table 4-3 further summarizes the total benefits and costs of all projects and management actions developed for each GSA or subregion.

The gross yield across all projects at full implementation (2040) is estimated to generate an average annual yield of over 200,000 AF. This includes the Madera County demand management program (management action) implemented by the Madera County GSA that reduces net groundwater pumping by about 90,000 acre-feet per year by 2040 from current pumping estimates. The gross yield is larger than the projected shortfall primarily due to changes in other water budget elements when flood flows are directed to recharge. The following subsections of this chapter provide additional details about project and management action implementation, costs, and benefits.

Table 4-1. Projects/Management Actions and Water Sources Considered in the Madera Subbasin.

GSA	Project type	Project Mechanism	Water Source			
			Fresno River Flood Releases	Millerton Flood Release and 215 water	Chowchilla Bypass flows	Purchase
Recharge						
All	Recharge Basins	Increase Recharge	X	X	X	X
All	On-Farm Recharge (Flood-MAR)	Increase Recharge	X	X	X	X
Conveyance						
MID	MID Pipeline Project, Main I-Road 23 Project	Reduces evaporation and GW Pumping				
MID	WaterSMART Pipeline Project	Reduces evaporation and GW Pumping				
MID	WaterSMART SCADA Project	Reduces evaporation and GW Pumping				
MID, MC, MWD	Water Supply Development-Partnerships	Purchase water from willing partners outside of the basin to increase recharge or reduce GW pumping	X	X	X	X
MWD, RCWD	Water Supply Development-Partnerships	Purchase water from willing partners in the basin to reduce GW pumping				X
NSWD	Water Right Utilization	Divert flood flow from Chowchilla Bypass, under existing water right			X	
Management Actions						
GFWD	Groundwater monitoring and well meters	Collect, analyze, and report data on conditions and use to improve management.				
MC	Demand Management	Reduce demand by limiting groundwater pumping				
MID	Explore new fee structures and incentive-based programs to use surface water	Encourage more use of district SW; reduce GW pumping				

Table 4-2. Madera Subbasin Projects and Management Actions.

GSA	Project	First Year of Implementation	Average Annual Gross Benefit at Full Implementation (AF)	Estimated Capital Cost ($ millions)	Estimated Average Annual Operating Cost ($ millions/year)
MWD	Expanded Surface Water Purchase	2023	2,810	14.90	0.90
MID	Rehab Recharge Basins	2016	5,030	0.06	0.43
MID	Ellis Basin	2016	240	0.02	0.02
MID/City of Madera	Berry Basin	2018	20	0.02	0.00
MID	Allende Basin	2019	1,050	0.20	0.07
MID	Additional Recharge Basins Phase 1	2030	5,470	1.00	0.24
MID	Additional Recharge Basins Phase 2	2040	21,890	14.20	3.75
MID	On-Farm Recharge	2015	510	0.00	0.05
MID	Phase 2 On-Farm Recharge	2025	1,690	0.00	0.19
MID	MID Pipeline	2016	420	0.56	0.00
MID	WaterSMART Pipeline	2019	880	1.30	0.00
MID	WaterSMART SCADA	2019	1,230	1.20	0.00
MID	Water Supply Partnerships	2025	3,990	0.00	2.50
MID	Incentive Program	2022	5,010	0.00	3.08
City of Madera	Meters and Volumetric Pricing	2015	3,350	11.00	0.00
City of Madera/MID	Berry Basin	2018	20	0.02	0.00
Madera County	Water Imports Purchase	2025	3,610	0.30	2.49
Madera County	Millerton Flood Release Imports	2025	7,060	39.10	0.45
Madera County	Chowchilla Bypass Flood Flow Recharge Phase 1	2025	12,710	67.00	0.32
Madera County	Chowchilla Bypass Flood Flow Recharge Phase 2	2040	26,470	118.90	1.16
Madera County	Demand Management	2020	90,000	0.00	53.90
GFWD	Recharge Basin and Canals	2020	2,620	*See GFWD GSP*	
NSWD	Water Right Utilization	2020	5,540	*See NSWD GSP*	
RCWD	Purchased Water for In-Lieu Storage	2019	4,380	*See RCWD GSP*	
RCWD	Holding Contracts	2020	9,840	*See RCWD GSP*	
Total			**215,840**	**262.58**	**69.55**

Note: estimated project benefit values and costs are rounded.

Table 4-3. Summary of Madera Subbasin Projects and Management Actions by GSA.

GSA	Average Annual Gross Benefit at Full Implementation (acre-feet)	Estimated Capital Cost ($, millions)	Estimated Average Annual Operating Cost ($/year, millions)
MWD	2,810	14.90	0.90
MID	47,430	18.56	10.33
City of Madera	3,370	11.02	0.00
Madera County	139,850	218.10	58.32[1]
GFWD	2,620	*See GFWD GSP*	
NSWD	5,540	*See NSWD GSP*	
RCWD	14,220	*See RCWD GSP*	
Total	**215,840**	**262.58**	**69.55**

[1]Costs of demand management include reduced economic activities in the county, this includes approximately $53.9 million per year in direct economic impacts alone (excluding multiplier effects).

4.1 Madera Water District GSA Projects

The Madera Water District GSA (MWD) has identified one project to include in the GSP to help the Subbasin meet sustainability goals. The project is an expanded surface water purchase program where MWD would secure new surface water supplies for use in its service area. Although expanded surface water purchases are considered one project, to obtain those additional deliveries, there will be various infrastructure components implemented by MWD.

4.1.1 MWD Surface Water Purchase Program

The MWD surface water purchase program provides in-lieu recharge benefits by providing growers with additional surface water supplies imported from inside or outside of the Subbasin. The program is an extension of current MWD practices of purchasing surface water when it is available, but access to surface water has been limited by the diversion facilities currently available to MWD. As part of the GSP development process, MWD has been investigating the ability to access additional surface water supplies.

4.1.1.1 Project Overview

The surface water purchase program includes a series of improvements to expand MWD's ability to purchase additional surface water supply. Improvements include upgrades to the Dry Creek turnout and pump stations, and additional conveyance capacity from the installation of a new pipeline connecting Madera Lake, both MID facilities, to the MWD's existing distribution system. To maximize the use of surface supplies, storage reservoirs will be constructed to store water for later delivery as irrigation demands occur. These improvements will enable MWD to purchase higher quantities of water in Wet and Above Normal years than it has been able to purchase historically. By expanding its ability to access additional surface water supplies, MWD expects to increase its in-lieu recharge volumes when supplies are available, which is typically in wetter years. However, even in extremely dry years MWD has often been able to purchase water from Madera Irrigation District (MID) for delivery out of Dry Creek.

4.1.1.2 Implementation

MWD will expand water purchases, particularly in Wet and Above Normal years. In addition, it has identified a set of facilities that will allow greater purchases. These facilities include:

- Improvements to the MWD Dry Creek Pump Station to support flow increases of about 2,000 gpm (4.5 cfs), from 10,500 (23.4 cfs) to 12,500 gpm (27.8 cfs),
- A new pipeline connection to Madera Lake sized for 6,000 gpm (13.4 cfs) with 4,000 gpm (8.9 cfs) capacity to Madera Water District,
- The construction of storage reservoirs within or near the District with capacity of 3,000 AF or more.

Permitting and environmental studies are expected to begin in late 2019 or 2020, with construction to begin in 2021. The new facilities will be operational in 2023.

Table 4-4. MWD Surface Water Purchase Program Implementation Timeline.

Phase	Start	End
Permitting and environmental documentation	2019 for Madera Lake pipeline; 2020 for other projects	2023
Financing	2019	2025
Construction	2021	2023
Operation	2023	2075

Construction activities and requirements

As described under Project Overview and Implementation, MWD will construct a new turnout, pump stations, pipeline, and storage reservoirs. Specific construction activities, scheduling, and more detailed cost estimation will be developed as part of final design of the project.

Water source

MWD intends to purchase surface water from CVP Friant Division contractors within or outside the Subbasin to the extent available. If surface water is not available from these partners, then MWD will seek supplies from other CVP contractors. Since any purchased water will need to be wheeled through MID's system, MWD will coordinate with MID to evaluate and address potential capacity limitations.

Conditions or constraints on implementation

Continued and expanded water purchases by MWD will depend on the cost and availability of water from willing sellers.

Permitting process and agencies with potential permitting and regulatory control

Potential permitting and regulatory control over the various projects will include the U.S. Bureau of Reclamation, Madera County, MID, DWR's Division of Safety of Dams, California Department of Fish and Wildlife, and the U.S. Fish and Wildlife Service.

MWD has already contacted many of these agencies for preliminary permit review as part of its due diligence on the various facilities. MWD will obtain needed permits for construction of new reservoirs, including grading permits from Madera County. Water transfer agreements will need to be developed along with any related CEQA/NEPA documentation for anticipated water purchases. However, since most water transfers will be on a year-to-year basis and/or involve flood or excess waters, the environmental documentation is anticipated to be minimal.

4.1.1.3 Project Operations and Monitoring

With the exception of one private domestic well, all the wells in MWD are owned by MWD, under its control and metered. Groundwater extractions will continue to be metered and managed by MWD as directed by the Board of Directors. Surface water supplies that are brought into MWD are also metered and under the direct management of MWD.

4.1.1.4 Project Benefits

There is limited recharge potential within the MWD service area. Therefore, surface water would be stored in reservoirs and delivered to meet crop demand. The hydrologic time series selected to establish benefits is 1993-2014. Table 4-5 shows the planned delivery schedule based on this hydrologic series for the additional surface water supplies that are proposed to be purchased and brought into the District. These amounts are in addition to historical purchases which are presumed to be able to continue in the future. Surface water will be purchased in any water year type that it is available, though supplies are likely only in Below Normal (BN), Above Normal (AN), or Wet (W) years. MID may have capacity constraints in both the Madera Canal and Dry Creek during the peak months of June, July, and August depending on the status of improvements to its diversion facilities, the water year type, and the weather. The proposed Madera Lake pipeline could provide deliveries during these summer months.

Table 4-5. Estimated Average Additional Surface Water Purchased, by Year Type.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	6,000	35%	2,118
AN	4,500	14%	618
BN	1,000	8%	78
D	0	16%	0
C	0	27%	0
Avg. Annual			**2,814**

The construction of additional turnout pumping capacity to increase Dry Creek deliveries would increase MWD's ability to import surface water via Dry Creek from about 10,000/10,500 gpm to 12,500 gpm (when MID is able to provide capacity). In addition, improvements are proposed to be made to Dry Creek to allow for reliable flow delivery to meet increased turnout capacity. These improvements will require regulatory approvals.

MWD also intends to evaluate the construction of reservoirs within or adjacent to MWD's boundaries and the installation of additional water lines connecting the reservoirs to MWD's current distribution system. Initial plans are to construct up to six 500-AF reservoirs for total storage of 3,000 AF, along with pipeline connections to the existing distribution system. Water purchased and stored in the reservoirs would be used throughout the entire District. The District's plan is to fill the reservoirs during the fall and winter months, so the water is available to be used during the summer months when capacity issues restrict flows.

Figure 4-1 illustrates the expected schedule for delivering and storing water from surface water and groundwater, including planned new supplies, for a wet and above normal water year. Crop demand is based on a total irrigated area of 3,486 acres with an average applied water rate of about 2.68 AF/acre, resulting in an average demand of 9,338AF/year (for year 1989 to 2014). The assumed native

groundwater yield is 0.5 AF/acre per year for 1,875 AF/year. In a wet and above normal water supply year, the cumulative storage at the end of the year in storage reservoirs is positive and would be available (minus losses) for the next crop year.

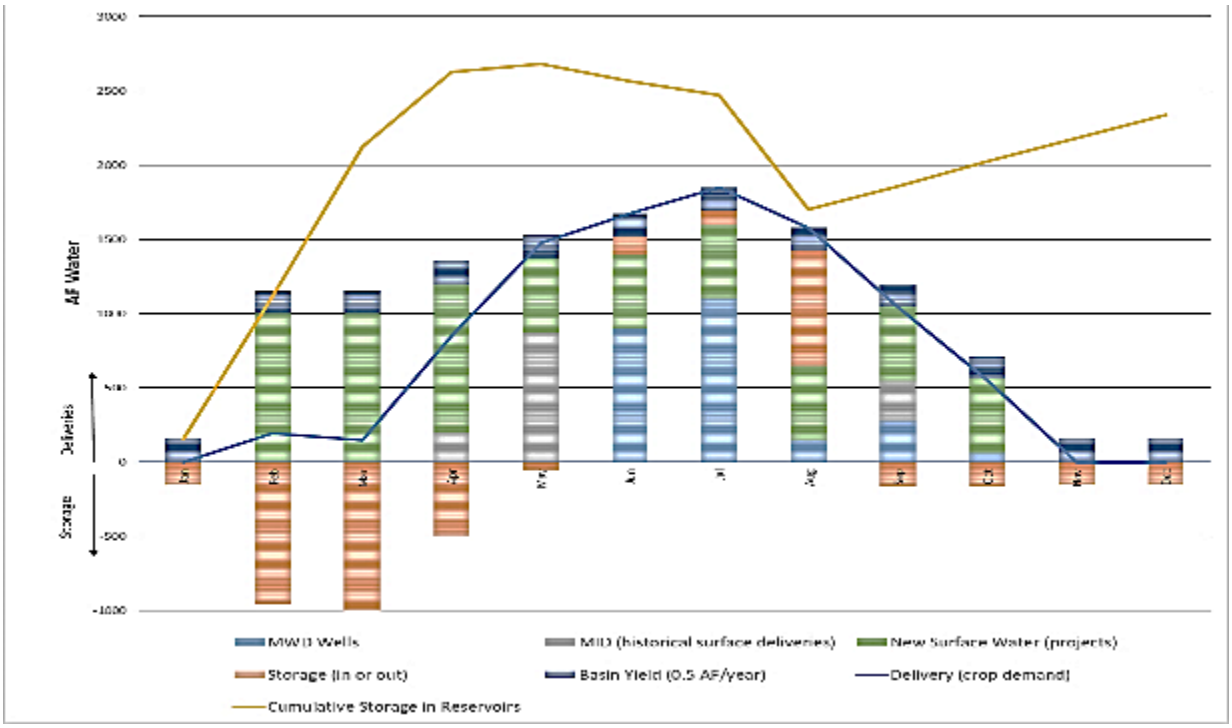

Figure 4-1. MWD Wet and Above Normal Year Water Supply Plan

Based on the planned additional surface water supply projects and associated infrastructure, charts for the 2020 – 2040 (Figure 4-2) and 2020 – 2070 (Figure 4-3) projected water budget periods have been created. The projected water budgets are described in Section 2.2.3 of the GSP and were prepared for 2020 – 2090 based on historical hydrologic data from 1965 – 2015, historical water supply data from 1965 – 2015 (with adjustment of CVP supplies based on projected Friant Releases under SJRRP), and projected land use. The running balance trend for both water budgets shows positive slope, with Figure 4-2 showing the GSA being sustainable in 2040. The groundwater trend line is positive in Figure 4-2 and Figure 4-3.

The reliability of the surface water purchase program will depend on how much excess water is available to purchase and the price of the surface water. However, MWD has historically been able to purchase surface water supplies from MID even in dry years such as 2015. Since MWD has only permanent crops, fallowing on a year to year basis is not practicable. However, MWD's Board of Directors has discussed the potential for land retirement as trees planted within MWD are removed due to aging/low yields or parcels are available for sale.

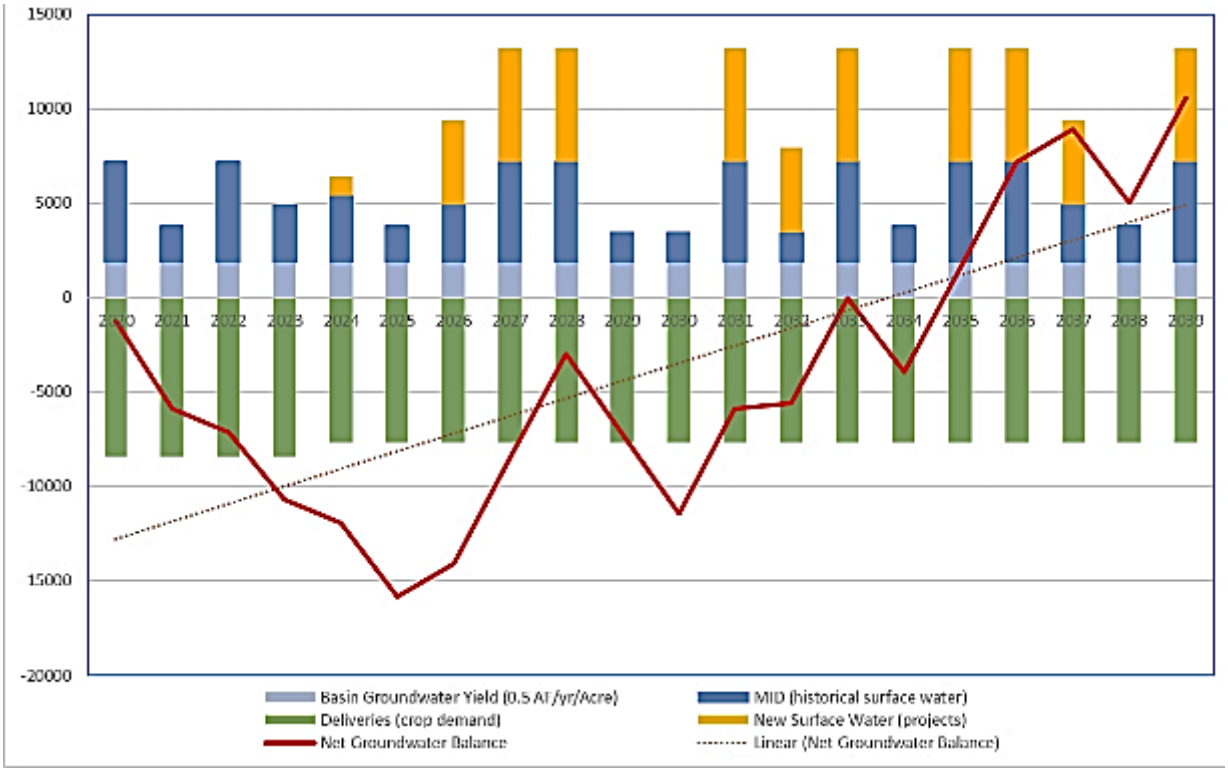

Figure 4-2. Madera Water District Water Budget, 2020 - 2040

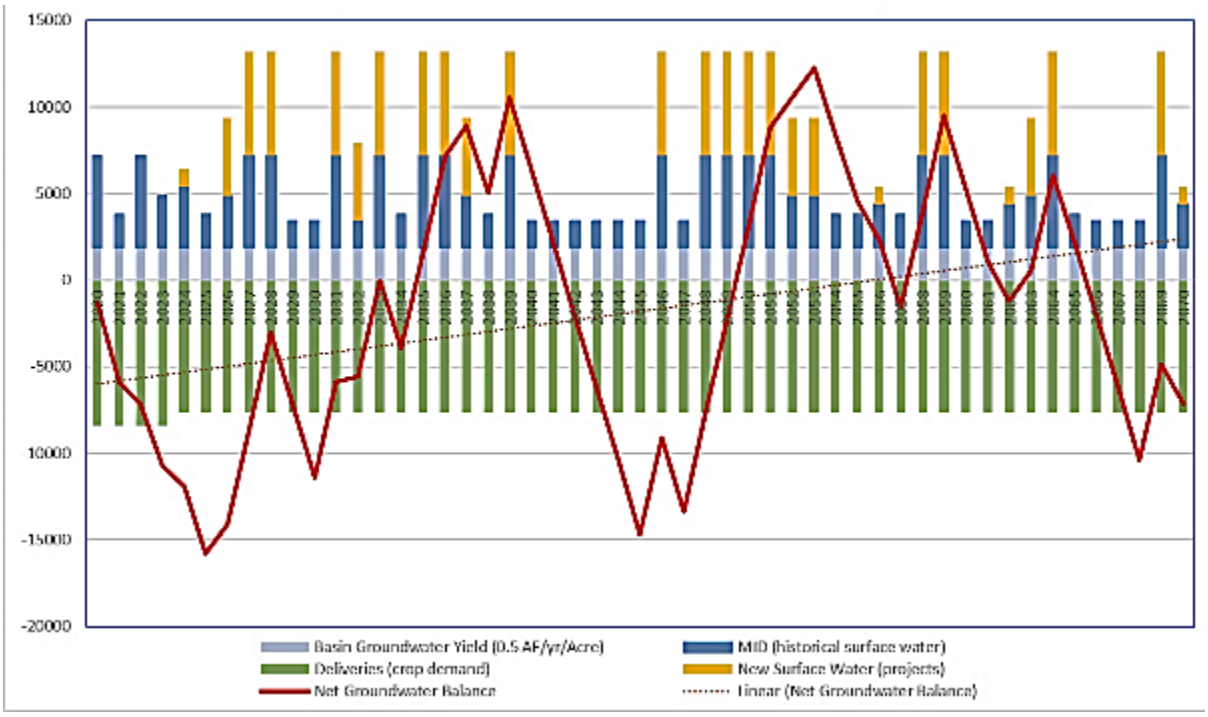

Figure 4-3. Madera Water District Water Budget, 2020 - 2070

4.1.1.5 Project Costs

Table 4-6 summarizes estimated project costs. Capital costs are estimated by MWD and include land acquisition, planning, permitting, and construction. Annual costs will be incurred to acquire water from other water suppliers, so the cost reflects estimated market prices averaged over the year types in which water is acquired.

Table 4-6. Project Cost Summary Table.

Item	Total Cost	Year Incurred	Notes
Capital Costs			
Project planning and development	$14.9 million	Start of project	
O&M Costs			
Water supply cost	$825,000	Annual average	Average annual water purchase cost to acquire water in W, AN, and BN years; costs are incurred in years when water is available.
Other O&M cost	$70,500	Annual average	Conveyance O&M assumed to be $25 per acre-foot; costs are incurred in years when water is available.

4.1.2 Project Financing

MWD will finance capital costs of the projects using cash reserves and, as needed, borrowing. Debt service on any borrowed funds plus ongoing O&M will be paid by MWD landowners. MWD imposes an annual assessment and charges its growers volumetrically for water. MWD holds a public hearing each year to set the annual water rate. MWD has also been building its cash reserves to pay for the cost of physical improvements to MWD facilities. If needed, MWD will also go through the Proposition 218 process to request an increase in land-based assessments.

4.1.3 Coordination with Other GSAs and Planning Agencies

This GSP is the coordinated Plan for the four coordinating GSAs in the Madera Subbasin (City of Madera GSA, Madera Irrigation District GSA, Madera County GSA, and Madera Water District GSA). A coordination agreement will be executed by the coordinating GSAs with the other three GSAs in the Subbasin (Gravelly Ford Water District GSA, New Stone Water District GSA, and Root Creek Water District GSA) detailing required GSA and GSP cooperation.

MID has historically conveyed water to Subordinate MID landowners in MWD. MID and MWD have been coordinating on the development of long-term projects to improve surface deliveries to MWD such as a new water supply agreement and the Madera Lake pipeline. MWD is continuing to discuss new water supply agreements with MID, including wheeling agreements, water purchase agreements, and the cost of water available for purchase.

4.2 Madera Irrigation District GSA Projects

The Madera Irrigation District GSA (MID) has identified several projects to include in the GSP to help MID achieve sustainability. These include new or expanded recharge capacity, increased operational flexibility, additional capacity to move water available from other areas, incentives to encourage MID growers to reduce groundwater pumping, and other management actions to bring the Subbasin into sustainability.

MID invested in several projects after passage of the SGMA legislation but prior to GSP development that help to bring MID into sustainability. Full implementation of these projects was achieved after 2015, the end of the historical hydrologic sequence used to develop the GSP, so the effects of implementing these projects are not included in the baseline MID water budgets described in Chapter 2. MID will continue to operate and pay for these projects and they are included as part of its projects and management actions.

The MID project descriptions are based on information developed during the GSP process by MID and, where applicable, other studies. Planning for the projects is at varying stages of development, so complete information on construction requirements, operations, costs, permitting requirements, and other details are not uniformly available. A description of how all the MID projects and management actions operate as part of the overall GSP is provided in Chapter 5: Implementation.

4.2.1 Groundwater Recharge Basins

Recharge basins are artificial ponds of varying size that are filled with water supply that would have otherwise left the Subbasin, which instead percolates into the groundwater system. The size, location, and performance of a recharge basin depends on site-specific characteristics that will be assessed by MID and its partners in the process of developing recharge basin projects.

The following subsections describe multiple[71] groundwater recharge basin projects that have been or will be implemented by MID to generate groundwater recharge benefits.

4.2.1.1 Project Overview

MID has identified five (5) individual groundwater recharge projects that it has already developed or will develop under the GSP. This includes one rehabilitation project where MID refurbished existing recharge basins that have been underutilized and were in a state of disrepair. MID developed three new recharge basins, including the Ellis Basin, Berry Basin, and Allende Basin. Finally, MID will acquire land and develop approximately 90 acres of new recharge basins by 2030 and another 260 acres by 2040, if needed. Locations and sizes of these new basins will be selected based on land uses, access to delivery facilities, and soils having appropriate percolation rates. Recharge basins are generally distributed throughout the MID service area.

MID recharge projects are similar in operation and implementation. A general description of the projects is provided. Detailed expected recharge benefits, operational descriptions, and estimated costs are provided for each individual project.

Recharge Basin Rehabilitation

MID rehabilitated and upgraded six (6) of its recharge facilities in 2015 and 2016. The facilities were underutilized by MID for many years. The upgrades included facility connections and metering for managing groundwater recharge purposes. The basins range in size from 3 acres to 220 acres with capacity of 20 to 2,300 acre-feet.

Ellis Basin

MID and Madera County worked cooperatively to construct a 180-ft. pipeline to connect MID's Lateral 24.2 canal to the County's Ellis Street Basin in early 2016 for recharge purposes. When water is available,

[71] MID recharge basins include the Berry Basin project, which is a joint project with the City of Madera GSA and the Ellis Basin project, which is a joint project with Madera County. Project benefits are split with the City of Madera (Section 4.3) and Madera County (Section 4.4), respectively.

a lift pump is used to convey the water through a meter to Madera County's basin. The benefits are shared equally by MID and Madera County at a 50:50 ratio.

Berry Basin

The Berry Basin project conveys surface water from an existing MID canal to an existing City of Madera stormwater basin to increase opportunities for groundwater recharge in the Madera Subbasin. The project installed approximately 120 feet of 15-inch pipeline from the MID facilities, Lateral 24.2-14.2 Canal, to the City of Madera facilities, a City-owned and operated storm water basin located on parcels APN 006-380-006 and 006-380-011. The project was completed in 2018. The benefits are shared equally by MID and City of Madera at a 50:50 ratio.

Allende Basin

MID purchased the Allende Basin, APN 047-310-039, in 2018 for the purposes of increasing recharge benefits. MID estimates that the basin storage equals 250 acre-feet. MID will manage the parcel as a permanent basin because of the benefits it provides for MID canal operations and regional groundwater recharge. By utilizing multiple MID surface water supplies, irrigation and flood water can be conveyed to the Allende Basin through the adjacent canal and existing basin turnout structure.

New Recharge Basin Development

MID will evaluate and acquire additional land for groundwater recharge basin development. This includes two additional projects: approximately 90 acres of recharge basins developed by 2030, and an additional 260 acres developed by 2040, if needed. Land suitable for recharge will be strategically located throughout the MID service area to maximize regional groundwater recharge benefits and district operations.

4.2.1.2 Implementation

Implementation will be staged based on the existing development of each groundwater recharge basin or new recharge basin, since 2015 and continuing through 2040 (Table 4-7). Implementation for each of the MID recharge projects is as follows:

- **Recharge Basin Rehabilitation**. Upgrades to existing recharge basins were completed by the end of 2016.
- **Ellis Basin**. The Ellis Basin project was developed in 2016 and is currently operational.
- **Berry Basin**. The Berry Basin project was developed in 2018 and is currently operational.
- **Allende Basin**. The Allende Basin parcel was acquired by MID in 2018 and is currently operational
- **New Recharge Basin Development**. MID will continue to identify additional sites that are good locations for construction of groundwater recharge ponds. Permitting and environmental documentation will be initiated, and financing will be identified and secured for the recharge basins. Construction of the first 90 acres of basins will be complete by 2030, and if necessary, an additional 260 acres of basins will be completed by 2040, if needed.

Table 4-7. MID Groundwater Recharge Basins Implementation Timeline.

Phase	Start	End
Permitting and environmental documentation	2015	2040
Financing	2015	2040
Construction	2015	2040
Operation	2016	On going

Construction activities and requirements

Construction activities include acquiring land suitable for recharge, developing that land for recharge, and acquiring and/or delivering water supplies to that land for recharge benefits. Construction activities vary by recharge basin site. General activities include survey, initial feasibility assessment, permitting, environmental review, land purchase, earthwork, site development, water supply development, and operating infrastructure. Details on construction activities, schedule, and project costs will be developed as part of final project design for each recharge basin developed by MID.

Water source

Water for recharge is expected to be available from one or more of the following sources:

- MID has a contract for CVP Class 1 and Class 2 water, and it can receive CVP surplus flows when available.
- Fresno River flood releases from Hensley Lake.
- Other water supplies that MID currently has access to or may be available in the future, including potential via exchange through the larger Friant system and delivered by Madera Canal.

The analysis of benefits below considers the source of water for each recharge project specified by MID. It does not account for other potential sources nor for any changes in operations elsewhere in the CVP system that might affect availability of surplus water. Water sources for each recharge project include:

- **Recharge Basin Rehabilitation**. MID diverts flood flows and other available water supplies in Wet, Above Normal, and Below Normal water years to the rehabilitated recharge basins.
- **Ellis Basin**. MID delivers flood flows and other available water supplies to the Ellis Basin project in Wet, Above Normal, and Below Normal water year conditions.
- **Berry Basin**. MID delivers flood flows and other available water supplies to the Berry Basin project in Wet, Above Normal, and Below Normal water year conditions.
- **Allende Basin**. MID delivers flood flows and other available water supplies to the Allende Basin project in Wet, Above Normal, and Below Normal water year conditions.
- **New Recharge Basin Development**. MID will deliver flood flows and other available water supplies to newly developed groundwater recharge basins in Wet, Above Normal, and Below Normal water year conditions. Depending on future conditions in MID, it may also purchase additional supplies from partners that will be identified to increase recharge benefits in other water year conditions.

Conditions or constraints on implementation

The groundwater recharge basins implemented by MID are planned projects of the GSP. MID groundwater recharge basin development does not depend on the performance of other projects or activities.

However, MID may develop additional recharge basins if the yield of other projects is lower than anticipated in order to meet its sustainability objectives.

Permitting process and agencies with potential permitting and regulatory control

The following agencies have potential permitting roles for the project: Madera County and Reclamation

Some recharge basin projects may require an environmental review process under CEQA. This would require either an Environmental Impact Report, and Negative Declaration, or a Mitigated Negative Declaration.

Depending on the source of water, projects may require coordination with Reclamation for scheduling the storage and delivery of water within Millerton or to facilitate exchanges of water acquired from other Federal Contractors.

4.2.1.3 Project Operations and Monitoring

Recharge will be conducted by MID in groundwater recharge basins. Extraction of recharged groundwater will be done by water users in MID through individual, private wells.

MID expects that water will be available for recharge in all W, AN, and BN years, to be delivered using existing canals and laterals. Water may be available in other years depending on water supply conditions in the region and MID's ability to purchase additional supplies from partners. Delivery to rehabilitated recharge basins, as well as the Ellis, Berry, and Allende basins has already begun. During years in which water is available for recharge, MID expects to deliver sufficient water to recharge the basins for most of the year. Operation of new recharge basins developed by MID will start in 2030 and 2040, or potentially before, and patterns of recharge will be dictated by water availability but are expected to be generally similar to existing recharge basins.

4.2.1.4 Project Benefits

Groundwater recharge will contribute to MID's sustainability and provide water for water users in MID to pump.

Based on a hydrologic and operations analysis covering the historical period, 1989-2014, and the resulting frequency and amount of recharge, the average annual gross recharge benefits for each of the recharge projects that will be implemented by MID is as follows:

- **Recharge Basin Rehabilitation**. 5,029 acre-feet.
- **Ellis Basin**. 243 acre-feet.
- **Berry Basin**. 48 acre-feet (24 acre-feet credited to MID and 24 acre-feet credited to City of Madera).
- **Allende Basin**. 1,045 acre-feet.
- **New Recharge Basin Development**. 5,474 acre-feet by 2030 and another 21,894 acre-feet by 2040 if necessary.

Tables 4-8 through 4-13 below summarize the average annual water supply benefits, shown as the average delivery year type. The average annual benefit of each project is the water year-type probability weighted average. Wet, Above Normal, Below Normal, Dry, and Critical year types have historically occurred with a probability of 35%, 14%, 8%, 16%, and 27%, respectively.

The reliability of the source water is based on historical hydrology being a good projection of future hydrology. In addition, the reliability depends on future water supply management, including changes to

the CVP system and the San Joaquin River Restoration Program, as well as diversions of other flood flows or sources of water by other GSAs or other entities with rights to that water.

Table 4-8. MID Estimated Average Deliveries by Year Type, in AF per Year – Recharge Basin Rehabilitation Project.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	11,000	35%	3,882
AN	5,500	14%	755
BN	1,500	8%	118
D	0	16%	0
C	1,000	27%	275
Avg. Annual			**5,029**

Table 4-9. MID Estimated Average Deliveries by Year Type, in AF per Year – Ellis Basin Project.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	550	35%	194
AN	300	14%	41
BN	100	8%	8
D	0	16%	0
C	0	27%	0
Avg. Annual			**243**

Table 4-10. MID Estimated Average Deliveries by Year Type, in AF per Year – Berry Basin Project.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	55	35%	19
AN	30	14%	4
BN	10	8%	1
D	0	16%	0
C	0	27%	0
Avg. Annual			**24**

Table 4-11. MID Estimated Average Deliveries by Year Type, in AF per Year – Allende Basin Acquisition.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	2,365	35%	835
AN	1,290	14%	177
BN	430	8%	34
D	0	16%	0
C	0	27%	0
Avg. Annual			**1,045**

Table 4-12. MID Estimated Average Deliveries by Year Type, in AF per Year – New Recharge Basins Constructed by 2030.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	12,650	35%	4,465
AN	6,350	14%	872
BN	1,750	8%	137
D	0	16%	0
C	0	27%	0
Avg. Annual			**5,474**

Table 4-13. MID Estimated Average Deliveries by Year Type, in AF per Year – New Recharge Basins Constructed in 2040.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	50,600	35%	17,859
AN	25,400	14%	3,486
BN	7,000	8%	549
D	0	16%	0
C	0	27%	0
Avg. Annual			**21,894**

Recharge basins may also provide environmental benefits by creating seasonal or perennial habitat for wildlife including waterfowl, amphibians, and reptiles and serve as drinking water sources and foraging habitat for mammals. Groundwater that may be flowing laterally from recharge basins to nearby rivers, particularly the San Joaquin River, may also support beneficial uses by providing an additional source of relatively cold water to support riparian vegetation and both cold and warmwater aquatic habitat including migration habitat for special-status salmonids.

4.2.1.5 Project Costs

Estimated project costs are based on actual costs (for projects that were already developed) and estimated costs for development of a typical recharge basin (Table 4-14). Costs for each basin will vary based on site characteristics and market conditions affecting land, construction, and material costs at that time. Capital costs include site survey, soil sampling, land purchase costs, earthwork, pumps, fencing, and power connection. Additional development costs include project administration, legal, permitting, and environmental review. Actual project costs may be lower than estimated costs if some of these activities are not required. O&M costs are expressed as annual averages but will vary annually according to year type and water availability. Estimated project costs do not include groundwater extraction costs (which would be borne by private pumpers in MID). All costs are reported in current 2019 dollars.

4.2.2 On-Farm Recharge (Flood-MAR)

MID is developing an On-Farm Recharge Program (referred to as Flood Managed Aquifer Recharge, Flood-MAR, by DWR). This program diverts flows that would have otherwise left the basin onto farms and fields of willing participants (growers) to percolate into the aquifer and provide recharge benefits for the Subbasin. It requires that the GSA has capacity to capture and divert water to growers and requires willing growers to participate in the program. The MID On-Farm Recharge project assumes that growers would operate existing irrigation systems on their fields when MID is able to provide water.

Table 4-14. MID Groundwater Recharge Basin Project Costs.

Item	Total Cost	Year Incurred	Notes[1]
Recharge Basin Rehabilitation			
Capital Costs	$64,000	Complete	Cost to rehab existing basin
O&M costs			
Purchase Water	$308,500 per year	Annual average	$38.54 per AF, incurred when water is available
Conveyance O&M	$126,000 per year	Annual average	$25 per AF cost to convey, incurred when water is available;
Ellis Basin			
Capital Costs	$24,000	Complete	Does not include land acquisition
O&M costs			
Purchase Water	$9,500 per year	Annual average	$38.54 per AF, incurred when water is available
Conveyance O&M	$6,000 per year	Annual average	$25 per AF cost to convey, incurred when water is available
Berry Basin			
Capital Costs	$15,000	Complete	Does not include land acquisition
O&M costs			
Purchase Water	$950 per year	Annual average	$38.54 per AF, incurred when water is available
Conveyance O&M	$600 per year	Annual average	$25 per AF cost to convey, incurred when water is available
Allende Basin Acquisition			
Capital Costs	$200,000	Complete	Does not include land acquisition
O&M costs			
Purchase Water	$40,500 per year	Annual average	$38.54 per AF, incurred when water is available
Conveyance O&M	$26,000 per year	Annual average	$25 per AF cost to convey, incurred when water is available
New Recharge Basins Constructed in 2030			
Capital Costs	$1.0 million	2028-2029	For basins to recharge up to 1,150 AF per month
O&M costs			
Purchase Water	$105,500 per year	Annual average	Assume half is CVP 215, half is other flood flow, incurred when water is available
Conveyance O&M	$137,000 per year	Annual average after 2040	$25 per AF cost to convey, incurred when water is available
New Recharge Basins Constructed in 2040			
Capital Costs	$14.2 million	2038-2039	For basins to recharge up to 12,000 AF per month
O&M costs			
Purchase Water	$3.2 million per year	Annual average	Assume half is acquired from other users, half is other flood flow, incurred when water is available
Conveyance O&M	$547,500 per year	Annual average after 2040	$25 per AF cost to convey, incurred when water is available

Notes: (1) MID O&M costs will be greater than $25 per AF and will be assessed as part of more detailed project development.

On-Farm Recharge imposes additional management costs on the GSA and additional operating costs on the grower to divert water, manage fields, and operate irrigation systems. MID will evaluate incentive structures to encourage growers to participate in the program.

MID has been and will implement two On-Farm Recharge projects in its service area to increase groundwater recharge. This includes a Phase 1 project that is already operating and a Phase 2, enhanced, project, where MID will also explore incentives to encourage more growers to participate in the program.

4.2.2.1 Project Overview

MID's On-Farm Recharge program would deliver available flood water to agricultural or other suitable land for percolation to groundwater. The project is distinct from dedicated recharge basins (Section 4.1.1) because existing land uses would be maintained, no basins would be constructed, and existing delivery facilities would be used.

MID, in cooperation with Sustainable Conservation, has been researching and implementing the Phase 1 program since 2015. Preliminary feedback indicated that the program could be an affordable and practical water management tool that can assist in moving groundwater basins, including the Madera Subbasin, toward a sustainable balance. Since 2015, interest among MID landowners has continued. MID has signed up close to 150 landowners in the program, many of which own multiple parcels in MID.

MID has been evaluating grower reluctance to participate in the program, including concerns about crop damage and costs, and is evaluating ways to incentivize more growers to participate in the program. Once these incentives are defined MID will implement the Phase 2 program in which additional acres will participate in the program.

4.2.2.2 Implementation

The implementation timeline for MID's On-Farm Recharge program is provided in Table 4-15. Because new facilities are not needed, the project can be implemented relatively quickly. MID implemented the program initially in 2015 and has signed up close to 150 landowners, many of which own multiple parcels throughout MID. The Phase 2 program will be implemented starting in 2025, or as soon as additional incentives and mechanisms are developed by MID.

Construction activities and requirements

On-Farm Recharge requires MID to secure water supply and manage deliveries. Growers make the decision to participate and are required to manage their own fields and operate their own irrigation systems. However, no large-scale construction projects or significant capital outlays are required.

Table 4-15. MID On-Farm Recharge Implementation Timeline.

Phase	Start	End
Permitting and environmental documentation	2015	2025
Financing	NA	NA
Construction	NA	NA
Operation	2015	2040

Water source

Water for recharge is expected to be available from one or more of the following sources:

- Fresno River supplies from Hensley Lake
- CVP supplies from Millerton Lake
- Other water available to MID or purchased by MID

The analysis of benefits below does not account for other potential sources nor for any changes in operations elsewhere in the CVP system that might affect availability of surplus water.

The Phase 1 and Phase 2 projects will compete for water with recharge basins developed by MID, and potentially, other GSAs. However, a preliminary assessment indicates that in very high runoff years water is available for all recharge projects. The GSP analysis of potential yield (benefit) to the entire Subbasin includes the joint effect of all proposed GSA projects and management actions and therefore already accounts for these interactions.

Conditions or constraints on implementation

On-Farm Recharge requires MID to secure water supply and manage deliveries. Growers are required to manage fields and operate irrigation systems. However, no large-scale construction projects or significant capital outlays are required. Deliveries of flood flows will need to be coordinated with maintenance activities on canals and other delivery facilities, both within MID and, if applicable, Madera Canal operations. The diversions are expected to occur during periods when flow exceeds beneficial or environmental uses.

The Phase 2 program will explore incentives to encourage additional participation. The general incentive structure would need to provide a greater benefit to the landowner than the total cost (including risk) to the grower. MID will evaluate options as it further develops the Phase 2 program.

Permitting process and agencies with potential permitting and regulatory control

MID has legal authority to deliver water to its customers. It could develop additional incentive structures and agreements (Phase 2).

Additional percolation of water on agricultural lands can affect movement of nitrates or other constituents into groundwater.

Project Operations and Monitoring

It is anticipated that the water will be delivered to participating lands that have high percolation rates in the initial program. The Phase 2 program will deliver water to additional acres of suitable farmland. The program can be scaled based on grower interest, water availability, and basin needs for sustainability.

4.2.2.3 Project Benefits

Groundwater recharge benefits are estimated using available flood flow over the historical water balance period of 1989-2014. This period is representative of long-term average hydrologic conditions in the basin. Based on the analysis, flood releases are expected to occur in approximately 1 out of 3 years. MID may be able to encourage grower participation in the program in drier year conditions, depending on the availability of water supplies and district operations. The average annual benefit is the water year-type probability weighted average. Based on the probabilities, the expected average annual delivery of water is 510 acre-feet in the Phase 1 program (Table 4-16).

Table 4-16. MID Estimated Average Deliveries by Year Type for Phase 1 On-Farm Recharge Project, in AF per Year.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	1,250	35%	441
AN	500	14%	69
BN	0	8%	0
D	0	16%	0
C	0	27%	0
Avg. Annual			**510**

MID will increase grower participation in the Phase 2 program. The program will scale-up the current On-Farm Recharge initiative and is expected to be implemented around 2025. The average annual benefit is the water year-type probability weighted average. Wet, Above Normal, Below Normal, Dry, and Critical year types have historically occurred with a probability of 35%, 14%, 8%, 16%, and 27%, respectively. The average annual yield of the Phase 2 program equals 1,686 acre-feet (Table 4-17).

Table 4-17. MID Estimated Average Deliveries by Year Type for Phase 2 On-Farm Recharge Project, in AF per Year.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	4,000	35%	1,412
AN	2,000	14%	275
BN	0	8%	0
D	0	16%	0
C	0	27%	0
Avg. Annual			**1,686**

Based on the historical hydrology and assuming no other changes to system operations, the average annual yield of the Phase 1 program equals 510 acre-feet. The average annual yield of the Phase 2 program equals 1,686 acre-feet. The combined MID On-Farm Recharge program will generate an additional 2,196 acre-feet per year starting in 2025 and continuing through the GSP implementation timeline.

4.2.2.4 Project Costs

Estimated project costs for Phase 1 and Phase 2 of the MID On-Farm Recharge program are summarized in Table 4-18. Capital costs of the MID On-Farm Recharge program are expected to be minimal because the project uses existing MID facilities and grower irrigation systems. No construction or land acquisition costs are currently anticipated. It is also assumed that no additional permitting costs would be incurred.

Recharge volumes are estimated using existing delivery facilities. Operating costs anticipated with this project are the cost of the water, pumping costs, and labor to irrigate. Table 4-18 provides estimates of these costs for the Phase 1 and Phase 2 projects. Water costs in the table represent CVP 215 water costs, though the programs will likely acquire a mix of CVP 215 water, other flood flow at a potentially low acquisition cost, and water acquired from other water suppliers at much higher market prices.

Table 4-18. Estimated Project Costs for MID On-Farm Recharge Project.

Item	Total Cost	Year Incurred	Notes[1]
Phase 1 Project			
Capital Costs	none	NA	Project uses existing district facilities and grower systems
O&M Costs			
Purchase Water	$20,000 per year	Annual average.	Assume cost of CVP 215 water, though water may be a mix of sources; incurred when water is available
District conveyance and grower costs	$25,500	Annual average	$25 per AF District charge to convey, plus $25 per AF to compensate for grower costs, incurred when water is available
Phase 2 Project			
Capital Costs	none	NA	Project uses existing district facilities and grower systems
O&M Costs			
Purchase Water	$65,000 per year	Annual average.	Assume cost of CVP 215 water, though water may be a mix of sources; incurred when water is available
District conveyance and grower incentive	$126,500 per year	Annual average	$25 per AF District charge to convey, plus $50 per AF incentive payment to compensate for grower costs, incurred when water is available

Notes: (1) MID O&M costs will be greater than $25 per AF and will be assessed as part of more detailed project development.

For the Phase 1 program, costs include an assumed $25 per acre-foot for district conveyance, pumping, and maintenance, plus $25 per acre-foot incurred by growers to manage the water on their fields. MID will assess actual O&M and water purchases costs as the program is more fully developed. This may include additional incentives under the Phase 2 Flood-MAR program.

4.2.3 MID System Improvements and Programs

MID will implement a series of projects to improve operations and better manage ground and surface water supply within its service area. This includes capital projects, some of which are partially funded through grants and many of are completed or are currently under development, as well as new programs to evaluate incentives and other changes to better manage surface water within MID.

4.2.3.1 Project Overview

The MID system improvements and programs project includes five separate activities that MID will implement as part of the GSP:

- **MID Pipeline Project**. Rehabilitate aging pipelines to reduce losses.
- **WaterSMART Pipeline Project**. Rehabilitate additional pipelines to reduce losses and allow MID to deliver water later in the irrigation season.
- **WaterSMART SCADA Project**. Improve MID water management, reduce losses, and allow MID to deliver water later in the irrigation season.
- **Water Supply Partnerships Project**. MID will identify and purchase or exchange additional water supplies from partnering districts.
- **Increase MID grower utilization of surface water supplies**. MID will explore incentives to encourage more MID growers to take district surface water and reduce groundwater pumping.

MID system improvement projects and programs are similar in operation and implementation. A general description of the projects is provided. Detailed expected benefits, operational descriptions, and estimated costs are provided for each individual project.

MID Pipeline Project

MID Main I Canal crossings at Road 23, Avenue 11, Avenue 10-1/2, and Avenue 10 were originally constructed in the early 1970s and have been patched numerous times over the years due to excessive cracks and leaking. These Techite pipe crossings have reached the end of their service lives and needed replacement. The project provides benefits to the basin by reducing system losses.

Historically, the tail end of the Main I Canal, which conveys most of the City of Madera stormwater, had been subject to multiple canal breaks during the flood season because of the close proximity to Cottonwood Creek, Road 23 shoulder, and the Lateral 24.2 spill pipeline. The canal also had operational issues and constraints related to MID deliveries and created unnecessary losses. The 36-inch pipeline replaced the four failing road crossings, two check structures, and eliminated the risk of canal breaks and improved operations between Avenues 10 and 11. The pipeline design and construction were completed in-house by MID staff in 2016.

WaterSMART Pipeline Project

In January 2016, MID staff prepared an application for two projects under the U.S. Bureau of Reclamation (USBR) WaterSMART: Water and Energy Efficiency grant program. One project was titled "Lateral 24.2-17.0 Pipeline Improvement Project." MID was awarded funding for the project.

The project redeveloped approximately 6,500 feet of the existing Lateral 24.2-17.0 canal into a 36-inch pipeline to reduce losses and improve operational efficiency. The project extends the irrigation season for growers and prevents spills leaving the basin, which allows growers to utilize more surface water thereby pumping less groundwater.

WaterSMART SCADA Project

In January 2016, MID staff prepared an application for two projects under the U.S. Bureau of Reclamation (USBR) WaterSMART: Water and Energy Efficiency grant program. One project was titled "Irrigation Water Conservation and Canal Automation Improvement Project." MID was awarded funding for the project.

The project expands the District's existing Supervisory Control and Data Acquisition (SCADA) system by installing 14 new solar-powered automated gates and meters throughout the District. The gates and meters can be remotely monitored and controlled by smart phones and are programmed to automatically open and close to maintain a constant flow within +/- 2.5% accuracy, regardless of varying upstream water level. The project extends the irrigation season for growers and prevents spills leaving the basin, which allows growers to utilize more surface water thereby pumping less groundwater.

Water Supply Partnerships

MID will obtain additional water through win-win exchanges and partnerships both within and outside of the Subbasin. MID is continually evaluating potential partnership opportunities. This will provide benefits by increasing water supply in the MID service area, both for direct irrigation use and groundwater recharge. MID recognizes that competition for water supply partnerships will increase as GSPs are implemented by its partner agencies. MID will continue to monitor the market to assess partnerships and increasing water purchase costs.

Incentive Programs

MID will evaluate programs to encourage more MID growers to utilize surface water supplies instead of groundwater. MID will be conducting studies to identify potential incentive structures and assess the relative costs and benefits of different alternatives. The project benefits MID by reducing groundwater pumping.

4.2.3.2 Implementation

Implementation will be staged based on the existing development of each of the projects, having already begun and continuing through 2030. Implementation for each of the MID operation and incentive projects is as follows:

- **MID Pipeline**. Upgrade of crossing and canal completed 2016.
- **WaterSMART Pipeline**. The WaterSMART pipeline upgrade completed in 2019.
- **WaterSMART SCADA**. SCADA upgrades, funded in part with the WaterSMART grant, completed in 2019.
- **Supply Partnerships**. MID has started working with partners to bring new water supply into the basin. MID will expand this program in the future.
- **Incentive Programs**. MID will conduct a study to identify appropriate incentive structures to encourage more growers to utilize surface water. Findings of the study will be implemented immediately thereafter, and basin water supply benefits will be realized starting in 2022.

Timeline

Table 4-19 summarizes the implementation timeline for all operation and incentive projects implemented by MID. Acquisition, permitting, and documentation started in 2016 or earlier will continue through 2022. MID pipeline upgrades have been operational since 2016. WaterSMART system upgrades to pipelines and SCADA were completed in 2019. Additional water purchases will start in 2020 and the MID incentive program will start in 2022.

Table 4-19. MID System Improvements and Programs Implementation Timeline.

Phase	Start	End
Permitting and environmental documentation	2016	2040
Financing	2016	2040
Construction	2016	2040
Operation	2016	2040

Construction activities and requirements

Construction activities vary by project. General activities include initial feasibility assessment, permitting, environmental review, earthwork, pipes, and installation. Details on construction activities, schedule, and project costs will be developed as part of final project design for each project by MID.

MID does not anticipate construction activities under the partnership project and incentive program beyond standard maintenance of existing facilities.

Water source

Additional water for the pipeline and SCADA projects, as well as the grower incentive initiative, is expected to be available from existing MID sources. MID has a contract for CVP Class 1 and Class 2 water, and it can receive CVP surplus flows when available, along with other supplies available to MID. Partnership opportunities will increase purchases from other water suppliers across the state. Water sources for each recharge project include:

- **MID Pipeline**. During the irrigation season the project will reduce losses and provide additional water to fields by lengthening the season, increasing the use of available water supplies. MID expects the project will provide water in all year types.
- **WaterSMART Pipeline**. During irrigation season the project will reduce losses and provide additional water to fields by lengthening the season, increasing the use of available water supplies. MID expects the project will provide water in all year types.
- **WaterSMART SCADA**. During irrigation season the project would lead to longer season by allowing growers to receive more water than before, reducing losses and spill which leaves the basin. MID expects the project will provide water in all year types, increasing the use of available water supplies.
- **Supply Partnerships**. Purchases from partner agencies will be identified by MID. Supplies are generally available under all water year conditions, although the cost can increase significantly in Dry and Critically Dry years.
- **Incentive Programs**. MID anticipates that water supply for the incentive program would be available under all water year types. MID estimates that even in Dry and Critically Dry years its growers could pump less groundwater and use more MID surface water.

Conditions or constraints on implementation

All the operations and incentive projects implemented by MID are planned to be implemented by 2040. Implementation of this set of projects does not depend on the performance of other projects or activities. However, the water supply source for each project does depend on the performance of other MID projects or activities. For example, purchased water may be used for recharge or additional surface water deliveries under a MID incentive program.

Permitting process and agencies with potential permitting and regulatory control

The following agencies have potential permitting roles for different projects: Madera County, US Bureau of Reclamation, other entities depending on agencies with authority over water supply available to MID trading partners. Water transfers with willing partners will require satisfying requirements to transfer water which will depend on the source of the supply and nature of the transfer. Incentive programs may require a rate study to justify any fees or financial incentives offered by MID.

4.2.3.3 Project Operations and Monitoring

MID will operate and monitor the MID Pipeline, WaterSMART Pipeline, and WaterSMART SCADA projects within existing district operations. The three projects provide additional operational flexibility to MID, allowing it to deliver surface water to growers longer into the season and preventing losses. MID will operate the projects in coordination with the rest of its system to maximize surface water supply deliveries to growers. In turn, growers will pump less groundwater, and this results in a benefit to the basin. MID will not monitor the specific performance of the projects but will continue to monitor and manage its water supplies with these integrated projects. MID expects these projects to provide water supply benefits in all water year types.

Incentive programs to encourage growers to use MID surface water in lieu of pumping groundwater will be developed by MID. MID will initiate studies in 2020 and implement programs as they are developed. Incentive programs could include pricing mechanisms to make MID surface water less expensive or other financial incentives. MID will identify, implement, and monitor any programs that it develops. The incentive program will be designed to provide water under all year types.

MID is planning to identify and purchase water from willing partners under all water year types. Water purchase costs are expected to be significantly higher in Dry and Critically Dry years. MID will provide any purchased water supplies directly to growers (in lieu of groundwater pumping), or depending on the timing and availability, use the purchased water for groundwater recharge. MID will monitor the program by tracking and reporting how water purchased from willing partners is used within the District.

4.2.3.4 Project Benefits

MID system improvements and program projects provide groundwater benefits in different ways. Pipeline projects provide additional groundwater benefits by allowing MID to deliver surface water to growers longer into the season, and by reducing losses. The SCADA project improves MID operational flexibility and allows MID to deliver more surface water to growers. MID incentive programs will encourage growers to use more surface water and pump less groundwater.

Based on an analysis of MID operations and project implementation developed by MID, the average annual gross benefit of each operation and incentive project is as follows:

- **MID Pipeline**. 420 acre-feet.
- **WaterSMART Pipeline**. 875 acre-feet.
- **WaterSMART SCADA**. 1,225 acre-feet.
- **Supply Partnerships**. 3,990 acre-feet (1,995 acre-feet by 2020 and another 1,995 by 2025).
- **Incentive Programs**. 5,005 acre-feet.

These expected values are averages over all year types (Wet, Above Normal, Below Normal, Dry, and Critical), weighted by the probability of each year type. Tables 4-20 through 4-24 below summarize average annual water supply benefits, shown as the average delivery by year type. The reliability of the source water is based on historical hydrology being a good projection of future hydrology. In addition, the reliability depends on future water supply management, including changes to the CVP system and the San Joaquin River Restoration Program that may affect MID operations.

Table 4-20. MID Estimated Average Yield by Year Type, in AF per Year — MID Pipeline Project.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	420	35%	148
AN	420	14%	58
BN	420	8%	33
D	420	16%	66
C	420	27%	115
Avg. Annual			**420**

Table 4-21. MID Estimated Average Yield by Year Type, in AF per Year — WaterSMART Pipeline Project.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	875	35%	309
AN	875	14%	120
BN	875	8%	69
D	875	16%	137
C	875	27%	240
Avg. Annual			**875**

Table 4-22. MID Estimated Average Yield by Year Type, in AF per Year — WaterSMART SCADA Project.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	1,225	35%	432
AN	1,225	14%	168
BN	1,225	8%	96
D	1,225	16%	192
C	1,225	27%	336
Avg. Annual			**1,225**

Table 4-23. MID Estimated Average Supply by Year Type, in AF per Year — Water Supply Development-Partnerships.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
Completed by 2020			
W	1,995	35%	704
AN	1,995	14%	274
BN	1,995	8%	156
D	1,995	16%	313
C	1,995	27%	548
Avg. Annual			**1,995**
Additional Completed by 2025			
W	1,995	35%	704
AN	1,995	14%	274
BN	1,995	8%	156
D	1,995	16%	313
C	1,995	27%	548
Avg. Annual			**1,995**

Table 4-24. MID Estimated Average Yield by Year Type, in AF per Year — Incentive Programs.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	5,005	35%	1,766
AN	5,005	14%	687
BN	5,005	8%	393
D	5,005	16%	785
C	5,005	27%	1,374
Avg. Annual			**5,005**

4.2.3.5 Project Costs

Estimated project costs for MID system improvements and program projects are shown in Table 4-25. MID is continuing to develop many of these projects. Costs will be refined under ongoing development efforts. All project costs have been indexed to current (2019) dollars for consistency of comparison.

The pipeline and SCADA projects are complete or nearly complete. Capital costs shown for these projects reflect estimated material costs (pipeline) and total project costs (including Reclamation cost share) for both WaterSMART projects (pipeline and SCADA).

The water supply partnerships and incentive programs will deliver additional water acquired from willing sellers. MID does not anticipate any capital expenditures under these projects. Costs include MID O&M to deliver the water plus the cost to acquire the water at market prices that vary by year type. The water prices paid are averages weighted by year type. Future market conditions and the terms of agreements that MID can reach with its partners will determine the actual cost. MID will continue to work with partners to identify opportunities.

4.2.4 Project Financing

Pursuant to GSP Regulations § 354.44 and § 354.6, MID has evaluated and described the ability to cover project costs. Some projects are complete and other projects are still being assessed, and feasibility studies are being refined or developed, a general description of how MID will cover project costs is presented. MID will conduct economic and fiscal feasibility studies as part of its ongoing planning efforts to better understand willingness and ability to pay for the projects included in the GSP.

MID will pursue available state and federal grants or loans to help construct projects. This may include grant funding for planning studies to support the development of proposed management actions, including its On-Farm Recharge program and incentives to increase surface water deliveries within the district. Operation and maintenance costs will be paid using revenues raised through water rates and/or fees and assessments. MID will conduct the necessary studies and decision processes (including Proposition 218 elections if necessary) to approve rates, fees, or assessments to provide the required funding. MID water users have, in the past, approved assessments to fund projects.

Table 4-25. MID System Improvements and Programs Costs.

Item	Total Cost	Year Incurred	Notes[1]
MID Pipeline Project			
Capital Costs	$556,000	2016-2020	The project is complete
O&M costs	none		No additional O&M cost
WaterSMART Pipeline Project			
Capital Costs	$1.3 million	Complete	Operation to begin in 2019; Includes Reclamation and MID costs
O&M costs	none		No additional O&M cost
WaterSMART SCADA Project			
Capital Costs	$1.2 million	Complete	Operation to begin in 2019; Includes Reclamation and MID costs
O&M costs	none		No additional O&M cost
Water Supply Partnerships Completed by 2020			
Capital Costs	none		
O&M costs			
Purchase Water	$1.2 million per year	Annual average	Include water purchase cost from willing sellers, weighted by year type
Conveyance O&M	$50,000 per year	Annual average	$25 per AF cost to convey, incurred when water is available
Water Supply Partnerships Completed by 2025			
Capital Costs	none		
O&M costs			
Purchase Water	$1.2 million per year	Annual average	Include water purchase cost from willing sellers, weighted by year type
Conveyance O&M	$50,000 per year	Annual average	$25 per AF cost to convey, incurred when water is available
Incentive Programs			
Capital Costs	none		
O&M costs			
Purchase Water	$2.95 million per year	Annual average	$590 per AF acquired from willing sellers, weighted by year type
Conveyance O&M	$125,000 per year	Annual average	$25 per AF cost to convey, incurred when water is available

Notes: (1) MID O&M costs will be greater than $25 per AF and will be assessed as part of more detailed project development.

4.2.5 Coordination with Other GSAs and Planning Agencies

This GSP is the coordinated Plan for the four coordinating GSAs in the Madera Subbasin (City of Madera GSA, Madera Irrigation District GSA, Madera County GSA, and Madera Water District GSA). A coordination agreement will be executed by the coordinating GSAs with the other three GSAs in the Subbasin (Gravelly Ford Water District GSA, New Stone Water District GSA, and Root Creek Water District GSA) detailing required GSA and GSP cooperation.

In addition, MID works cooperatively with other districts to develop, provide, and manage water supply. For example, MID and MWD have been coordinating on the development of long-term projects to improve surface deliveries to MWD such as a new water supply agreement and the Madera Lake pipeline (see Section 4.1).

4.2.6 MID Projects Already Implemented: Madera Ranch Annexation

MID has been proactive in developing projects to help sustainably manage groundwater within the MID service area. All the projects that MID has already implemented were completed after the historical base period used in the GSP to develop the historical and current water budgets (post 2015), thus provide additional groundwater benefit to MID. One project that does not provide any new water to the Subbasin but is important to acknowledge is the Madera Ranch Annexation.

In 2015, MID annexed 18 parcels, totaling 10,485 acres, owned by the District since 2005 within the area known as Madera Ranch. The annexation provided MID with jurisdiction over the parcels.

The Madera Ranch is located in Madera County, approximately 5 miles southwest of the City of Madera and 10 miles northwest of the City of Fresno. The Fresno River is located to the north and the San Joaquin River is located to the south of the project site. The subject property is located east of Firebaugh Boulevard and south of Avenue 12. The subject property adjoins the existing boundaries of the MID and Gravelly Ford Water District. Adjacent land uses surrounding the property are agricultural with various agricultural zoning designations. Currently, the project site is used for cattle grazing and the project maintains the existing, non-irrigated land use and zoning designations.

4.3 City of Madera GSA Projects

The City of Madera GSA includes two projects for the GSP, one that is already complete and another that is currently being implemented. The project that is fully complete, Berry Basin, is a recharge basin implemented in cooperation with Madera Irrigation District. The project involves delivering water to the basin in wet, above normal, and below normal years. The expected recharge averaged over all years is 48 acre-feet per year, with half credited to the City and half to MID.

A detailed description of the project, pursuant to GSP Regulations §354.44 and § 354.6, is provided above under MID projects (Section 4.2). Table 4-26 summarizes the expected annual benefit of the project that accrues to the City of Madera.

Table 4-26. City of Madera Estimated Average Recharge in Berry Basin by Year Type, in AF per Year.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	55	35%	19
AN	30	14%	4
BN	10	8%	1
D	0	16%	0
C	0	27%	0
Avg. Annual			**24**

4.3.1 Installation of Water Meters and Volumetric Billing

The City of Madera GSA installed water meters between2011 and 2018 and implemented a volumetric billing process for single-family users in 2015. The City of Madera water deliveries on a per capita basis for 2017 to average per capita water deliveries from 1999 through 2012 are significantly less for both inside and outside uses (Table 4-27).

Table 4-27. City of Madera Water Deliveries.

Days	Month	Gallons per Day per Capita (GPDC)					Gallons (2017 pop.)		AF (2017 pop.)	
		Baseline (1999-2012)	Future (2017-2018)	Savings	Savings Indoor	Savings Outdoor	Savings Indoor	Savings Outdoor	Savings Indoor	Savings Outdoor
31	1	115	74	41	41	0	82,884,157	0	254	0
28	2	115	79	36	36	0	65,666,360	0	202	0
31	3	140	78	62	40	22	81,361,654	42,997,652	250	132
30	4	185	99	86	40	46	78,737,084	89,152,185	242	274
31	5	254	148	106	40	66	81,361,654	134,039,273	250	411
30	6	312	160	152	40	112	78,737,084	217,696,436	242	668
31	7	338	183	155	40	115	81,361,654	231,704,936	250	711
31	8	324	167	157	40	117	81,361,654	235,380,469	250	722
30	9	284	146	138	40	98	78,737,084	190,677,719	242	585
31	10	214	119	95	40	55	81,361,654	109,179,746	250	335
30	11	152	95	57	40	17	78,737,084	33,233,600	242	102
31	12	121	78	44	44	0	88,498,763	0	272	0
Avg/Total		213	119	94	40	54	958,805,886	1,284,062,016	2,946	3,940
Ratio Indoor/Outdoor									43%	57%

The City of Madera has installed approximately 13,000 meters, with an additional 250 that will be installed over the coming years. The total cost of the project equals $11 million. The City of Madera expects to complete installation of meters on unmetered services including City medians, parks, facilities and landscape districts. This includes up to 200 private accounts and approximately 50 public water services. Many older parcels have cross connections that will also be addressed thereby increasing individual accountability for water usage and ideally leading to lower water usage. Cost estimates range from $400,000 to $600,000 for the additional meters.

The outdoor savings in applied water includes reductions in turf consumptive use and deep percolation. Assuming 85 percent efficiency, 591 acre-feet of the applied water savings is reduced deep percolation. The remaining 3,350 acre-feet is reduction in consumptive use, or a reduction in the water that leaves the Subbasin.

4.4 Madera County GSA Projects

Madera County GSA (Madera County) has identified four projects and a substantial demand management program that it will implement as part of the GSP.

A water purchase program would seek to acquire water from outside Madera County and provide direct or in-lieu recharge benefits to the Subbasin. A second project would use flood flows from Millerton releases to spread onto participating lands for flood managed aquifer recharge (Flood-MAR). Two additional projects would construct basins to recharge winter floodwater diverted from the Chowchilla Bypass. For purposes of evaluating the timing of the projects, one would be constructed in 2025 and the other in 2040. The project descriptions are based on information developed during the GSP process and, where applicable, other studies.

As a primary element of its efforts to become sustainable, Madera County will implement a demand management program that would oversee a managed reduction in the volume of groundwater consumed

by irrigated agriculture during the 20-year implementation period – terminating in about a 50% reduction from estimated current consumptive use quantities. This will be achieved through programs that will be developed and implemented during the first year following adoption of the GSP, and may impose groundwater pumping limits, allocate pumping credits to parties based on those limits, and potentially allow groundwater users to buy, sell, or carry over pumping credits. This section provides a general overview of demand management and how it could be implemented by Madera County GSA and potentially by other GSAs in the Subbasin to achieve sustainability objectives. Madera County is currently working with stakeholders to develop program-specific parameters.

Description of how these projects fit and coordinate with other Subbasin projects and actions is provided in Chapter 5: Implementation.

4.4.1 Water Purchase for Direct or In-Lieu Recharge

Madera County will develop partnerships and import additional water into Madera County for direct or in-lieu recharge. The project would purchase additional water supplies that would be delivered to Madera County parcels near existing Reclamation and Madera Irrigation District (MID) facilities. Madera County will work with Reclamation, MID, and other potential partners to identify sources of supply, costs, and wheeling agreements.

4.4.1.1 Project Overview

Madera County would directly acquire or facilitate the acquisition of new surface water supplies that would be available for diversion from Millerton Lake or other sources during the irrigation season. Madera County estimates that 3,500 to 9,000 acre-feet could be acquired in one year, but on average the project would provide about 3,600 acre-feet per year in in-lieu recharge.

The project water would be acquired from a water supplier with rights/contracts for water from Millerton, or from another water supplier whose supply can be exchanged with water from Millerton. The water would be conveyed to Madera County parcels that are near an existing major water delivery system (e.g. Madera Canal, MID delivery system, natural stream course). Water would be conveyed to the various locations under a conveyance agreement, as may be appropriate. Diversion and conveyance facilities would be constructed to serve the lands not currently within the delivery system of a district.

4.4.1.2 Implementation

The County will contact (either directly or in coordination with MID) potential sellers of water delivered from Millerton and, if necessary, with other sellers of water that can be delivered from Millerton via exchange agreements. Diversion and conveyance facilities would be constructed to serve the lands. The County will negotiate operation and conveyance agreements to deliver the water to parcels within the Madera County area east of Highway 99. The exact parcels to receive the water have yet to be identified. To minimize costs, Madera County intends to serve parcels with irrigation systems accessible within ¼ mile of a conveyance pathway (e.g. Madera Canal, MID channel, or natural stream course).

The implementation timeline for this project is summarized in Table 4-28. Madera County has already started working with partners to identify potential purchases. Implementation of the project would start immediately in 2020 and continue through full development of the project by 2025.

Table 4-28. Water Purchase for Direct or In-Lieu Recharge Implementation Timeline.

Phase	Start	End
Permitting and environmental documentation	2020	2022
Financing	2022	2023
Construction	2023	2024
Operation	2025	On going

Construction activities and requirements

Construction would be required to divert water from existing canals or streams and convey the water to served lands. Depending on the expected frequency and duration of diversions, both temporary and permanent diversion structures could be used. Madera County will work with MID to identify parcels that are located near existing MID facilities and build necessary infrastructure to serve each parcel. This would include conveyance and all other necessary agreements. Madera County will also work directly with Reclamation to identify and potentially convey to parcels directly adjoining Reclamation owned facilities.

Water source

The project intends to acquire water from Millerton by agreement with an existing CVP contractor, or from other sources that could result in water supplies available in Millerton for delivery. This could include any water that can be conveyed to the County via exchange agreements, including water from potential new projects such as Sites Reservoir.

Conditions or constraints on implementation

A necessary requirement for this project is the availability of water for purchase. Construction of the diversion facilities would not be justified without reasonable access to water. The cost of the water to growers receiving the water could also be an impediment to participation. Delivery of acquired water must be within the capability of existing facilities and reasonably assured by conveyance agreements.

Permitting process and agencies with potential permitting and regulatory control

The project will require conveyance and other agreements to allow the use of facilities to route the water to the new diversion locations. The project will require coordination with Reclamation for scheduling the storage and delivery of water within Millerton or to facilitate exchanges of water acquired from more distant parts of the Central Valley.

The following agencies have potential permitting roles for the project: Madera County, Madera Irrigation District, and US Bureau of Reclamation. Depending on construction requirements for needed delivery infrastructure, an environmental review process under CEQA and/or NEPA could be required. Water transfers with willing partners will require satisfying requirements to transfer water which will depend on the source of the supply and nature of the transfer.

4.4.1.3 Project Operations and Monitoring

Between 3,500 and 9,000 acre-feet would be targeted for acquisition in all year types except wet years, adjusted as appropriate for hydrologic conditions that affect water supply availability. The water would be delivered during the irrigation season using existing conveyance facilities, focusing on the early and later portions of the season when capacity in conveyance facilities may be more available. To minimize

costs, Madera County intends to serve irrigated lands accessible within ¼ or ½ mile of a conveyance pathway (e.g. Madera Canal, MID facilities, or natural stream course). The surface water would be provided directly for irrigation, thereby providing in-lieu recharge of groundwater that would otherwise have been pumped. Future extraction of the in-lieu recharged groundwater will be done by water users within Madera County. If allocation of the in-lieu recharged groundwater is determined to be necessary, groundwater extraction will be monitored and enforced by Madera County with meters installed on individual wells.

4.4.1.4 Project Benefits

Table 4-29 summarizes the expected water purchases by year type. Expected average annual water purchases equal 3,608 acre-feet. To the extent the delivered water substitutes for groundwater, it provides in-lieu recharge equal to the net amount of avoided pumping (gross pumping minus return percolation from the pumped water) plus the percolation from applying the surface water. Therefore, the total recharge (in-lieu plus direct percolation) is equal to the amount of surface water purchased and delivered.

Table 4-29. Madera County Estimated Average Deliveries by Year Type for Water Purchases, in AF per Year.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	0	35%	0
AN	5,000	14%	686
BN	7,000	8%	549
D	9,000	16%	1,412
C	3,500	27%	961
Avg. Annual			**3,608**

4.4.1.5 Project Costs

The estimated costs of this project are summarized in Table 4-30. Project capital costs will include the cost of delivery infrastructure to Madera County parcels. It is assumed that the turnout consists of a canal gate and an open flow propeller meter. If it is necessary to pump water to the field, capital costs may include an in-line propeller meter or mag meter. Madera County is working with partners to define the specific parameters of the project and refine initial project cost estimates. An estimated capital cost of $300,000 for a total of six turnouts and limited conveyance infrastructure is assumed for initial planning purposes.

Annual operating costs of the water purchase project include wheeling agreement cost, other delivery costs (if pumping water is required), and the water purchase cost. The value of water supply is high in this region, especially in critical years. Current estimates of water purchased from existing users under SGMA implementation range from $270 per acre-foot in wet years to over $1,100 in critical years. The weighted average water purchase cost equals $2.4 million per year. An additional cost of $25 per acre-foot is included to convey the water to the fields. All costs are reported in current 2019 dollars.

Table 4-30. Estimated Project Costs for Madera County Water Purchases for Direct or In-Lieu Recharge.

Item	Total Cost	Year Incurred	Notes
Capital Costs	$300,000		Assuming six turnouts and limited conveyance infrastructure
O&M Costs			
Purchase Water	$2.4 million	Annually	Water purchase cost averaged over different year types.
Conveyance O&M	$90,000	Annually	Assume $25 per AF charge to convey including wheeling and delivery

4.4.2 Madera County Import and Recharge of Millerton Flood Releases

The import and recharge of Millerton flood releases project is similar to the Madera County water purchase project (Section 4.4.1), except Madera County would target water (CVP Section 215 supply) that is less expensive than direct transfer agreements with partners, and the water would likely be used for direct recharge, rather than in-lieu of pumped groundwater for direct irrigation events.

4.4.2.1 Project Overview

Through modifications to its existing CVP contract, Madera County would request CVP Section 215 flood water when available, either on its own or partnered with another contractor (Reclamation has previously indicated 215 water would be available in 10,000 acre-foot blocks). Between 2,000 and 10,000 acre-feet per month would be targeted for acquisition when available in wet and above normal years. A total of 20,000 acre-feet would be targeted during wet years, and the expected benefit, averaged over all year types, is about 7,000 acre-feet per year.

The water would be conveyed to Madera County recharge basins or irrigated parcels (Flood-MAR) that are near an existing major water delivery system (e.g. Madera Canal, MID delivery system, natural stream course). Water would be conveyed to the various locations under a conveyance agreement, as may be appropriate. Turnouts and conveyance facilities would be constructed to deliver water to these parcels, potentially using the same facilities that serve surface water during the irrigation season (see prior project).

4.4.2.2 Implementation

Project implementation includes securing water supply, partnerships, wheeling agreements, and building delivery facilities and recharge ponds (where necessary). Madera County will negotiate operation and conveyance agreements to deliver the water to parcels. The exact parcels to receive the water have yet to be identified. To minimize costs, Madera County intends to serve parcels within ¼ or ½ mile of a conveyance pathway (e.g. Madera Canal, MID channel, or natural stream course) that can either construct recharge basins or participate in Flood-MAR programs.

The timeline for implementation of this project is summarized in Table 4-31. Madera County would construct necessary basins, dry-wells, and conveyance facilities to deliver the water for recharge. The exact mix of facilities used for recharge will be determined during project planning in 2020 and 2021. The project will be fully operational by 2025.

Table 4-31. Import and Recharge of Millerton Flood Releases Implementation Timeline.

Phase	Start	End
Permitting and environmental documentation	2020	2022
Financing	2022	2023
Construction	2023	2024
Operation	2025	On going

Construction activities and requirements

Construction would be required to divert water from an existing canal and convey the water to served lands, basins, or recharge wells. Construction of recharge basins and appurtenant facilities would be required to the extent those are determined to be incorporated into the project. The project description and costs presented herein assume that Madera County would construct dedicated recharge basins for the water.

Water source

Water will be Section 215 CVP water from Millerton, obtained through the County's CVP contract with Reclamation, or through partnership with another CVP Contractor, and delivered through existing facilities utilizing necessary conveyance agreements with MID or others.

Conditions or constraints on implementation

A requirement for this project is the availability of Section 215 water for Madera County. Madera County will use its existing contract with Reclamation and/or an agreement with a contractor willing and able to deliver Section 215 water. Delivery of acquired water must be within the capability of existing facilities and reasonably assured by conveyance agreements.

Permitting process and agencies with potential permitting and regulatory control

Reclamation will have authority over the sale of the Section 215 water, and MID or other parties will require conveyance agreements to allow delivery, in addition to all other necessary agreements. Coordination with the State Water Board may be needed to verify the right to divert the water and avoid potential third-party impacts. Additional percolation of water on agricultural lands can affect movement of nitrates or other constituents into groundwater. Coordination with the Central Valley RWQCB's Irrigated Lands Regulatory Program (ILRP) may be needed. The project may require an environmental review process under CEQA and would require compliance with NEPA prior to Reclamation selling the water to the County.

4.4.2.3 Project Operations and Monitoring

Between 2,000 and 10,000 acre-feet per month would be targeted for acquisition when water is available in wet and above normal years. For purposes of estimating the benefit this project may provide to the overall Subbasin sustainability goal, water is assumed to be available only in wet years. The water would be conveyed to recharge facilities using existing channels and facilities to the extent feasible. New conveyance would be constructed where needed.

4.4.2.4 Project Benefits

Table 4-32 summarizes the results of an integrated hydrologic analysis of water potentially available by year type and month for this project. All deliveries represent new supplies. Over time, the average delivery, weighted by the probability of different year types, would be about 7,000 acre-feet per year.

Table 4-32. Madera County Estimated Average Deliveries by Year Type for CVP Section 215 Purchases, in AF per Year.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	20,000	35%	7,059
AN	0	14%	0
BN	0	8%	0
D	0	16%	0
C	0	27%	0
Avg. Annual			**7,059**

Recharge basins may also provide environmental benefits by creating seasonal or perennial habitat for wildlife including waterfowl, amphibians, and reptiles and serve as drinking water sources and foraging habitat for mammals.

4.4.2.5 Project Costs

The estimated costs of this project are summarized in Table 4-33. Project capital costs will include the cost of a turnout and other conveyance required to deliver the water to Madera County parcels, in addition to recharge basins that would in total be able to handle up to 10,000 acre-feet per month. Madera County is working with partners to define the specific parameters of the project and refine initial project cost estimates. Project capital costs may be lower if Madera County is able to identify existing recharge areas or find sites suitable for Flood-MAR closer to existing conveyance systems.

Annual operating costs of the Millerton flood release project include wheeling agreement cost, other delivery costs (if pumping water is required), and the water purchase cost. Project O&M costs are shown as annual averages. Costs will vary annually according to year type and availability of water in those years.

Table 4-33. Estimated Project Costs for Recharge of Millerton Flood Releases.

Item	Total Cost	Year Incurred	Notes
Capital Costs	$31.9 million	2023	Basins to recharge up to 10,000 AF per month
O&M Costs			
Purchase Water	$272,000 per year for CVP Section 215 water	Annual average	$38.40 per AF for CVP 215, incurred when water is available
Conveyance O&M	$176,500	Annual average	$25 per AF District charge to convey, incurred when water is available

4.4.3 Madera County Chowchilla Bypass Flood Water Recharge Basins

Madera County will construct additional recharge basins or work with landowners to develop a Flood-MAR program to divert flood flows from the Chowchilla Bypass (Bypass) onto lands in western portions of Madera County. The project will provide benefits by increasing recharge in this area of Madera County.

4.4.3.1 Project Overview

Madera County will divert water from the Bypass into recharge basins, primarily during wet years but also in other years when water is available. The project proceeds in two phases.

The first phase of the project will develop recharge ponds that would be operational by 2025. Basins would have a capacity to recharge up to 36,000 acre-feet in a wet year (12,000 acre-feet per month from February through April). Madera County would construct diversions, delivery facilities, and recharge basins sized to accommodate this recharge rate. The average annual recharge produced will be about 12,700 acre-feet.

The second phase of the project will develop recharge ponds that would be operational by 2040. Basins would be sized to recharge up to 75,000 acre-feet in a wet year (25,000 acre-feet per month from February through April). The average annual recharge produced by the second set of facilities will be about 26,500 acre-feet.

4.4.3.2 Implementation

Implementation for the first set of basins will be staged over a five-year period, beginning in 2020 (Table 4-34). Madera County will conduct a study to identify appropriate recharge sites. Permitting and environmental documentation will be initiated in 2020, and financing for construction will be identified and secured. Construction will occur in 2023 and 2024.

The second set of recharge basins will follow a similar implementation pattern, beginning in 2035. Construction of facilities will begin in 2038. Basins will be operational by 2040.

Table 4-34. Basins to Recharge Floodwater Implementation Timeline.

Phase	First Set of Basins (2030)		Second Set of Basins (2040)	
	Start	End	Start	End
Permitting and environmental documentation	2020	2022	2035	2037
Financing	2022	2023	2037	2038
Construction	2023	2024	2038	2039
Operation	2025	On going	2040	On going

Construction activities and requirements

Construction activities will include building diversions from the Bypass, conveyance to recharge basins, and the recharge basins themselves. The initial set of basins will be in operation by 2025. The second set of basins will begin operation in 2040. Land used for the basins will be selected based on location and suitability for recharge and will likely include land that is currently farmed.

Water source

Flood flow from the Bypass will be diverted during wet years or other periods of high excess flow. This may require new water rights to allow diversion during high flow conditions.

Conditions or constraints on implementation

The projects rely on the availability of flood flow in the Bypass and the availability of suitable land to construct recharge basins. The second set of recharge basins are planned for operation beginning in 2040. This lead time will provide substantial new information on groundwater conditions and trends, allowing for possible re-evaluation of the need for, scale, and best location of future basins.

Permitting process and agencies with potential permitting and regulatory control

The following agencies have potential permitting or partnership roles for the project: Madera County, the Regional Water Quality Control Board, U.S. Bureau of Reclamation, and other partner agencies. It will be necessary to obtain grading permits for construction of the recharge basins. Madera County will coordinate with others to apply for permits required from the State Water Board for diversion of water into the recharge basins.

4.4.3.3 Project Operations and Monitoring

During periods of winter flood flow, water will be diverted into recharge basins or onto lands participating in Flood-MAR. Based on hydrologic analysis, the initial basins will recharge up to 36,000 acre-feet in wet years, about one out of three years. The second set of basins will recharge up to 75,000 acre-feet in wet years, also about one out of three years. Delivery would typically occur during the winter and early spring but could occur any time that surplus water is available.

Extraction of recharged groundwater will be done by water users within Madera County. If allocation of groundwater recharge credits is determined to be necessary, groundwater extraction will be monitored and enforced by Madera County.

4.4.3.4 Project Benefits

Groundwater recharge will provide water for water users in the Madera County GSA to pump. Based on a hydrologic and operations analysis covering the historical period, the gross yield would average about 12,700 acre-feet per year for the first basins and about another 26,500 acre-feet per year from the second set of basins (Table 4-35).

Recharge basins may also provide environmental benefits by creating seasonal or perennial habitat for wildlife including waterfowl, amphibians, and reptiles and serve as drinking water sources and foraging habitat for mammals

The reliability of source water is based on the use of historical hydrology as an indicator of future hydrology. In addition, the reliability depends on future water supply management, including changes to the CVP system and the San Joaquin River Restoration Program, as well as diversions of other flood flows or sources of water by other GSAs or other entities with rights to that water.

4.4.3.5 Project Costs

The estimated costs of this project are summarized in Table 4-36. Project capital costs will include the cost of a turnout and other conveyance required to deliver the water to Madera County parcels. Details regarding the development of these capital costs are provided in Appendix 4.A. Recharge basins would require permitting, land acquisition, earthwork, and site development to connect to the conveyance.

Madera County is working with partners to define the specific parameters of the project and refine initial project cost estimates. An estimated capital cost of $67 million for the first phase of recharge basins and $119 million for the second phase of recharge basins (in current 2019 dollars) is used for initial planning purposes.

Annual operating costs include the cost to deliver water to recharge basins and maintain the system. O&M costs may be lower if limited energy costs are required to move water to recharge basins. Madera County is evaluating options and will continue to refine O&M cost estimates.

Table 4-35. Madera County Estimated Average Deliveries by Year Type for Recharge Basins, in AF per Year.

First Set of Basins			
Year Type	**Total Annual Volume**	**% of Years**	**Weighted Avg.**
W	36,000	35%	12,706
AN	0	14%	0
BN	0	8%	0
D	0	16%	0
C	0	27%	0
Avg. Annual			**12,706**
Second Set of Basins			
Year Type	**Total Annual Volume**	**% of Years**	**Weighted Avg.**
W	75,000	35%	26,471
AN	0	14%	0
BN	0	8%	0
D	0	16%	0
C	0	27%	0
Avg. Annual			**26,471**

Table 4-36. Estimated Project Costs for Basins to Recharge Flood Water from Chowchilla Bypass.

Item	**Total Cost**	**Year Incurred**	**Notes**
First Set of Basins			
Capital Costs	$67 million	2023-2024	For diversion and conveyance facilities and basins to recharge up to 12,000 AF per month
O&M costs			
Conveyance O&M	$318,000 per year	Annual average after 2025	$25 per AF cost to convey, incurred when water is available
Second Set of Basins			
Capital Costs	$118.9 million	2038-2039	For diversion and conveyance facilities and basins to recharge up to 25,000 AF per month
O&M costs			
Conveyance O&M	$1,160,000 per year	Annual average after 2040	$25 per AF cost to convey plus contingency costs, incurred when water is available

4.4.4 Management Action: Demand Management

Madera County has determined that its potential projects are unlikely to generate enough new water to offset the estimated current and projected future overdraft conditions in its GSA. It has decided to implement a management action to gradually reduce groundwater pumping over the GSP implementation period, achieving significant reductions in the consumptive use of groundwater by 2040.

The management action is a demand management (water use reduction) program. In broad terms, demand management can include any water management activity that reduces the diversion, conveyance, or use of irrigation water. However, to be effective for purposes of sustainable groundwater management, demand management must result in a decline in the consumptive use of groundwater pumped and applied for irrigation (pumping net of recharge). Activities that, for example, reduce canal seepage or reduce deep percolation from irrigation will not be effective. They may decrease quantity of water diverted or applied but they also reduce recharge to usable groundwater, so do not improve the net pumping from the aquifer.

Madera County is continuing to work with stakeholders to develop the specific details of the program. A general overview of the proposed program and summary of decisions that had been made as of late May 2019 are summarized in this section.

4.4.4.1 Program Overview

The Madera County demand management program will reduce consumptive water use (measured as evapotranspiration, ET) over the GSP implementation period. Demand management actions that reduce consumptive use can include changing to lower water-using crops, water-stressing crops (providing less water than the crop would normally consume for full yield), reducing evaporation losses, and reducing irrigated acreage. However, Madera County will not dictate which of those reduction methods growers would implement. Madera County's primary approach to demand management is to set demand reduction targets for the GSA service area as a whole, based on conditions in the Subbasin. Achieving the targets can be approached through a variety of methods, including groundwater allocations, internal groundwater markets (e.g. limited to within the GSA), fee structures, and fallowing programs. The County seeks a balance of individual flexibility and GSA-wide accountability. The Madera County GSA is considering various methods, including satellite observations, to monitor and enforce pumping limits to ensure compliance with the demand reduction targets and sustainability objectives. California Water Code §10726.4 (a)(2) provides the Madera County GSA with the authority to control groundwater extractions by regulating, limiting, or suspending extractions from individual groundwater wells or extractions from groundwater wells in the aggregate.

The following principles are guiding development of the demand management program. These are in no order of preference and Madera County recognizes tradeoffs exist among these principles.

- Minimize the economic impacts of any demand management required in Madera County
- Maintain established water rights
- Incentivize investment in water supply infrastructure
- Incentivize economically efficient water use
- Incentivize recharge in aggregate, and in specific regions
- Allow sufficient program flexibility for groundwater pumpers to adjust over time
- Ensure access to domestic water supply (de minimis domestic use as defined by SGMA is less than 2 acre-feet annually per user)

4.4.4.2 Implementation

Madera County is currently evaluating a range of demand management program options. All options impose a limit on groundwater pumping that will initiate upon adoption of the GSP. Madera County is continuing to work with stakeholders to develop a program that is implementable, is consistent with the guiding principles, and achieves sustainability objectives in the Subbasin. The demand management program may include one or more of the following approaches:

- **Allocations**. Madera County would implement a groundwater allocation program that would directly relate to the overall demand reduction goals necessary to achieve anticipated reductions by 2040. Allocations could be tied to a crop-type or historic use, or could be evenly distributed among existing irrigators or over all lands. Various approaches have differing effects on grower flexibility, County management and administration, and perceptions of equality.
- **Water trading program (water market, cap and trade)**. Madera County would establish a local groundwater credit system and allow trading of those credits among groundwater users. The program would establish a full accounting of available groundwater supply, allocation of that water supply to local stakeholders, and a record-keeping system that facilitates and records all trades. Additional conditions on location and timing of the use of traded credits may be needed, and in fact, are likely to be required in many areas.
- **Easements**. Madera County would identify potential easement programs and other sources of funding to incentivize fallowing of irrigated lands.

The Madera County demand management program may impose groundwater pumping limits starting in 2020 (Table 4-37). At this time, based on the expected yield of the projects identified under Section 4.2.1 and 4.2.2, the Madera County demand management program will, by 2040, reduce average annual groundwater pumping by 90,000 acre-feet. However, if Madera County project yields are lower than initially estimated, Madera County will increase the level of demand management.

Madera County plans to gradually phase-in demand management between now and 2040. Starting in 2020 and continuing through 2025, average annual groundwater pumping will be reduced by 2% (of the total demand reduction amount) per year, for a total cumulative reduction of 10% by 2025. Groundwater pumping will be reduced by 6% per year starting in 2026 and continuing through 2040. Figure 4-4 illustrates the annual reduction in pumping by year between 2020 and 2040. The annual reduction in pumping in Madera County will equal 90,000 acre-feet by 2040. The second axis on the right shows the corresponding reduction in crop ET_{aw}, consumptive use, under the demand management program. Crop ET_{aw} will be reduced to about 64% of the current ET_{aw} in the Madera County area by 2040.

Table 4-37. Madera County Demand Management Program Implementation Timeline.

Phase	Start	End
Permitting and environmental documentation	2020	On going
Financing	2020	On going
Construction	N/A	N/A
Operation	2020	On going

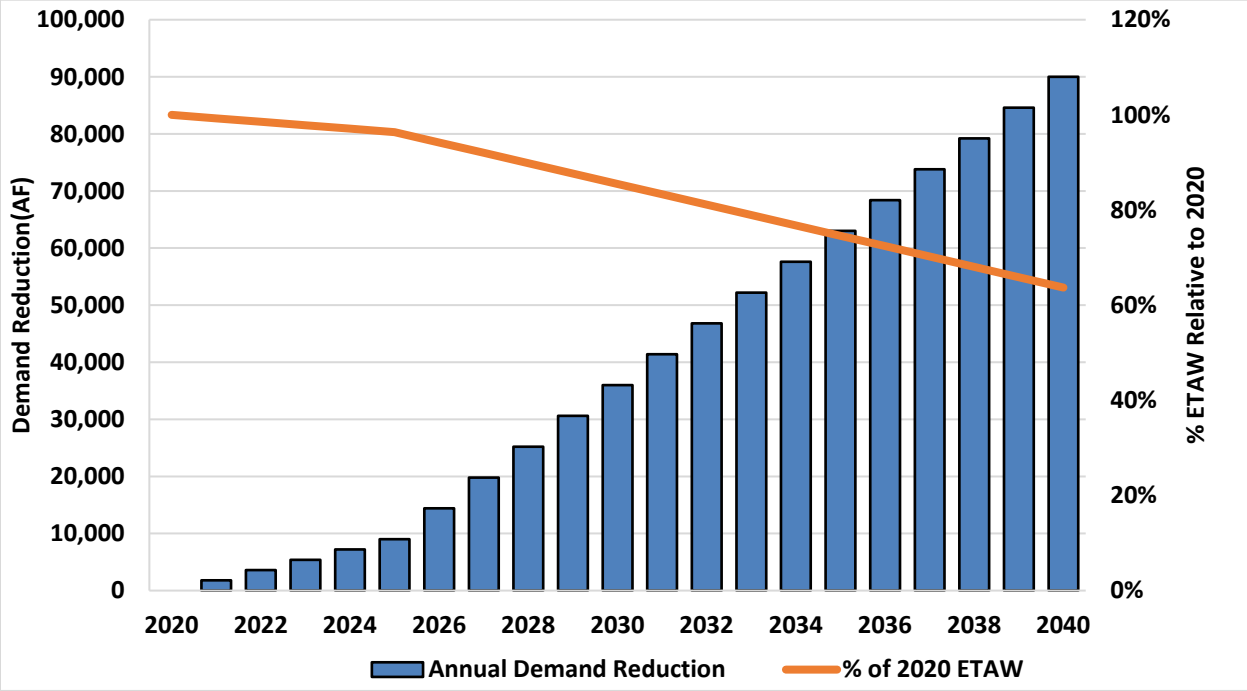

Figure 4-4. Madera County Demand Management Program

The fundamental requirements of any demand management program include establishing a full accounting of available groundwater supply, a method for allocating the supply, and a system for monitoring and enforcement to ensure that the allocation is not exceeded by any individual or in the aggregate. Madera County is currently working with stakeholders to develop the initial guidelines of the demand management program. Important events and preliminary decisions relevant to the demand management program include:

- June 27 – 29, 2018 – The County of Madera met with representatives in Ventura County to tour recharge facilities and discuss Fox Canyon Groundwater Management Agency water market approaches that could apply to Madera County.
- July 17, 2018 – Following several weeks of development, the County of Madera submitted a proposal for a US Bureau of Reclamation WaterSMART grant to fund a study to evaluate water trading strategies.
- September 24, 2018 – The County of Madera met with the Pajaro Valley Groundwater Management Agency to discuss groundwater management options that may apply to Madera County.
- October 5, 2018 – The County of Madera was notified that it received funding for its US Bureau of Reclamation WaterSMART proposal to develop a groundwater marketing strategy for Madera County.
- November 11, 2018 – The County of Madera held a water marketing workshop to allow stakeholders to discuss water trading approaches that could be implemented under the demand management program.

- December 17, 2018 – The County of Madera held a second water marketing workshop to allow stakeholders to discuss water trading approaches that could be implemented under the demand management program, and test alternative market rules.
- February 12, 2019 – The Madera County Advisory Committee for GSAs recommended that as part of the GSP, native groundwater should be allocated equally across irrigated and unirrigated land within the County GSAs. The vote was 10-1.
- March 7, 2019 – The Madera County Advisory Committee for GSAs recommended that as part of the initial modeling efforts, groundwater pumping in the County GSAs decrease over time decreased at approximately 2% a year from 2020 to 2040 (see Figure 4-4 for example implementation schedule). The vote was 11-0.
- April 12, 2019 – The Madera County Advisory Committee for GSAs recommended that credits be given only for activities that introduce new water into the Subbasin (new water is water that would not otherwise be part of the Subbasin water supplies). The vote was 8-0.
- April 12, 2019 – The Madera County Advisory Committee for GSAs recommended that credits be evaluated by an outside entity to establish the quantity of water to be credited. The vote was 8-0.

Madera County will continue to work with stakeholders to further develop the demand management program. Implementation will start immediately and continue indefinitely.

The following subsections describe the demand management program activities and costs assuming that the Madera County demand management program includes groundwater trading.

Construction activities and requirements

No new physical water storage or conveyance facilities are required to operate a demand management program. The program could require investment in well meters or other monitoring approaches (e.g. remote sensing) to ensure pumpers comply with pumping limits.

The demand management program will require significant outreach, planning, and strategy development efforts. A groundwater market, if established, would require measurement of groundwater pumping and development of accounting software to manage trades and pumping credits. Individual water users may incur costs to manage their demand and participate in trading, but such costs are borne by individual users, may include voluntary activities, and do not require funding by the GSA.

Water source

No new water is provided. The existing groundwater use is capped, and annual reductions are managed under the demand management program.

Conditions or constraints on implementation

The demand management program is a mandatory program for Madera County groundwater users. If Madera County implements a groundwater market, participation in the market (trading) would be voluntary. Successful implementation of a trading program does not depend on all users participating, but the success of the program does depend on other factors, including:

- Any trading program must establish definitive limits on groundwater pumping and be able to enforce conditions.

- Any trading program must have an accounting mechanism to monitor pumping (or allocate credits) and an acceptable method for reviewing and ensuring compliance with the program.
- Any trading program must implement rules and constraints to ensure that the program is consistent with the GSP goals.

Permitting process and agencies with potential permitting and regulatory control

The County will likely have the primary and only regulatory control for the GSA's demand management program.

Additional regulatory or permitting processes or control are not anticipated to be necessary under this component of the Madera County GSA's sustainability program.

4.4.4.3 Program Operations and Monitoring

Madera County is currently working with GSA stakeholders and other GSAs in the subbasin to define the demand management program, including the potential for a within-GSA groundwater market. The County has recently received a U.S. Bureau of Reclamation WaterSMART grant to investigate the functionality and viability of a groundwater market, anticipating results from that effort to further inform development of the demand management program.

Tasks that are funded by the WaterSMART grant include:

1. Defining opportunities with potential partners
2. Obtaining input from potential partners regarding concerns and priorities
3. Assessing economic, social, and environmental impacts of a water marketing strategy
4. Analyzing legal opportunities and constraints regarding a water marketing system
5. Developing monitoring, quantification, mitigation and standards for assessment of future needs
6. Developing finalized water marketing strategy framework through the grant program
7. Conducting a pilot water market demonstration

The County recognizes a critical element of success for this program will be on-going monitoring of groundwater use across the entire GSA management area. Madera County is currently evaluating potential measurement methods including:

- Meters on wells.
- Water use based on established crop factors.
- Remote-sensing measures of ET with additional analysis to determine ET_{aw}.

4.4.4.4 Program Benefits

The demand management program allows Madera County GSA and groundwater users to achieve the sustainability targets in a flexible and cost-effective way. Coupled with the Madera County projects to augment supplies, demand must be reduced to meet the sustainability goals.

4.4.4.5 Program Costs

Madera County is currently developing the demand management program and assessing potential costs. Since the details are still under development, project costs cannot be estimated at this time, but demand management is anticipated to require substantial County administration and implementation budgets.

Costs to measure pumping and monitor groundwater conditions are part of overall GSP management and not imposed by this program.

The most significant cost of the demand management program falls on agricultural groundwater pumpers (growers) and the regional economy. An economic impact analysis of the demand management program has estimated average annual direct economic costs at $53.9 million per year. This represents reduced net returns to crop production resulting from demand management. It does not include indirect and induced economic impacts to other businesses, employees, and the Madera County regional economy.

4.4.5 Other Potential Projects

Three other projects have been identified by Madera County to either increase recharge or reduce consumptive use of water. These ideas are in early stages of discussion, so complete details about project features, yields, and costs have not yet been developed. Potential project yields are not included in the GSP.

4.4.5.1 Arundo Removal

Madera County has identified areas within Madera Subbasin where an invasive plant called *Arundo donax* (Arundo) could be controlled or removed, potentially saving a significant amount of consumptive water use. Arundo is a non-native, fast growing, and dense reed that purportedly has high water consumption. It currently grows primarily in stream channels. The Nature Conservancy (TNC) has provided a literature review of Arundo's consumptive use and other impacts on native ecosystems (TNC, 2019). Studies of its consumptive use show an extremely wide range of estimates, from 1 acre-foot per acre per year to as much as 48 acre-feet per acre per year, depending on how consumptive use is estimated and the plants' location, size, and access to water. In the Madera Subbasin, consumptive use is likely on the lower end of the range of estimates because the water courses where Arundo grows are often dry for much of the year.

Based on preliminary estimates, approximately 500 acres of Arundo exists in concentrated stretches of Berenda, Cottonwood, and Dry Creeks. Details on acreage of infestation, water use, the potential for reduction, and the cost would be developed before a removal/control plan is prepared.

4.4.5.2 Private, Small-Scale Recharge Projects

Several private, direct or in-lieu groundwater recharge projects have been implemented or proposed by landowners. These projects are similar to Madera County GSA recharge projects, though much smaller in scale. Up to 20 acre-feet per day would be recharged. The water would either be used in lieu of groundwater pumping for irrigation or be recharged through drywells.

Typical project components would include permits and environmental documents, planning and design, and construction of the diversion structure, pump, and conveyance.

4.4.5.3 Dry Well Groundwater Recharge

Drywells have been installed in various areas of Madera County. Located on private residential property, dry wells are typically constructed 2 feet in diameter and 50 feet in depth and have served to recharge areas with running and standing water. In recent tests, the drywell size was increased to 3 feet in diameter by 75 feet deep in order to increase the recharge capacity and potentially reduce the unit cost of recharge.

Test results are still being evaluated and potential groundwater recharge volumes resulting from dry well installation has yet to be evaluated. Thus, the evaluation of dry wells as a potential groundwater recharge program is still in the early stages of evaluation and discussion.

Projects that comply with the existing Madera County Dry Well detail located on residential parcels may be permitted through the Madera County Environmental Health Department. Drywells that are larger than the 2-foot diameter, 50-foot depth are registered with the Environmental Protection Agency (EPA) as a Class V Injection well.

Because drinking water quality is of critical importance, Madera County is working with the Regional Water Quality Control Board to develop a process for evaluating the potential of deeper injection wells.

To be useful in meeting sustainability goals, any dry well project would need to demonstrate a right to the water source and that the source is new to the subbasin (e.g. not just recharging water already present that would otherwise recharge through other means).

4.4.6 Project Financing

Pursuant to GSP Regulations § 354.44 and § 354.6, Madera County has evaluated and described the ability to cover project costs. Since most projects are still being assessed, and feasibility studies are being refined or developed, a general description of how Madera County will cover project costs is presented. Madera County will conduct economic and fiscal feasibility studies as part of its ongoing planning efforts to better understand willingness and ability to pay for the projects included in the GSP. Demand management program costs will likely be covered through fees on groundwater pumpers.

To help with projected costs for projects and demand management, Madera County will continue to pursue available state and federal grants or loans for actions such as planning studies, construction projects, fallowing easements, and monitoring. Generally, construction costs will be financed through issuance of bonds, to be repaid from revenues raised through water fees and other assessments. Operation and maintenance costs will be paid using revenues raised through water fees and other assessments. Madera County will conduct the necessary studies and decision processes (including Proposition 218 elections) to approve fees or assessments to provide the required funding.

4.4.7 Coordination with Other GSAs and Planning Agencies

This GSP is the coordinated Plan for the four coordinating GSAs in the Madera Subbasin (City of Madera GSA, Madera Irrigation District GSA, Madera County GSA, and Madera Water District GSA). A coordination agreement will be executed by the coordinating GSAs with the other three GSAs in the Subbasin (Gravelly Ford Water District GSA, New Stone Water District GSA, and Root Creek Water District GSA) detailing required GSA and GSP cooperation.

At this time, no trading of pumping credits across GSA boundaries is anticipated. To the extent that trading within Madera County GSA may affect groundwater conditions at the boundary between it and a neighboring GSA, additional coordination may be needed.

4.5 Gravelly Ford Water District GSA Projects

Gravelly Ford Water District GSA (GFWD) is developing its own GSP. However, it falls within the Madera Subbasin, so its projects are included here to describe their effects on the groundwater and overall water balance of the Subbasin. Additional details are provided in the GFWD GSP.

GFWD has identified three projects and management actions for its GSP implementation. One is a recharge project that will provide additional groundwater recharge and two projects provide improved measurement of pumping and monitoring of groundwater conditions. All three projects support the goals of groundwater sustainability and improved overall water management in GFWD.

4.5.1 Recharge in Canals and Basin

GFWD will develop recharge basins. Water will be diverted from Cottonwood Creek into basins where it will percolate into the deep aquifer. The size, location, and performance of the recharge basins depends on site-specific characteristics that are currently being assessed by GFWD.

The project will use an existing basin to recharge water either purchased or available as excess flow. The basin is in the northern half of GFWD, just south of Cottonwood Creek and west of the Gravelly Ford Canal. Historically, flood and storm flows have been routed through Cottonwood Creek or GFWD facilities and discharged from the District. Instead, this water will be held in the recharge basin or distribution canals in order to recharge the groundwater. In addition, water may be purchased and delivered to the basin for recharge.

The project will also implement improved measurement of the flood and storm flows through the District and the incidental recharge associated with them.

4.5.1.1 Implementation

GFWD is responsible for developing and implementing the recharge project. It will modify its operations as needed beginning in 2020 to divert available flood flows or storm water flows into the Basin or hold them in the distribution system for recharge (Table 4-38). Purchased water would be delivered to the basin if and when it is available.

The recharge basin and other needed conveyance facilities are in place, so the project can start immediately. No additional permitting or construction is needed. Actual operation will begin when flood or storm water (or purchased water) is available.

The primary water source will be flood flows in the San Joaquin River or in Cottonwood Creek. Purchased water will also be recharged when available. GFWD will coordinate with Reclamation and the State Water Board for any pumping of water from the two natural channels. No additional permitting requirements are expected. The District currently receives or purchases water through its permitted facilities on the San Joaquin River and Cottonwood Creek. The project will modify operations of existing facilities to capture and recharge flood and stormwater flows and, when available, purchased water.

Table 4-38. GFWD Recharge in Canals and Basin Implementation Timeline.

Phase	Start	End
Permitting and environmental documentation	Not applicable (NA)	NA
Financing	**NA**	NA
Construction	NA	NA
Operation	2020	On going

4.5.1.2 Project Benefits

The water diverted into the basin will percolate and recharge groundwater. Surplus winter and spring flows are expected to be available in some wet, above normal, and below normal years. Purchased water, if and when available, could be delivered during any year and month.

The recharge benefits of the project will vary annually depending on the available flood flows. Table 4-39 summarizes the expected average amounts available by year type and month. See GFWD's GSP for description of benefits, how the project works with other projects, and costs.

Recharge basins may also provide environmental benefits by creating seasonal or perennial habitat for wildlife including waterfowl, amphibians, and reptiles and serve as drinking water sources and foraging habitat for mammals.

Table 4-39. GFWD Recharge Basins Estimated Average Annual Additional Flood Flow Available, by Year Type.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	4,956	35%	1,749
AN	4,956	14%	680
BN	2,478	8%	194
D	0	16%	0
C	0	27%	0
Avg. Annual			**2,624**

The expected flood flows shown in the table are based on available winter flows during the period October – March over the historical period 1965-2015. Expected monthly benefits by water year type are changes in stored groundwater (or reduced groundwater overdraft). Initial volumes will be determined based on results from pilot testing or percolation testing. On-going measurement of benefits to groundwater storage will be integrated into the overall GSP monitoring and measurement program.

4.5.2 Groundwater Pumping Measurement

GFWD staff will assist landowners/customers (owners) to install flow meters on groundwater wells used for crop production within the District. Various wells in the District already have meters and those that do not will be outfitted with the new meters, at the owner's expense. The owner will provide monthly and annual pumping volumes from the well. GFWD will collect and process the data and report the aggregate (not specific to individual wells) annual volume pumped from the local aquifer.

The project's first measurements and evaluations of the proposed 24 wells in the GFWD boundary will start this year (2019). The project will be reviewed by the Board of Directors and notice sent out to the owners in the GFWD service area.

Installation of new meters will be the responsibility of the owners. GFWD staff will assist those that currently do not have a flow meter, to assure that it is installed correctly. Staff will provide a standard reporting form for the monthly and annual report to GFWD.

No permitting is required from other agencies for this effort. The District will receive permission from each owner for the reporting of the well flow data.

The project will not provide new water supply, but it will allow GFWD to measure groundwater use, monitor conditions, and better understand the overall water balance within the District. It will support GFWD's efforts to manage groundwater sustainably as part of the Madera Subbasin GSP. The meters will also assist the growers to make more informed irrigation management decisions.

4.5.3 Groundwater Monitoring Program

GFWD's hydrogeologist has selected 24 wells to measure and record the standing water level. Measurements would be taken twice a year, one in the spring (February or March) prior to the irrigation season and another measurement in the fall (October or November). These levels will be tracked, and the data will be charted and analyzed to determine long-term trends and annual patterns related to water year types.

The project's first measurements and evaluations of the proposed 24 wells in the District boundary will start this year. The project will be implemented by the Hydrogeologist for the District and will continue under his direction. The Hydrogeologists' staff will take the measurements or train District staff to take the measurement.

No permitting is required from other agencies for this effort. GFWD will receive permission from owners for access to wells and reporting of the monitoring data.

The project will not provide new water supply, but it will allow GFWD to measure groundwater levels and better understand the overall condition and trends in levels within its boundaries. It will support GFWD's efforts to manage groundwater sustainably as part of the Madera Subbasin GSP. GFWD will use this data to improve the distribution and application of water to properties in its service area.

4.5.4 Coordination with Other GSAs and Planning Agencies

This GSP is the coordinated Plan for the four coordinating GSAs in the Madera Subbasin (City of Madera GSA, Madera Irrigation District GSA, Madera County GSA, and Madera Water District GSA). A coordination agreement will be executed by the coordinating GSAs with the other three GSAs in the Subbasin (Gravelly Ford Water District GSA, New Stone Water District GSA, and Root Creek Water District GSA) detailing required GSA and GSP cooperation.

GFWD is preparing its own GSP, and it has cooperated with the coordinating GSAs in developing this Madera Subbasin GSP. The Madera Subbasin GSP establishes the requirements and process for monitoring groundwater conditions, and GFWD will comply with these requirements. Data collected from individual wells will be used to verify consistency with the sustainability goals of the GSP. No other coordination agreements are needed to implement these projects.

4.6 New Stone Water District GSA Projects

New Stone Water District GSA (NSWD) is developing its own GSP. However, it falls within the Madera Subbasin, so its projects are included here to explain their effects on the groundwater and overall water balance of the Subbasin. Additional details can be found in the NSWD GSP.

4.6.1 Water Right Utilization

NSWD GSA has an appropriative water right along the Chowchilla Bypass (referred to as Eastside Bypass/Chowchilla Canal in its water rights permit number 19615) of 15,700 acre-feet/year. Currently, NSWD does not use this water right. With the implementation of SGMA, NSWD intends to fully use the water right and bring 15,700 AF of surface water into NSWD. The water is expected to be available during times of flood flows in the Chowchilla Bypass, about one year out of three. The water may be recharged directly or used for irrigation, thereby providing in-lieu groundwater recharge.

4.6.1.1 Implementation

NSWD intends to begin diverting water as soon as it is available (Table 4-40). NSWD already has the water rights permit and diversion facilities, so no further documentation or permitting requirements are anticipated.

Table 4-40. NSWD Water Right Utilization Implementation Timeline.

Phase	Start	End
Permitting and environmental documentation	2019	2020
Financing	Not applicable (NA)	NA
Construction	NA	NA
Operation	2020	On going

Water will be diverted from the Chowchilla Bypass during times of available flood flow. NSWD will coordinate as needed with the State Water Board and local agencies as needed when it is diverting water.

4.6.1.2 Project Benefits

The water diverted into the basin will percolate and recharge groundwater. Surplus winter and spring flows are expected to be available in some wet, above normal, and below normal years. Purchased water, if and when available, could be delivered during any year and month.

The quantity will vary from year to year depending on the available flood flows. Table 4-41 summarizes the expected average amounts available by year type and month.

The expected available flood flows are based on winter flows in the Chowchilla Bypass during the period January – June over the historical period 1965-2015. Expected monthly benefits by water year type are changes in stored groundwater (or reduced groundwater overdraft).

Benefits to groundwater will be determined based on measured diversions from the Bypass and monitoring of groundwater conditions as part of GSP implementation.

4.6.2 Coordination with Other GSAs and Planning Agencies

This GSP is the coordinated Plan for the four coordinating GSAs in the Madera Subbasin (City of Madera GSA, Madera Irrigation District GSA, Madera County GSA, and Madera Water District GSA). A coordination agreement will be executed by the coordinating GSAs with the other three GSAs in the Subbasin (Gravelly Ford Water District GSA, New Stone Water District GSA, and Root Creek Water District GSA) detailing required GSA and GSP cooperation. NSWD is preparing its own GSP for its portion of the Subbasin but is participating in the broader SGMA planning efforts for the Subbasin.

4.7 Root Creek Water District GSA Projects

Root Creek Water District GSA (RCWD) is developing its own GSP. However, it falls within the Madera Subbasin, so its projects are included here to explain their effects on the groundwater and overall water balance of the Subbasin. Additional details can be found in the RCWD GSP.

Table 4-41. NSWD Estimated Average Flood Flow Available, in AF by Year Type

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	15,700	35%	5,541
AN	0	14%	0
BN	0	8%	0
D	0	16%	0
C	0	27%	0
Avg. Annual			**5,541**

4.7.1 Distribution of Purchased Water for In-Lieu Storage

In 2014, RCWD received a grant to help pay for a turnout and pipeline from MID Lateral 6.2 to bring surface water supplies into the north side of RCWD. The purpose of the pipeline is to mitigate groundwater overdraft by using surface water, when available, in place of groundwater in the 3,000-acre service area. This project will enable RCWD to utilize its surface water contracts with MID, Westside Mutual, and Reclamation, thus decreasing groundwater pumping. Since project completion, about 8,000 AF of surface supplies have been brought into the District. Existing facilities include a 48-inch diameter main line that runs south for about 2.7 miles and has approximately 5.4 miles of laterals. The design maximum capacity of the system is approximately 50 cfs with 17.6 cfs discharge into Root Creek.

Some agricultural land in the northeast corner of the District that is currently served by the pipeline and laterals is planned for a housing development. Therefore, as that land is taken out of production, this project will expand the distribution system to replace the acreage.

4.7.1.1 Implementation

RCWD is responsible for developing and implementing the project. It will modify its operations as needed to bring in additional surface water supplies. Project construction is already complete and RCWD expects the project to be operational starting in 2019 (Table 4-42).

Table 4-42. RCWD Purchased Water Project Implementation Timeline.

Phase	Start	End
Permitting and environmental documentation	Not applicable (NA)	NA
Financing	NA	NA
Construction	2014	2014 (already complete)
Operation	2019	On going

4.7.1.2 Project Benefits

RCWD has contracts with MID, Westside Mutual, and Reclamation for surface water. The contract with MID states that RCWD may purchase water in excess of MID water demands, up to 10,000 AF in any one year. Since this water is dependent on how much water MID receives based on their CVP Class I and Class II allocation, it will likely only be seen by Root Creek in wet years at a much lower volume. The agreement

with USBR will allow RCWD to use Section 215 water, or flood flow, when available. The ability of RCWD to take the water will depend on time of year for irrigation demand and capacity of Lateral 6.2 to carry the water. Lastly, the contract with Westside Mutual is a dependable supply, up to 7,000 AF per year. However, this is the most expensive source of water and will likely only be used in dry years when other sources are not available. All contract water mentioned above will come from the San Joaquin River and Millerton Lake.

This project has been completed with the intent of bringing RCWD into a condition of sustainable groundwater management. Conditions for implementation included the recognition of continued overdraft, as mentioned in the 2012 update of the Groundwater Management Plan and a funding opportunity.

The project will use existing facilities that include a 48-inch diameter main line that runs south for about 2.7 miles and has approximately 5.4 miles of laterals. In addition, new distribution laterals will be built to replace service area that is expected to be lost to new development. Water acquired from one or more of the sources described above will be delivered as irrigation water via MID Lateral 6.2, pipeline, and distribution laterals, thereby providing in-lieu recharge.

Water supply may be provided in all year types, but benefits are generally expected in non-critical years. Up to 9,100 acre-feet could be delivered when water is available in wet years (Table 4-43). On average, the project is expected to provide about 4,400 acre-feet per year of surface supply, resulting in reduced pumping and increased recharge from percolation of the surface water.

Table 4-43. RCWD Estimated Average Water Purchase, in AF by Year Type.

Year Type	Total Annual Volume	% of Years	Weighted Avg.
W	9,100	35%	3,212
AN	5,100	14%	700
BN	3,000	8%	235
D	1,500	16%	235
C	0	27%	0
Avg. Annual			**4,400**

4.7.2 RCWD Holding Contracts

RCWD holds a historical right to divert water from the San Joaquin River to irrigate 3,000 acres. It has diverted water under this holding contract in the past and intends to make greater use of it to increase its surface water supply. RCWD intends to establish this as a permanent water source, diverting an average of 9,840 acre-feet per year in every year type.

4.7.3 Coordination with Other GSAs and Planning Agencies

This GSP is the coordinated Plan for the four coordinating GSAs in the Madera Subbasin (City of Madera GSA, Madera Irrigation District GSA, Madera County GSA, and Madera Water District GSA). A coordination agreement will be executed by the coordinating GSAs with the other three GSAs in the Subbasin (Gravelly Ford Water District GSA, New Stone Water District GSA, and Root Creek Water District GSA) detailing required GSA and GSP cooperation. RCWD is preparing its own GSP for its portion of the Subbasin but is participating in the broader SGMA planning efforts for the Subbasin.

4.8 Subbasin Water Available for Recharge Used by Projects

Four primary sources of water are available for the projects: flood releases and 215 water from Millerton Lake, Chowchilla Bypass flows, Fresno River Flood Releases from Hensley Lake, and water purchases. A summary of the total projected water available, the projected water committed to projects, and the expected water remaining after the projects recharge or use the water committed is provided below for each water source.

4.8.1 Flood Releases and 215 Water from Millerton Lake

The first source of water available for projects in the Madera Subbasin is the flood releases and 215 water from Millerton. Table 4-44 summarizes the volume of flood releases and 215 water released from Millerton Lake along Madera Canal and the San Joaquin River that is potentially available for recharge projects in the Madera Subbasin.

Table 4-44. Average Flood Releases and 215 Water from Millerton Lake Committed to Madera Subbasin Recharge Projects, by Water Year Type (2019-2090).

Year Type	Total Annual Volume (AF)	% of Years	Weighted Avg. Volume (AF)
W	85,400	35%	29,900
AN	47,600	14%	6,700
BN	21,500	8%	1,700
D	8,000	16%	1,300
C	8,100	27%	2,200
Avg. Annual			41,700

4.8.2 Chowchilla Bypass

The second source of water available for projects in the Madera Subbasin is flows along Chowchilla Bypass. Table 4-45 summarizes the average water available to projects by water year type. Table 4-46 summarizes the volume of water along Chowchilla Bypass that is potentially available for recharge projects in the Madera Subbasin. Table 4-47 summarizes the volume of water estimated to be remaining in the Chowchilla Bypass after the projects have taken water.

4.8.3 Fresno River Flood Releases

The third source of water available for projects in the Madera Subbasin is flood releases from Hensley Lake along Fresno River. Table 4-48 summarizes the volume of flood releases along Fresno River that is potentially available for recharge projects in the Madera Subbasin.

Table 4-45. Average Projected Chowchilla Bypass Water Available to Madera Subbasin Recharge Projects, by Water Year Type (2019-2090).

Year Type	Total Annual Volume (AF)	% of Years	Weighted Avg. Volume (AF)
W	404,100	35%	141,400
AN	47,900	14%	6,700
BN	4,600	8%	400
D	6,500	16%	1,000
C	6,200	27%	1,700
Avg. Annual			151,200

Table 4-46. Average Chowchilla Bypass Water Committed to Madera Subbasin Recharge Projects, by Water Year Type (2019-2090).

Year Type	Total Annual Volume (AF)	% of Years	Weighted Avg. Volume (AF)
W	99,100	35%	34,700
AN	0	14%	0
BN	0	8%	0
D	0	16%	0
C	0	27%	0
Avg. Annual			41,700

Table 4-47. Average Available Chowchilla Bypass Water Remaining After Madera Subbasin Recharge Projects, by Water Year Type (2019-2090).

Year Type	Total Annual Volume (AF)	% of Years	Weighted Avg. Volume (AF)
W	305,000	35%	106,700
AN	47,900	14%	6,700
BN	4,600	8%	400
D	6,500	16%	1,000
C	6,200	27%	1,700
Avg. Annual			116,500

Table 4-48. Average Fresno River Flood Releases Committed to Madera Subbasin Recharge Projects, by Water Year Type (2019-2090).

Year Type	Total Annual Volume (AF)	% of Years	Weighted Avg. Volume (AF)
W	28,600	35%	10,000
AN	22,100	14%	3,100
BN	8,000	8%	600
D	0	16%	0
C	2,500	27%	700
Avg. Annual			14,400

4.8.4 Water Purchases

The fourth source of water available for projects is water acquired from willing sellers. This supply is constrained by the capacity to move it from its source to a location of use in Madera County, via existing natural channels or the Madera Canal. Imported water could be purchased from any willing seller anywhere in the Central Valley provided the water can be delivered to Madera County using existing or proposed conveyance facilities, including via exchanges involving three or more parties. For example, water offered for sale from the Sites JPA could be imported via exchanges through CVP contractors and facilities. Beyond this, purchases are also limited by other factors including market considerations of availability and price.

Table 4-49 summarizes the average water purchases and additional CVP diversions committed to recharge projects in the Madera Subbasin by water year type.

Table 4-49. Average New Water Purchases Committed to Madera Subbasin Recharge Projects, by Water Year Type (2019-2090).

Year Type	Total Annual Volume (AF)	% of Years	Weighted Avg. Volume (AF)
W	26,200	35%	9,200
AN	26,200	14%	3,700
BN	22,600	8%	1,800
D	22,000	16%	3,500
C	15,100	27%	4,100
Avg. Annual			22,200