developed solely for the purpose of estimating basinwide sustainable yield and is not intended to prescribe or describe how pumping would actually be reduced in the basin during GSP implementation to achieve sustainability. The implementation of pumping reductions to achieve sustainability will be done by the GSAs and take into account multiple considerations including water rights, beneficial uses, needs, human right to water, etc. The status of plans for implementing management actions related to pumping reductions is further discussed in Chapter 6 - Projects and Management Actions to Achieve Sustainability Goal.

Because of the reduction of agricultural supply and demand, the sustainable groundwater management condition scenario simulates reductions in evapotranspiration (reduced to 798,000 AF) and groundwater production (reduced to 570,000 AF) across the Subbasin. Subsurface outflow to neighboring subbasins (93,000 AF), stream discharge (29,000 AF), and other flows (10,000 AF) bring the total Subbasin discharges to 702,000 AFY.

Under sustainable groundwater management conditions, the groundwater system of the Merced Subbasin maintains inflows equal to its outflow volume of 702,000 AF each year, of which 293,000 AF is deep percolation. There is also recharge from rivers, streams, and canals (321,000 AF), and subsurface inflows (87,000 AF) from the Sierra Nevada foothills and the neighboring subbasins of Turlock, Delta-Mendota, and Chowchilla.

The sustainable groundwater management scenario results in groundwater outflows equal to groundwater inflows, bringing the long term (50-year) average change in groundwater storage to a net-zero. Figure 2-107 summarizes the average projected groundwater inflows and outflows in the Merced Subbasin. Based on this analysis, the sustainable yield of the basin is approximately 570,000 AFY. Figure 2-108 shows the annual change in the groundwater budget components, as well as cumulative storage, through the simulation period.

Under the July 2022 update to this GSP, the minimum thresholds for groundwater levels were revised (made shallower). To avoid undesirable results under the revised minimum thresholds, the GSAs have identified a need for an estimated 175,000 AFY of additional recharge or reduced groundwater pumping. The reduced volume of pumping, however, is not the revised sustainable yield, as the large volume is necessary to sufficiently raise groundwater levels prior to 2040. Once desired groundwater levels are achieved, pumping will likely be able to be increased somewhat to achieve stable, sustainable groundwater levels. This volume of pumping, which avoids undesirable results for groundwater levels and other sustainability indicators, would be the revised sustainable yield. The sustainable yield will be revised as part of the GSAs' 2025 GSP evaluation, with the GSAs focused in the near-term on the more aggressive estimated 175,000 AFY target for additional recharge or reduced groundwater pumping.

Figure 2-107: Groundwater Water Budget under Sustainable Groundwater Management Conditions Long-Term (50-Year) Average Annual

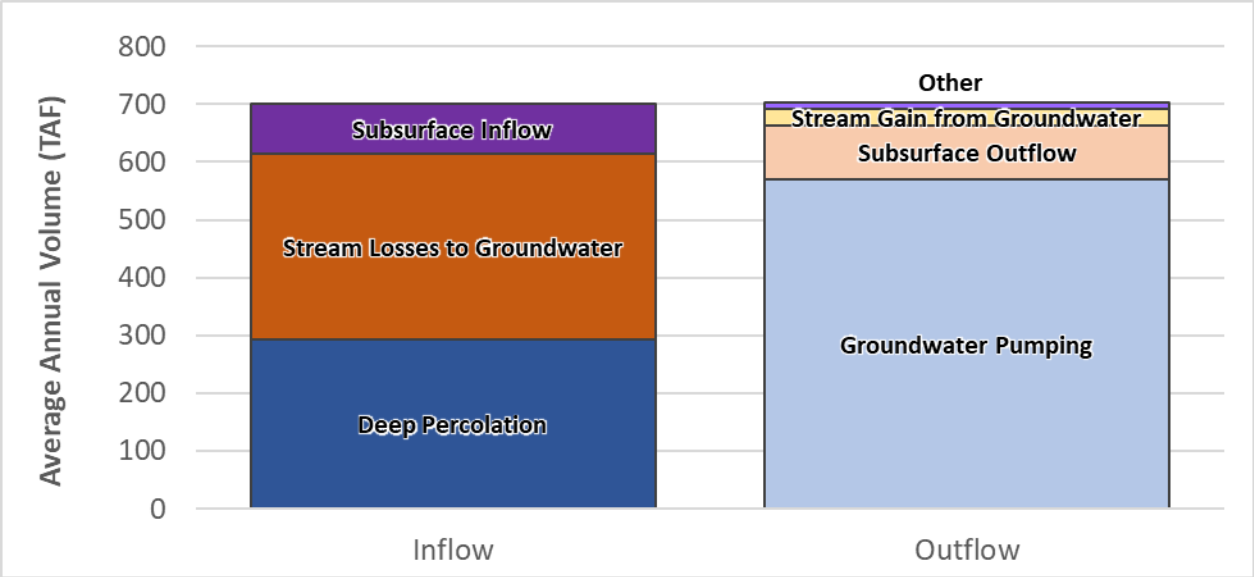
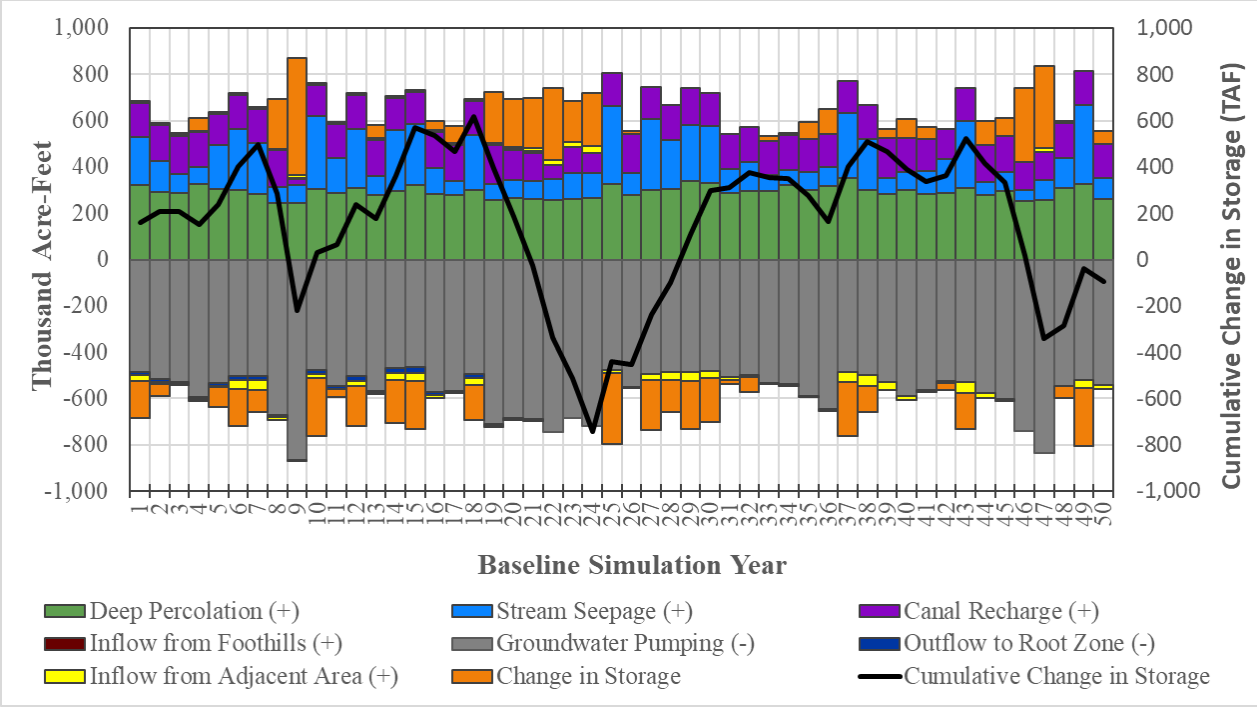


Figure 2-108: Groundwater Water Budget under Sustainable Groundwater Management Conditions Long-Term (50-Year) Annual



2.4 CLIMATE CHANGE ANALYSIS

2.4.1 Regulatory Background

SGMA requires taking into consideration uncertainties associated with climate change in the development of GSPs.

Consistent with §354.18(d)(3) and §354.18(e) of the SGMA Regulations, analyses for the Merced GSP evaluated the projected water budget with and without climate change conditions.

2.4.2 DWR Guidance

Climate change analysis is an area of continued evolution in terms of methods, tools, forecasted datasets, and the predictions of greenhouse gas concentrations in the atmosphere. The approach developed for this GSP is based on the methodology in DWR's guidance document (DWR, 2018a). Similarly, the "best available information" related to climate change in the Merced Subbasin was deemed to be the information provided by DWR combined with basin-specific modeling tools. The following resources from DWR were used in the climate change analysis:

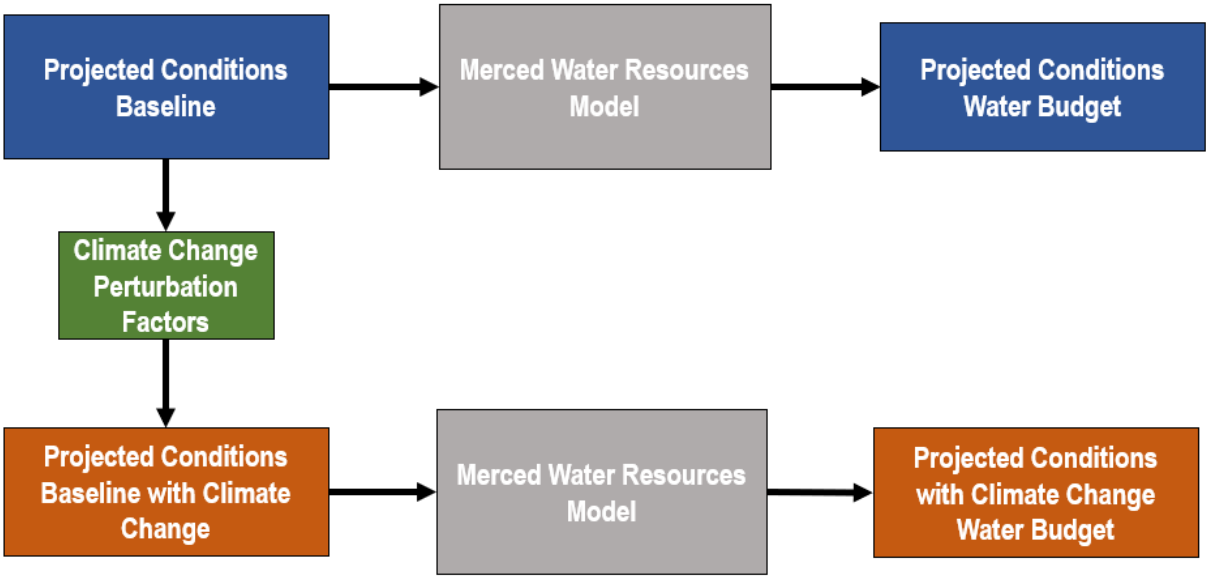
- SGMA Data Viewer
- Guidance for Climate Change Data Use During Sustainability Plan Development and Appendices (Guidance Document)
- Water Budget BMP
- Desktop IWFM Tools

SGMA Data Viewer provides the location for which the climate change forecasts datasets[6] were downloaded for the Merced Subbasin (DWR, 2019). The guidance document details the approach, development, applications, and limitations of the datasets available from the SGMA Data Viewer (DWR, 2018a). The Water Budget BMP describes in greater detail how DWR recommends projected water budgets be computed (DWR, Best Management Practices for the Sustainable Management of Groundwater Water Budget, 2016a). The Desktop IWFM Tools are available to calculate the projected precipitation and evapotranspiration inputs under climate change conditions (DWR, 2018b).

The methods suggested by DWR in the above resources were used, with modifications where needed, to ensure the resolution would be reasonable for the Merced Subbasin and align with the assumptions of the Merced Water Resources Model (MercedWRM). Figure 2-109 shows the overall process developed for the Merced GSP consistent with the Climate Change Resource Guide (DWR, 2018a) and describes workflow beginning with baseline projected conditions to perturbed 2070 conditions for the projected model run.

[6] In the industry, climate change impacted variable forecasts are sometimes referred to as "data" and their collections are called "datasets." Calling forecasted variable values "data" can be misleading so this document tries to be explicit about when we are referring to data (historical data) vs. forecasts or model outputs.

Figure 2-109: Merced GSP Climate Change Analysis Process



The process described in Figure 2-109 of developing a projected conditions water budget with and without climate change was discussed with DWR staff[7] and is consistent with the regulations. Further, it enables the analysis to account for variability in demand and supply separate from climate change uncertainty.

Table 2-19 below summarizes the forecasted variable datasets provided by DWR that were used to carry out the climate change analysis (DWR, 2019). The "VIC" model (Variable Infiltration Capacity) referred to in Table 2-19 is the fully mechanistic hydrologic model used by DWR to derive hydrographs under baseline and climate change conditions. "Impaired" streamflow referred to in Table 2-19 is DWR's terminology for streams whose flow is impacted by ongoing water operations, such as diversions, deliveries, and storage. Flows on these streams are simulated using the CalSim II model. Conversely, "unimpaired" streamflow refers to the natural streamflow produced by a watershed, not impacted by ongoing operations. All time series shown in Table 2-19 use a monthly timestep. Section 2.4.3 includes further description of the model and other tools and datasets.

Table 2-19: DWR-Provided Climate Change Datasets

Input Variable	DWR Provided Dataset
Unimpaired Streamflow	Combined VIC model runoff and baseflow to generate change factors, provided by HUC 8 watershed geometry
Impaired Streamflow (Ongoing Operations)	CalSim II time series outputs in .csv format
Precipitation	VIC model-generated GIS grid with associated change factor time series for each cell
Reference ET	VIC model-generated GIS grid with associated change factor time series for each cell

[7] Pers. Comm. 4/4/2019 meeting with DWR staff.

2.4.3 Climate Change Methodology

For climate change impacts on groundwater, accepted methods are based on the assessment of impacts on the individual water resource system elements that directly link to groundwater. These elements include precipitation, streamflow, evapotranspiration and, for coastal aquifers, sea level rise as a boundary condition. For the Merced Subbasin, sea level is not relevant.

The method for perturbing the streamflow, precipitation, and evapotranspiration input files is described in the following sections. The late-century, 2070 central tendency climate scenario was evaluated in this analysis, consistent with DWR guidance (DWR, 2018a).

DWR combined 10 global climate models (GCMs) for two different representative climate pathways (RCPs) to generate the central tendency scenarios in the datasets used in this analysis. The "local analogs" method (LOCA) was used to downscale these 20 different climate projections to a scale usable for California (DWR, 2018a). DWR provides datasets for two future climate periods: 2030 and 2070. For 2030, there is one set of central tendency datasets available. For 2070, DWR has provided one central tendency scenario and two extreme scenarios: one that is drier with extreme warming and one that is wetter with moderate warming.

The 2070 central tendency among these projections serves to assess impacts of climate change over the long-term planning and implementation period. For this reason, it was chosen as the most appropriate scenario to assess in the Merced GSP.

2.4.3.1 Streamflow under Climate Change

Hydrological forecasts for streamflow under various climate change scenarios are available from DWR as either a flow-based timeseries or a series of perturbation factors applicable to local data. DWR simulated volumetric flow in most regional surface water bodies by utilizing The Water Resource Integrated Modeling System (WRIMS, formally named CalSim II). While river flows and surface water diversions in the Merced, Chowchilla, and San Joaquin rivers are simulated in CalSim II, there are significant variations when compared to local historical data. Due to the uncertainty in reservoir operations, flows from CalSim II provided by the state are not used directly in the Merced GSP climate change analysis. Instead, as explained later in this section, relative perturbation factors were used to derive surface water inflows and diversions for analysis with the MercedWRM.

Local tributaries and smaller streams within Merced Subbasin are not simulated in CalSim II and must be simulated using adjustment factors developed by DWR for unregulated stream systems. While not all of these local tributaries are completely unregulated, most control structures are minor in operation, do not significantly impair natural flow when simulated on a monthly timestep, and are considered unimpaired for this analysis. Resolution of these perturbation factors are available at the HUC 8 watershed scale and include Bear Creek, Owens Creek, and Mariposa Creek. The remaining streams simulated in the MercedWRM utilize the IWFM small-watershed package, whose climate change impacts are dynamically calculated using the Curve Number Method and soil moisture routing.

Table 2-20 presents which streams, modeled by the MercedWRM for the Merced GSP, are considered impaired or unimpaired in this analysis.

Table 2-20: Merced Stream Inflows

Stream	Impaired	Unimpaired
Merced River	X	
Bear Creek		x
Owens Creek		x
Mariposa Creek		x
Chowchilla River	X	
San Joaquin River	X	

2.4.3.1.1 Unimpaired Flows

Change factors for unimpaired streams were downloaded from SGMA Data Viewer and multiplied by the projected conditions baseline. Perturbed flows on Bear Creek, Owens Creek, and Mariposa Creek were calculated in this way. DWR provided change factors are available through 2011. However, the model period runs from 1969 through 2018. Flows for the remaining seven water years between 2012 and 2018 were synthesized using the change factor from the most recent water year type in the available dataset. Water year types are designated for each year based on the San Joaquin Valley Runoff WY year type index (DWR, 2017c). DWR uses five WY type designations: Critical, Dry, Below Normal, Above Normal, and Wet. Table 2-21 below shows the year type designations used to synthesize the remaining years (2011-2018). A "Critical" year type represents the driest designation.

Table 2-21: DWR San Joaquin Valley Water Year Type Designations

Water Year	Year Type
2003	Below Normal
2004	Dry
2005	Wet
2006	Wet
2007	Critical
2008	Critical
2009	Below Normal
2010	Above Normal
2011	Wet
2012	Dry
2013	Critical
2014	Critical
2015	Critical
2016	Dry
2017	Wet
2018	Below Normal

Source: Water year types based on San Joaquin Valley Water Year Index (DWR, 2017c)

The hydrograph in Figure 2-110 shows the perturbed time series against the model baseline time series for Bear Creek. Results for the other unimpaired streams present a similar trend where the changes in stream flows are relatively small compared to the magnitude of flows in the baseline. The x-axis represents the period of record from which the future conditions simulation is made. Figure 2-111 through Figure 2-113 present the exceedance probability curves[8] for Bear Creek, Owens Creek, and Mariposa Creek, respectively. The exceedance curves are provided because they more

[8] Exceedance probability describes the probability that streamflow or precipitation will be greater than (or "exceed") a certain value. An exceedance probability curve shows how the probability changes over a range of streamflow or precipitation values.

clearly show the differences between the baseline scenario and the climate change scenario. Generally, flows under the climate change scenario selected are only slightly higher, and almost unperceivable.

Figure 2-110: Bear Creek Hydrograph

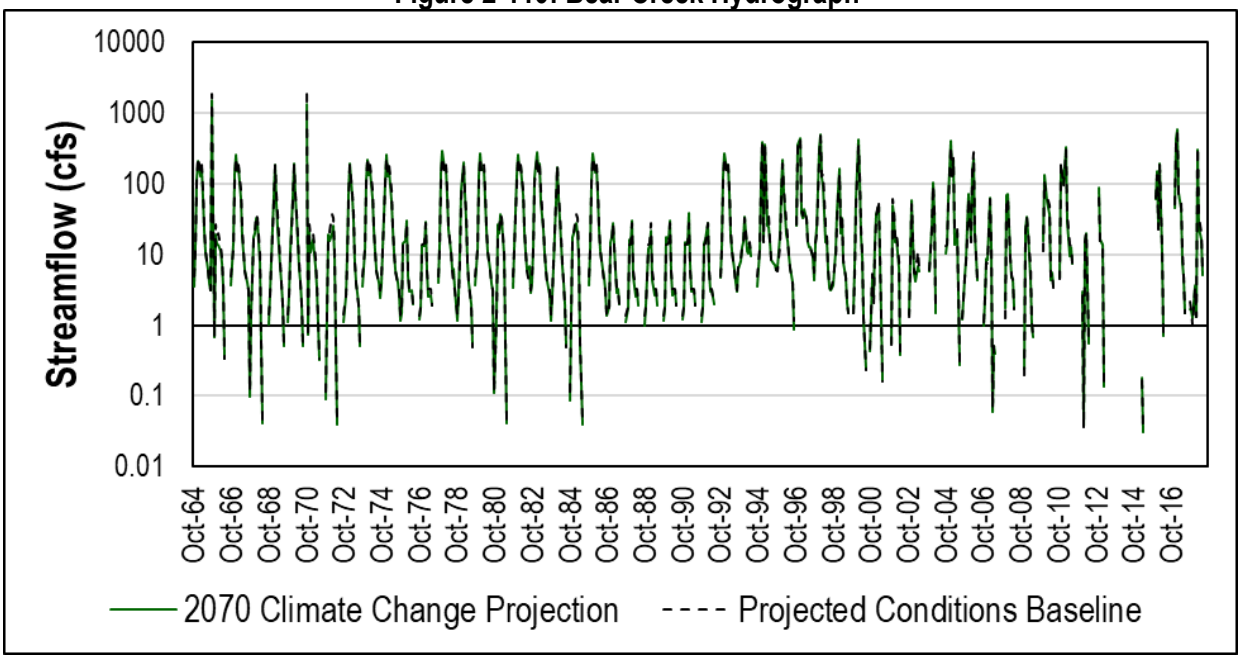


Figure 2-111: Bear Creek Exceedance Curve

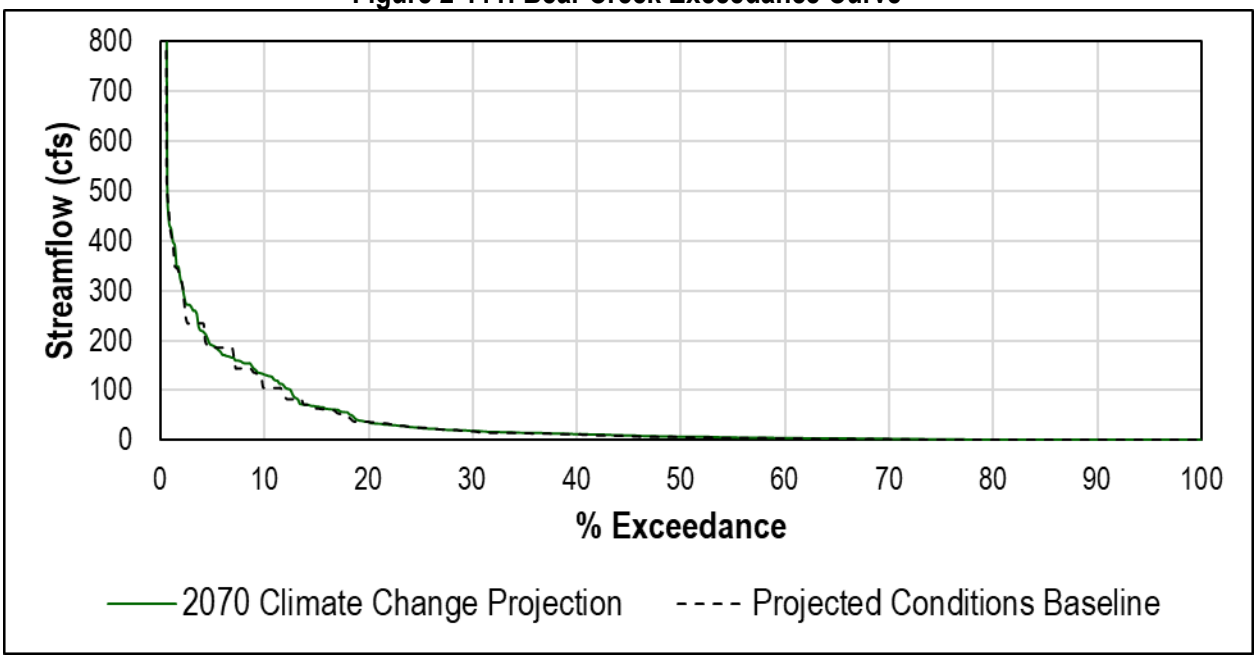


Figure 2-112: Owens Creek Exceedance Curve

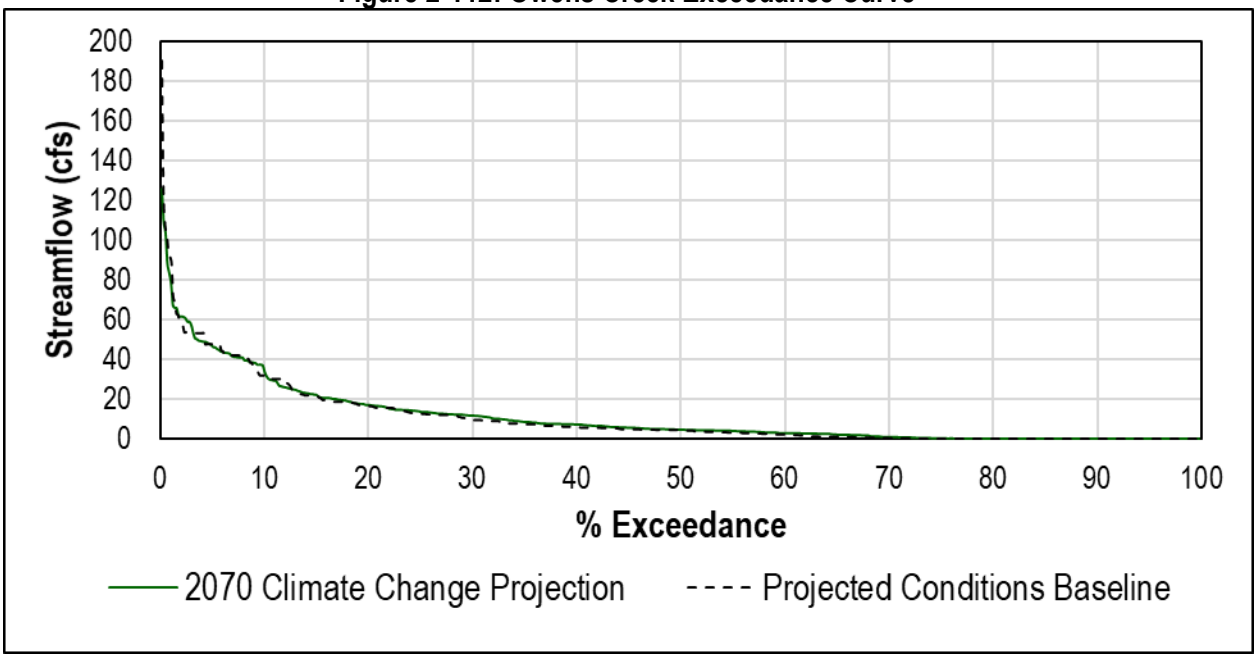
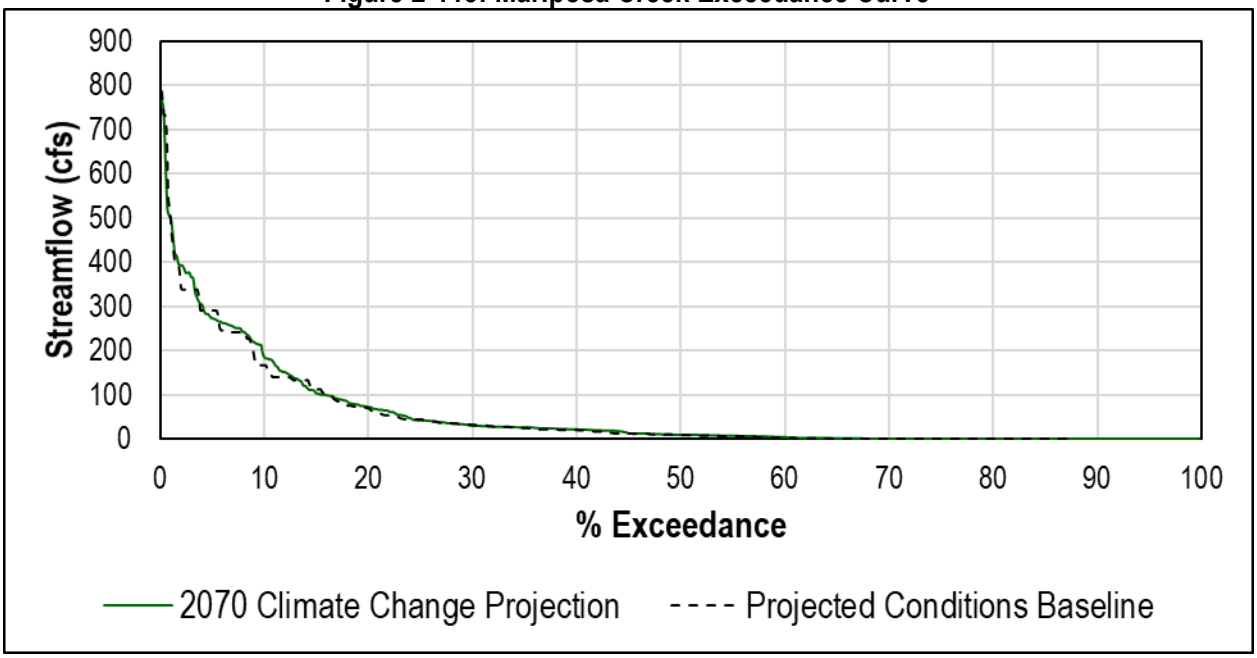


Figure 2-113: Mariposa Creek Exceedance Curve



2.4.3.1.2 Impaired Flows

CalSim II estimated flows for point locations on the Merced River, Chowchilla River, and the San Joaquin River were downloaded from DWR. The three key flows obtained from CalSim II include:

- **Merced River:** Lake McClure Outflow
- **Chowchilla River:** Eastman Lake Outflow
- **San Joaquin River:** San Joaquin River below Mendota Pool

These flows represent projected hydrology with climate change based on reservoir outflow, operational constraints, and diversions and deliveries of water for the State Water Project and the Central Valley Project. CalSim II data from WY 1965 to WY 2003 was available. For WY 2004 to WY 2018, streamflow was synthesized based on flows from WY 1965 to WY 2003 and the DWR San Joaquin Valley water year type index. Table 2-21 indicates the water year types that were used for the years with synthesized streamflow (DWR, 2017c). For example, the total monthly streamflow for October 2003 would be calculated as the average of the monthly streamflow from October 1966 and October 1971 because they are the same year type.

In order to verify the relative accuracy of CalSim II simulated flows on the local scale, simulated flows were compared with those generated using the DWR-provided unimpaired perturbation factors. As expected, streamflow simulated in CalSim II and those derived using the unimpaired adjustment factors did not present similar trends, particularly in dry years. Because they are indicative of reservoir operations, CalSim II outputs are considered more appropriate for regulated streams given that downstream flow is driven by surface water demand rather than natural flow. DWR-provided unimpaired change factors do not account for variations in the operation of the reservoirs that would result from climate change conditions. The CalSim II flows, however, were also not considered completely appropriate for local conditions so a method was derived to compute change factors from CalSim II flows, as described below.

Using DWR's method of deriving the precipitation and evapotranspiration factors as a guide, the team explored a hybrid approach to improve upon the discrepancy between the CalSim II and local models while accounting for some change in reservoir operations. In this approach, change factors are generated from the difference between each simulated future climate change CalSim II scenario (i.e., 2070) and the "without climate change" baseline CalSim II run. This "without climate change" baseline run is the CalSim II 1995 Historical Detrended simulation run provided through personal communication from DWR. The generated change factors are then used to perturb the regulated river inflows simulated in the MercedWRM Projected Conditions Baseline. For the purposes of simplicity, this method is referred to throughout the rest of the document as CalSim II Generated Perturbation Factors (CGPF). The CGPF method presents limitations given that the resulting flows are not directly obtained from an operations model. The actual mass balance on the reservoirs is not tracked in the estimates of the flows and, instead, the method relies on CalSim II tracking that storage and managing the reservoir based on the appropriate rule curves.

Figure 2-114 through Figure 2-119 provide a comparison of projected conditions baseline and the CGPF method described above. Exceedance curves are included for each of the CGPF flows against the projected conditions baseline. It should be noted that the CalSim II 1995 Historical Detrended simulation appears to have an erroneous value for Merced River inflow[9] into the subbasin on 9/30/1988, as it is 2 orders of magnitude smaller than the rest. This explains the high peaks or low troughs in the hydrographs above for this month.

[9] Identified in the dataset as "Lake McClure Outflow".

Figure 2-114: Merced River Hydrograph

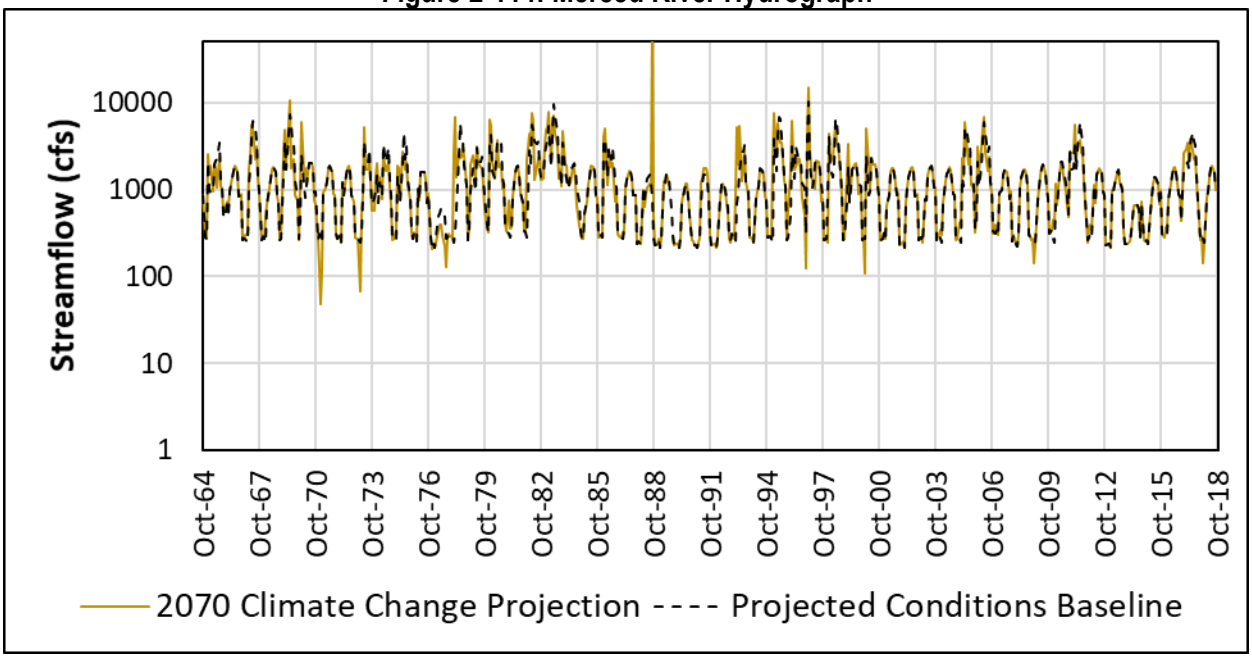


Figure 2-115: Merced River Exceedance Curve

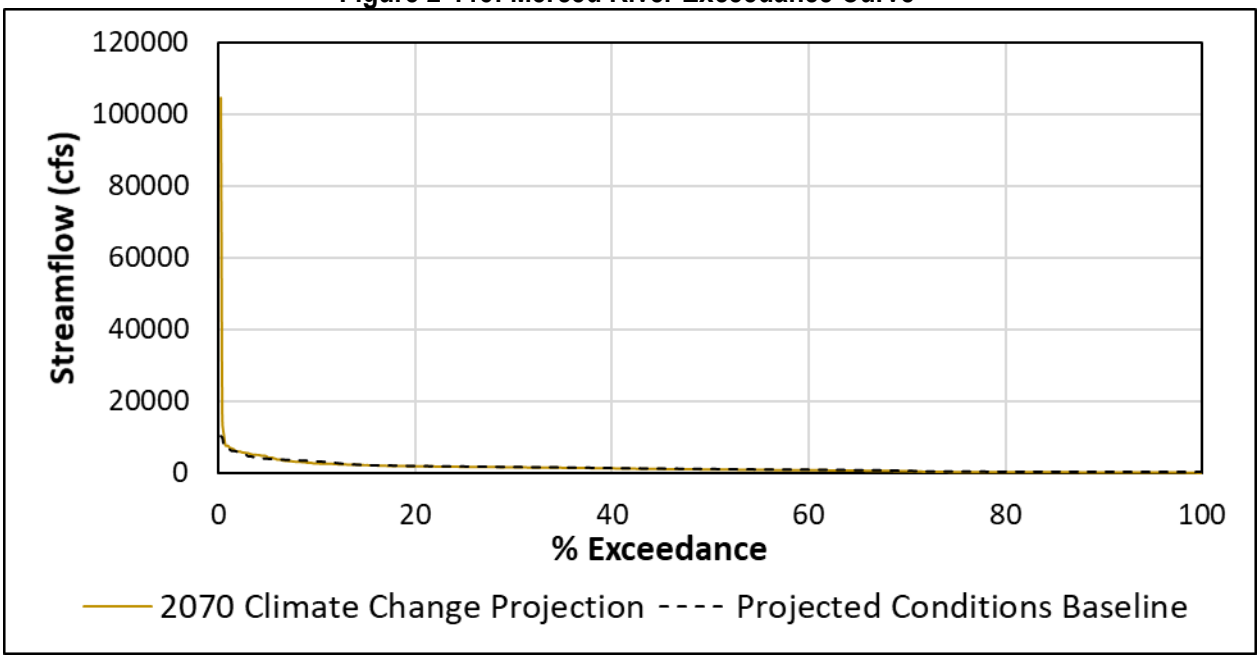


Figure 2-116: Chowchilla River Perturbed Hydrograph

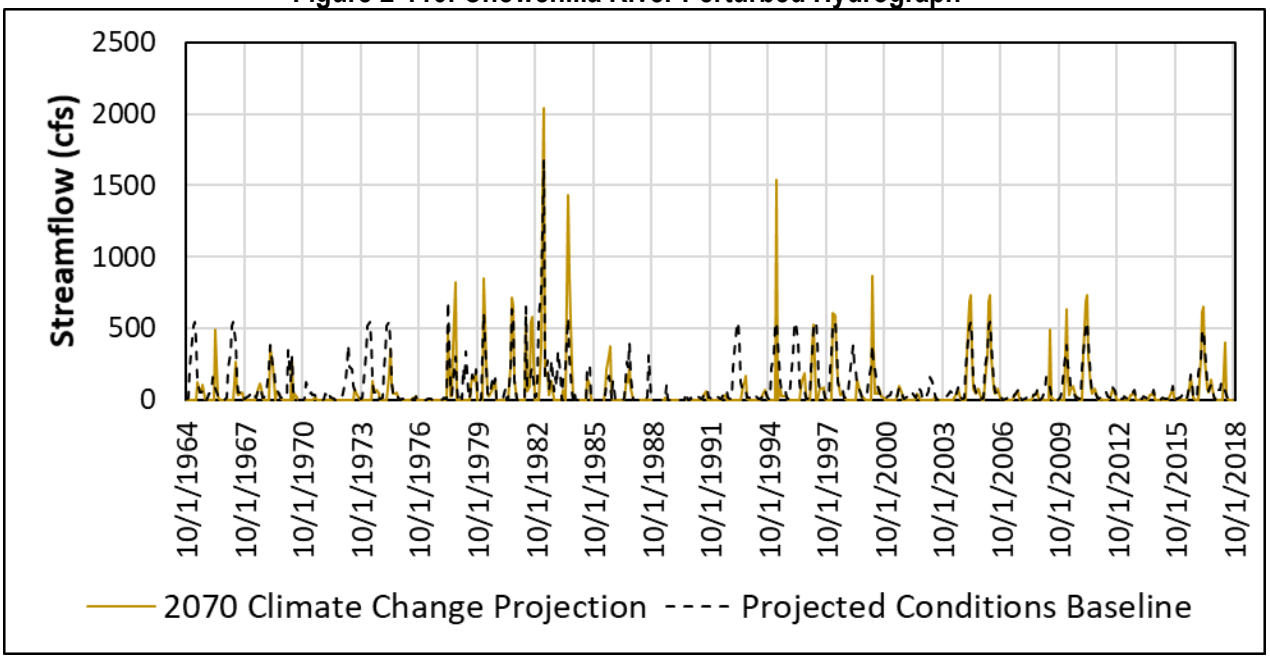


Figure 2-117: Chowchilla Exceedance Curve

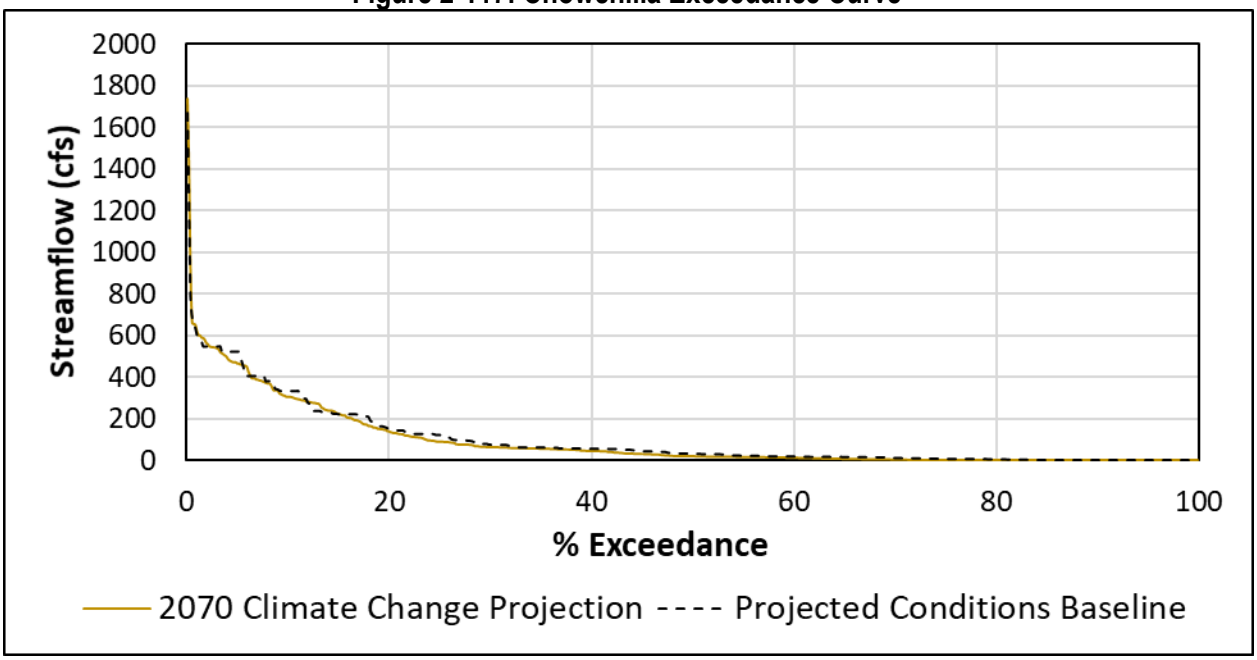


Figure 2-118: San Joaquin River Hydrograph

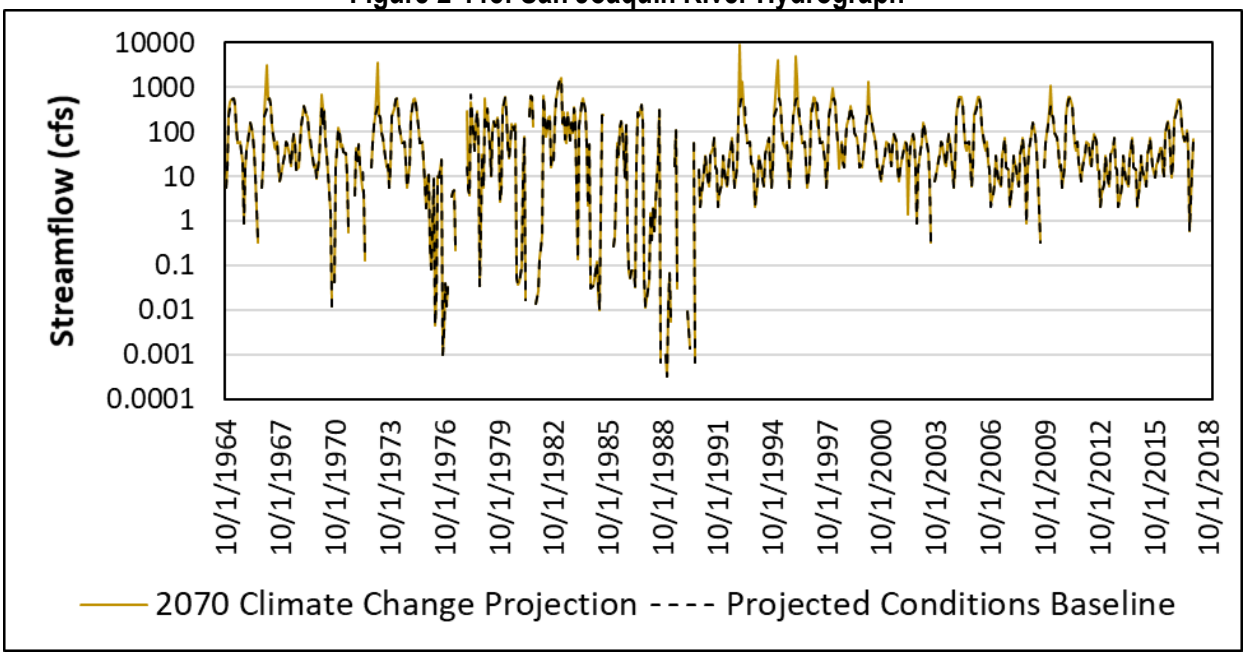
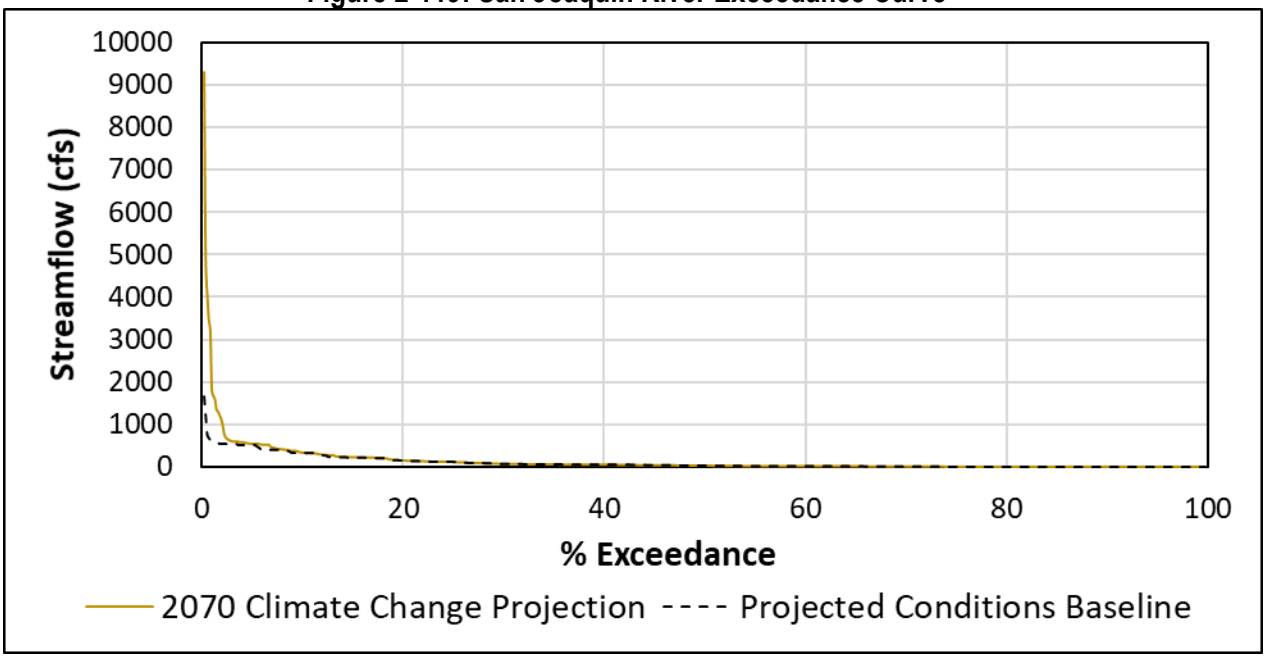


Figure 2-119: San Joaquin River Exceedance Curve



2.4.3.2 Precipitation and Evapotranspiration under Climate Change

Projected precipitation and evapotranspiration (ET) change factors provided by DWR were calculated using a climate period analysis based on historical precipitation and ET from January 1915 to December 2011 (DWR, 2018a). The Variable Infiltration Capacity (VIC) hydrologic model was used by DWR to simulate land-surface atmosphere exchanges of moisture and energy on a six-kilometer grid. Model output includes both precipitation and reference evapotranspiration whose change factors provided by DWR were calculated as a ratio of the value of a variable under a "future scenario" divided by a baseline. The baseline data is the 1995 Historical Template Detrended scenario by the VIC model through GCM downscaling. The "future scenario" corresponds to VIC outputs of the simulation of future conditions using GCM forecasted hydroclimatic variables as inputs. These change factors are thus a simple perturbation factor that corresponds to the ratio of a future with climate change divided by the past without it. Change factors are available on a monthly time step and spatially defined by the VIC model grid. Supplemental tables with the time series of perturbation factors are available by DWR for each grid cell. DWR has made accessible a Desktop GIS tool for both IWFM and MODFLOW to process these change factors (DWR, 2018b).

2.4.3.2.1 Applying Change Factors to Precipitation

DWR change factors were multiplied by projected conditions baseline precipitation to generate projected precipitation under the 2070 central tendency future scenario using the Desktop IWFM GIS tool (DWR, 2018b). The tool calculates an area weighted precipitation change factor for each model grid geometry. This model grid geometry was generated based on polygons built around the PRISM nodes that are within the model area.

However, the DWR tool only includes change factors through 2011. The remaining seven years of the time series were synthesized according to historically comparable water years. The perturbation factor from the corresponding month of the comparable year was applied to the baseline of the missing years (2012-2018) to generate projected values. Months with no precipitation in the baseline were assumed a monthly precipitation of 1 mm under climate change to account for increased precipitation that cannot be calculated from a baseline of 0 mm for these synthesized years. The comparable years that were used can be found in Table 2-22.

Table 2-22: Comparable Water Years (Precipitation)

Missing Water Year	Comparable Water Year
2012	1968
2013	2007
2014	2002
2015	1971
2016	1981
2017	1993
2018	1987

The resulting perturbed precipitation values and the baseline precipitation values for the representative historical period can be found in Figure 2-120 below. The exceedance plot for these two times series can be found in Figure 2-121.

Figure 2-120: Perturbed Precipitation Under Climate Change

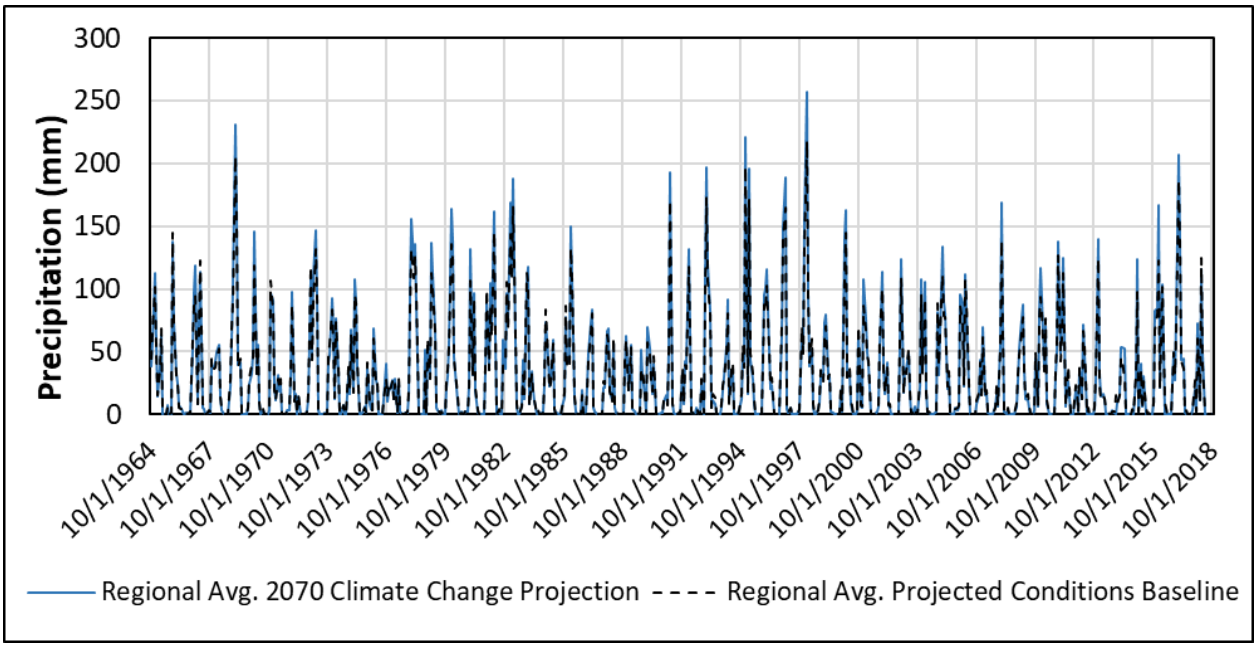


Figure 2-121: Perturbed Precipitation Exceedance Curve

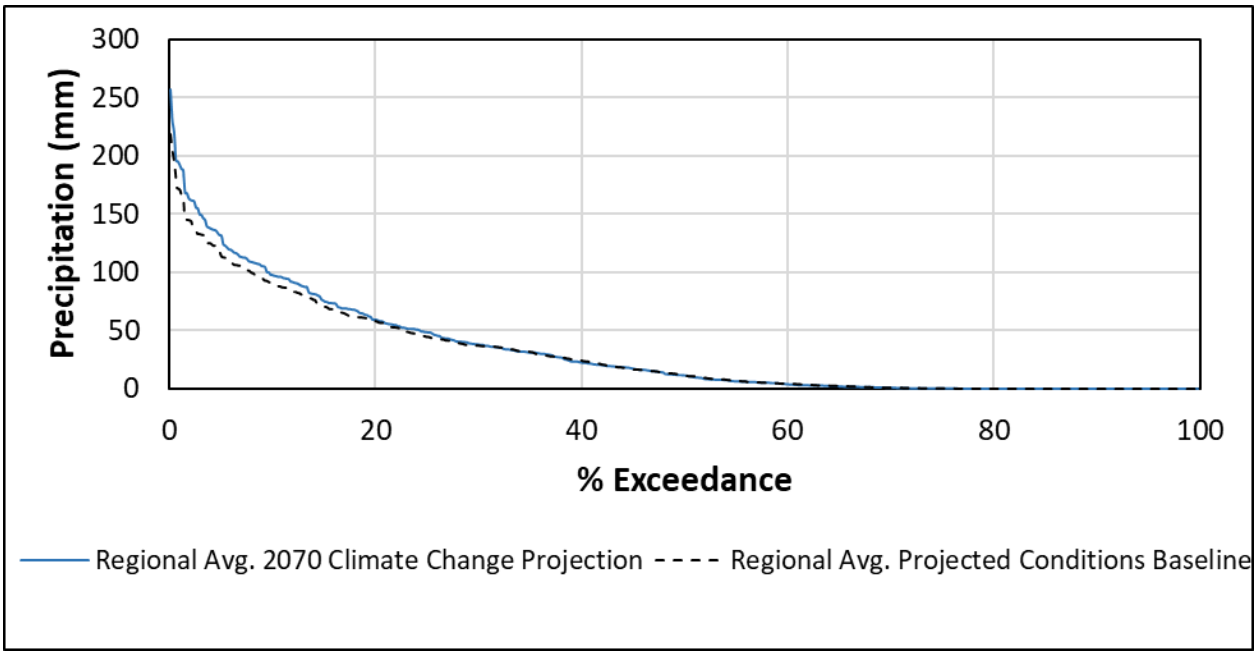
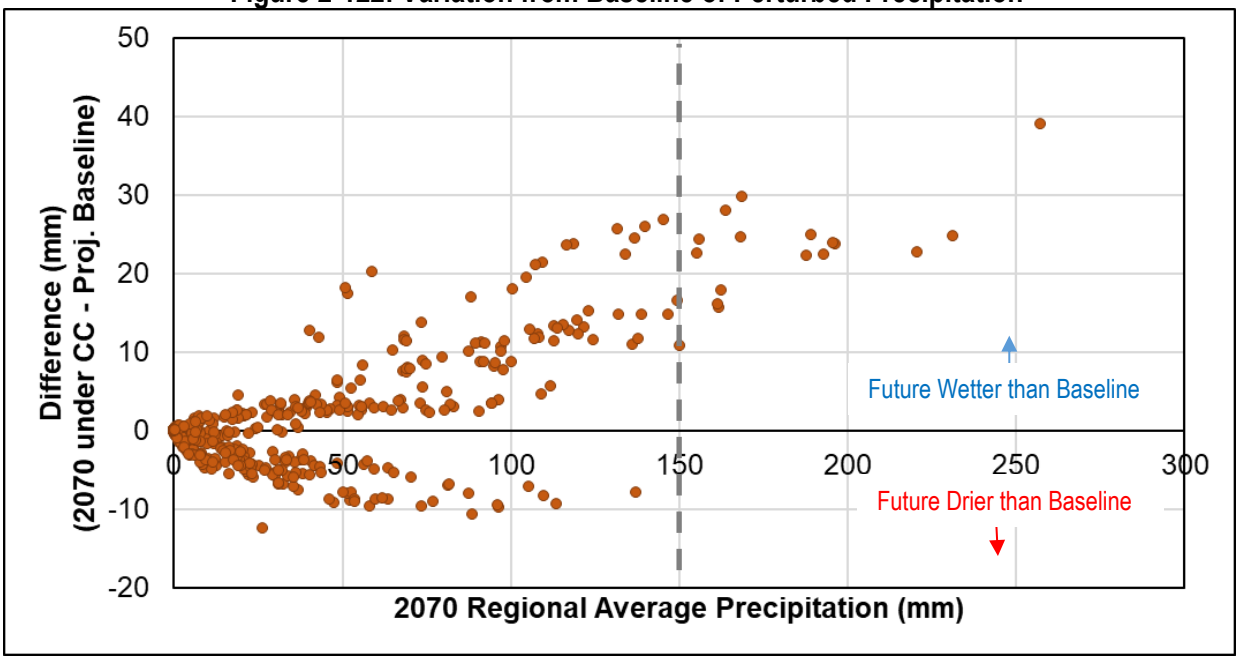


Figure 2-122 shows the difference between the regional average under 2070 climate change conditions and the regional average under projected conditions baseline plotted against different amounts of projected monthly precipitation. The average was taken across the area of the Merced Subbasin.

Figure 2-122: Variation from Baseline of Perturbed Precipitation

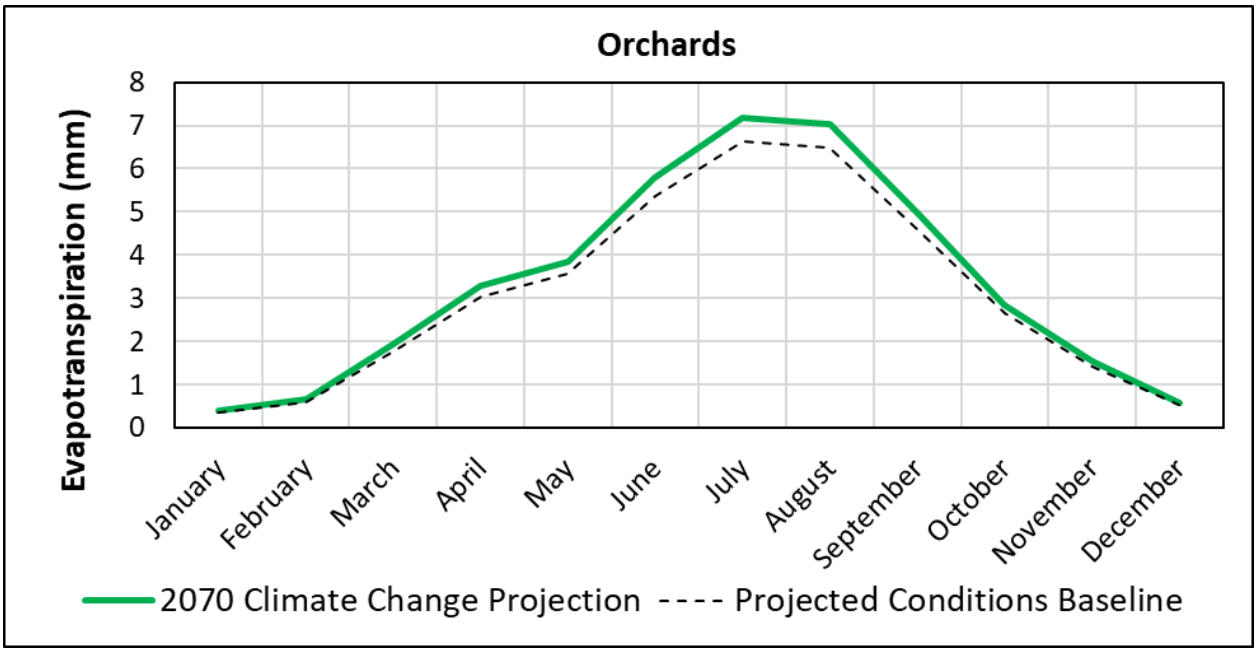


This plot (Figure 2-122) demonstrates that in 2070 with climate change added, in low precipitation months, there is approximately equal probability that the month will be wetter or drier than projected conditions baseline. However, under climate change, the 2070 conditions will be wetter in months with precipitation above approximately 150mm, indicated by the vertical gray dashed line. Therefore, under climate change conditions (in the scenario selected for the GSP), we can see that the occurrence of low precipitation months will likely not change significantly, but the higher precipitation months are predicted to be wetter overall than the projected conditions baseline.

2.4.3.2.2 Applying Change Factors to Evapotranspiration

Potential ET is in the Merced Subbasin is aggregated to one of seventeen land use categories but does not vary spatially. DWR provides change factors for ET in the same spatially distributed manner as precipitation, as described above. However, to match the level of discretization with the Merced model, an average ET change factor was calculated across all VIC grid cells within the Merced Subbasin boundary. Therefore, the tool to process ET provided by DWR was not needed or used. Change factors provided by DWR for November 1, 1964 through December 1, 2011 were averaged. This average ET change factor was then applied to the baseline ET time series for each crop type. Because the same ET change factor was applied over the entire baseline, no synthesis was required in this analysis. Refinement to the simulated evapotranspiration of orchards under 2070 climate conditions is shown in Figure 2-123 below. For 2070, the average change factor is 1.08.

Figure 2-123: Monthly ET for Sample Crops



2.4.3.3 Merced Subbasin Water Budget Under Climate Change

A climate change scenario was developed for the MercedWRM to evaluate the hydrological impacts under these conditions. The analysis was based on the projected conditions baseline with climate change perturbed inputs for streamflow, precipitation, and ET. Tabular results are presented below in Table 2-23, Table 2-24, and Table 2-25. Under the climate change scenario, the average annual volume of evapotranspiration is seven percent higher than the projected conditions baseline, increasing to 916,000 AFY from 853,000 AFY. Due to changes to local hydrology, the average annual surface water availability was projected to increase 4 percent from 274,000 AFY to 286,000 AFY.[10] The simulated increase in surface water supply is not enough to meet the increased water demands under the climate change scenario. As a result, private groundwater production is simulated to increase approximately 7 percent, from 536,000 AFY to 565,000 AFY. Under climate change conditions, depletion in aquifer storage is expected to increase by about 60 percent to an average annual rate of 130,000 AFY, from 82,000 AFY in the projected conditions baseline. A graphical representation of simulated changes to evapotranspiration, surface deliveries, and groundwater pumping are presented in Figure 2-124 though Figure 2-126, below, and complete water budgets for the climate change scenario are shown in Figure 2-127 and Figure 2-128.

[10] There are various approaches to estimating the effects of climate change on local hydrology. The 2070 Central Tendency used in this GSP according to DWR guidelines for GSP submittal may differ from local studies or certain Flood-MAR scenarios.

Figure 2-124: Simulated changes in Evapotranspiration due to Climate Change (Scenario minus Baseline)

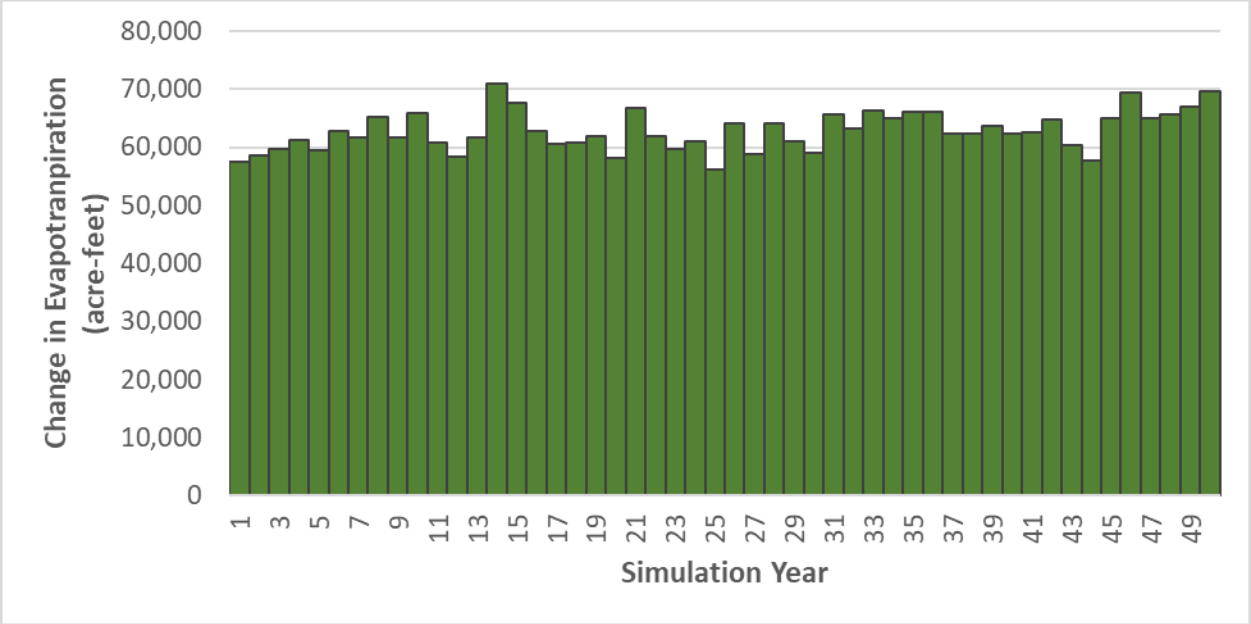


Figure 2-125: Simulated Changes in Surface Water Supplies due to Climate Change (Scenario minus Baseline)

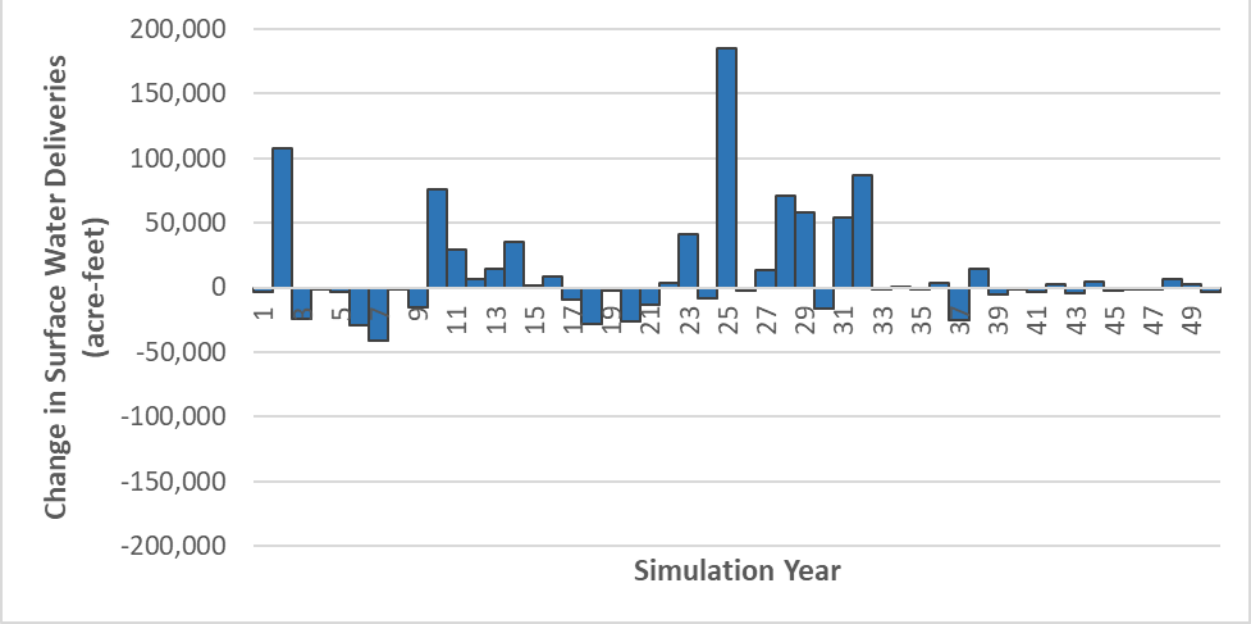


Figure 2-126: Simulated Changes in Groundwater Production due to Climate Change (Scenario minus Baseline)

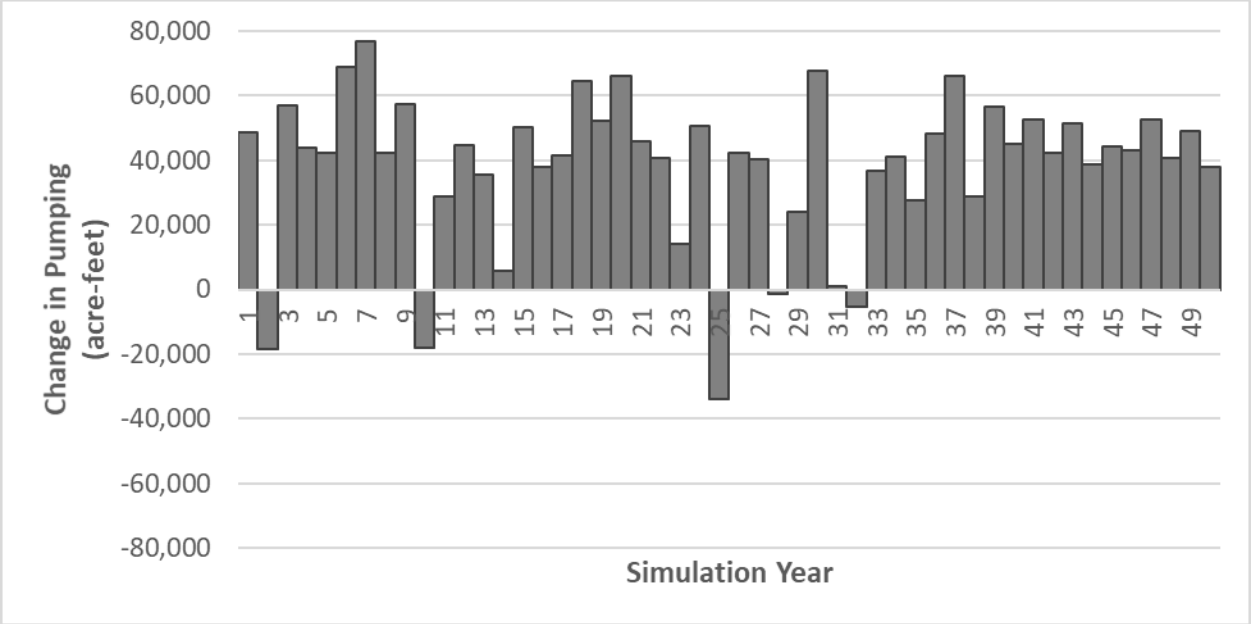


Figure 2-127: Land and Water Use Budget - MercedWRM Climate Change Scenario

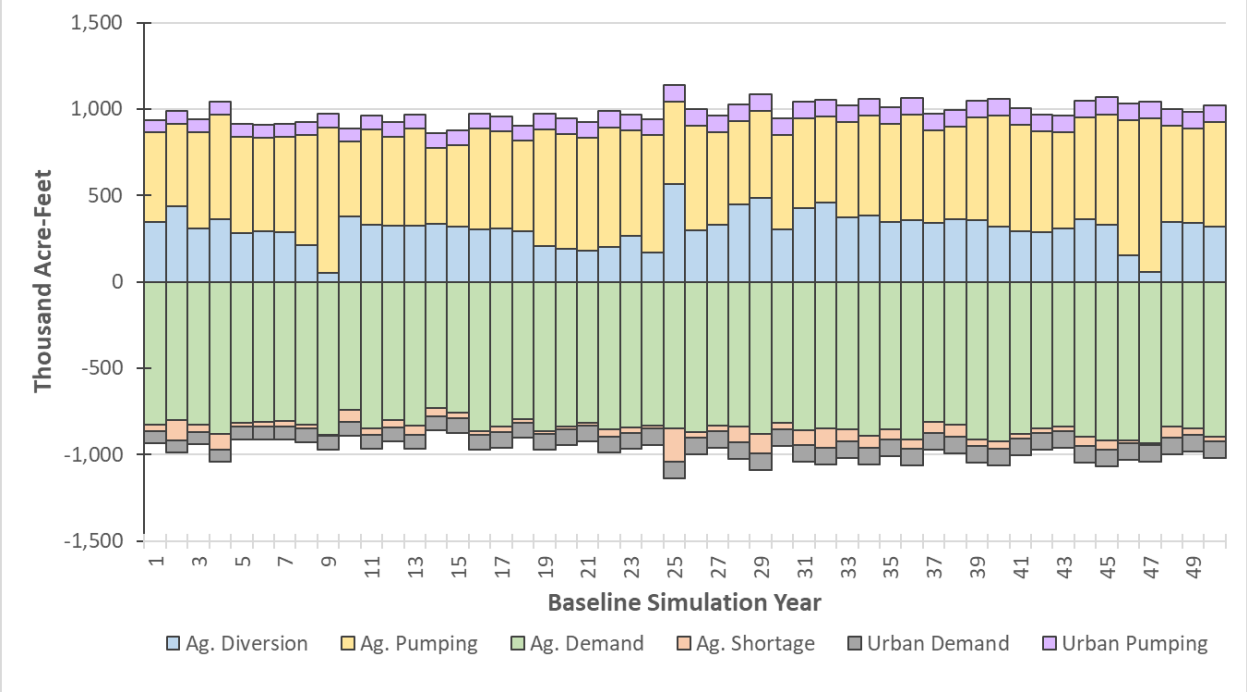


Figure 2-128: Groundwater Budget - MercedWRM Climate Change Scenario

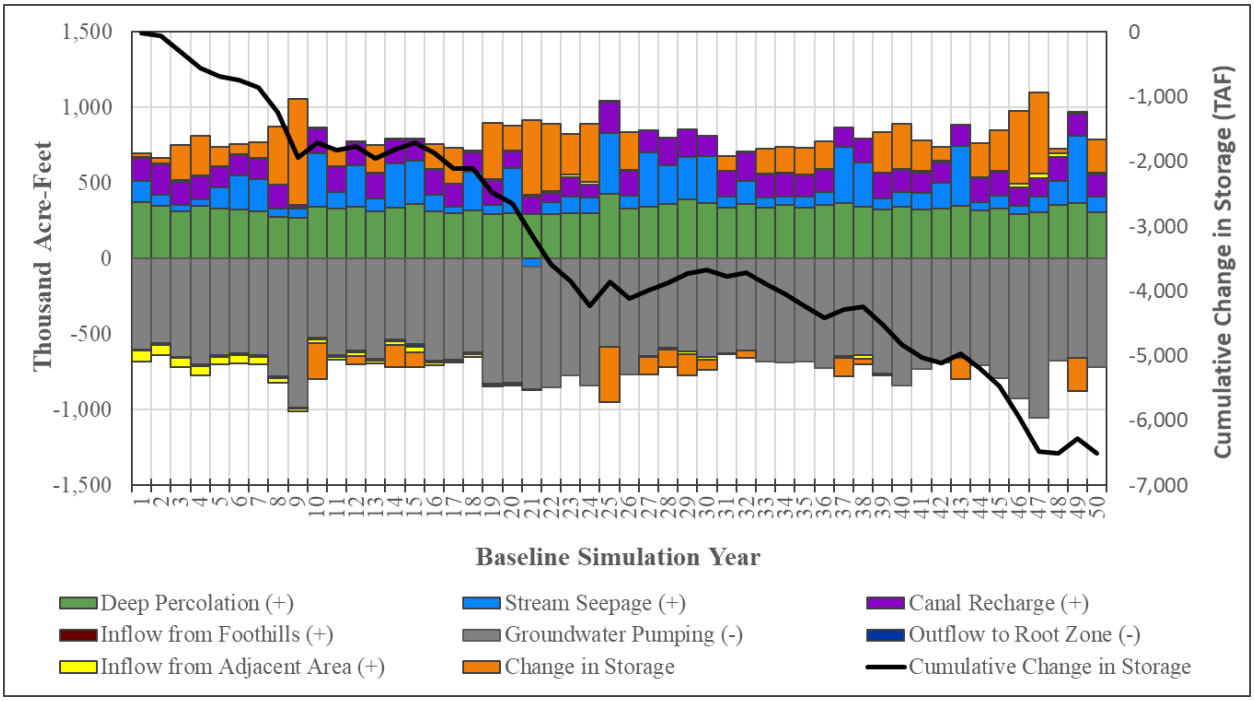


Table 2-23: Average Annual Water Budget Under Climate Change – Stream and Canal Systems, Merced Subbasin (AFY)

Component	Projected Condition Water Budget	Climate Change Water Budget
Hydrologic Period	**WY 1969 - 2018**	**WY 1969-2018**
Inflows[1]		
Stream Inflows	2,480,000	2,138,000
Merced River	981,000	1,140,000
Eastside Bypass	773,000	773,000
San Joaquin River	581,000	103,000
Chowchilla River	72,000	49,000
Local Tributaries[1]	74,000	73,000
Stream Gain from Groundwater	49,000	60,000
Merced Subbasin	29,000	29,000
Merced River	9,000	16,000
Eastside Bypass	1,000	17,000
San Joaquin River	7,000	9,000
Chowchilla River	2,000	4,000
Local Tributaries[1]	11,000	-18,000
Other Subbasins[2]	20,000	31,000
Merced River	10,000	17,000
San Joaquin River	6,000	9,000
Chowchilla River	3,000	6,000

Component	Projected Condition Water Budget	Climate Change Water Budget
Hydrologic Period	**WY 1969 - 2018**	**WY 1969-2018**
Runoff to the Stream System	357,000	553,000
Merced Subbasin	206,000	290,000
Other Subbasins[2]	151,000	262,000
Return Flow to Stream System	143,000	146,000
Merced Subbasin	79,000	81,000
Other Subbasins[2]	64,000	66,000
Groundwater Pumping to Canals	45,000	45,000
Other[3]	32,000	28,000
Total Inflow	**3,105,000**	**2,970,000**
Outflows[1]		
San Joaquin River Outflows	2,360,000	2,245,000
Stream Losses to Groundwater	401,000	371,000
Merced Subbasin	318,000	337,000
Merced River	42,000	16,000
Eastside Bypass	44,000	18,000
San Joaquin River	36,000	9,000
Chowchilla River	2,000	5,000
Local Tributaries[1]	52,000	142,000
Canal Recharge	141,000	145,000
Other Subbasins[2]	83,000	34,000
Merced River	42,000	17,000
San Joaquin River	39,000	10,000
Chowchilla River	2,000	7,000
Surface Water Deliveries	274,000	286,000
Groundwater Delivery via Canals	45,000	45,000
Riparian Uptake from Streams	25,000	25,000
Merced Subbasin	14,000	15,000
Other Subbasins	11,000	10,000
Total Outflow	**3,105,000**	**2,970,000**

[1] Local Tributaries include Bear Creek, Black Rascal Creek, Deadman Creek, Duck Slough, Dutchman Creek, Mariposa Creek, Miles Creek, and Owens Creek. Additional smaller creeks exist but were not modeled due to minimal natural flows.

[2] Other Subbasins include the Turlock, Chowchilla, and Delta-Mendota Subbasins. As supporting data was not available, modeling inputs such as curve number and return flow fractions were assumed to be similar to those used in the Merced Subbasin.

[3] Other flows is a closure term that captures the stream and canal system including gains and losses not directly measured or simulated within IWFM. Some of these features include but may not be limited to direct precipitation, evaporation, unmeasured riparian diversions and return flow, temporary storage in local lakes and regulating reservoirs, and inflow discrepancies resulting from simulating impaired flows.

Table 2-24: Average Annual Water Budget Under Climate Change – Land Surface System, Merced Subbasin (AFY)

Component	Projected Condition Water Budget	Climate Change Water Budget
Hydrologic Period	**WY 1969 - 2018**	**WY 1969-2018**
Inflows		
Precipitation	506,000	612,000
Total Surface Water Supply	274,000	286,000
Surface Water - Local	229,000	229,000
Surface Water - Riparian	46,000	46,000
Total Groundwater Supply	660,000	699,000
Agricultural - Agency	45,000	45,000
Agricultural - Private	526,000	565,000
Urban - Municipal	50,000	50,000
Urban - Domestic	39,000	39,000
Riparian Uptake from Streams	14,000	15,000
Inflow from Groundwater System	12,000	10,000
Total Inflow	**1,466,000**	**1,621,000**
Outflows		
Evapotranspiration	853,000	916,000
Agricultural	682,000	738,000
Municipal and Domestic	37,000	39,000
Refuge, Native, and Riparian	134,000	138,000
Runoff to the Stream System	206,000	290,000
Return Flow to the Stream System	79,000	81,000
Agricultural	26,000	27,000
Municipal and Domestic	54,000	54,000
Deep Percolation	327,000	333,000
Precipitation	79,000	82,000
Surface Water	73,000	73,000
Surface Water - Local	61,000	61,000
Surface Water - Riparian	12,000	12,000
Groundwater	175,000	178,000
Agricultural - Agency	12,000	11,000
Agricultural - Private	139,000	144,000
Urban - Municipal	13,000	13,000
Urban - Private	10,000	10,000
Other[1]	1,000	1,000
Total Outflow	**1,466,000**	**1,621,000**

[1] Other flows is a closure term that captures the gains and losses due to land expansion and seasonal storage in the root-zone.

Table 2-25: Average Annual Water Budget Under Climate Change – Groundwater System, Merced Subbasin (AFY)

Component	Projected Condition Water Budget	Climate Change Water Budget
Hydrologic Period	**WY 1969 - 2018**	**WY 1969-2018**
Inflows		
Deep Percolation	327,000	333,000
Precipitation	79,000	82,000
Surface Water	73,000	73,000
Surface Water - Local	61,000	61,000
Surface Water - Riparian	12,000	12,000
Groundwater	175,000	178,000
Agricultural - Agency	12,000	11,000
Agricultural - Private	139,000	144,000
Urban - Municipal	13,000	13,000
Urban - Private	10,000	10,000
Stream Losses to Groundwater	318,000	337,000
Merced River	42,000	16,000
Eastside Bypass	44,000	18,000
San Joaquin River	36,000	9,000
Chowchilla River	2,000	5,000
Local Tributaries[1]	52,000	142,000
Canal Recharge	141,000	145,000
Subsurface Inflow	79,000	73,000
Total Inflow	**723,000**	**743,000**
Outflows		
Stream Gain from Groundwater	29,000	29,000
Merced River	9,000	16,000
Eastside Bypass	1,000	17,000
San Joaquin River	7,000	9,000
Chowchilla River	2,000	4,000
Local Tributaries	11,000	-18,000
Groundwater Production	660,000	699,000
Agricultural - Agency	45,000	45,000
Agricultural - Private	526,000	565,000
Urban - Municipal	50,000	50,000
Urban - Private	39,000	39,000
Subsurface Outflow[2]	103,000	134,000
Outflow to Land Surface System	12,000	10,000
Other[3]	1,000	1,000
Total Outflow	**805,000**	**873,000**
Change in Storage	**-82,000**	**-130,000**

[1] Local Tributaries include Bear Creek, Black Rascal Creek, Deadman Creek, Duck Slough, Dutchman Creek, Mariposa Creek, Miles Creek, and Owens Creek. Additional smaller creeks exist but were not modeled due to minimal natural flows.

[2] The goal of projecting interbasin flows is to maintain a reasonable balance between the neighboring Subbasins. The results are within 10-12%, which is within the reasonable range, given the availability of projected land use, population, surface water delivery, and groundwater production data from areas outside of the Merced Subbasin.

[3] Other flows within the groundwater system including temporary storage in the vadose zone, and root water uptake from the aquifer system.

2.4.3.4 Opportunities for Future Refinement

The climate change approach developed for this GSP is based on the methodology in DWR's guidance document (DWR, 2018a) and uses "best available information" related to climate change in the Merced Subbasin. There are limitations and uncertainties associated with the analysis. One important limitation is that Calsim II does not fully simulate local surface water operations. Thus, the analysis conducted for this GSP may not fully reflect how surface and groundwater basin operations would respond to the changes in water demand and availability caused by climate change. For this first GSP iteration, use of a regional model and the perturbation factor approach were deemed appropriate given the uncertainties in the climate change analysis.

A recommendation for future refinements of this analysis is utilization of the local surface water operations model, the Merced Irrigation District Hydrologic and Hydraulic Operations Model (MIDH2O). Use of this model would allow for greater resolution in the simulation of Merced River flows and surface water supply based on local management. Additionally, utilization of MIDH2O will allow for analysis of the localized climate conditions effecting snow-pack and its implications on reservoir operations and streamflow. Further monitoring and adaptive management should be considered for the next update if the GSP along with improvements in DWR's climate change data.

3 SUSTAINABLE MANAGEMENT CRITERIA

This section presents the sustainable management criteria developed for the Merced Subbasin GSP. GSP regulations consolidate several requirements of GSPs under the heading of "Sustainable Management Criteria." These criteria include:

- Sustainability Goal
- Undesirable Results
- Minimum Thresholds
- Measurable Objectives

The development of these criteria for the Merced GSP relied upon information about the Subbasin developed in the hydrogeologic conceptual model (Section 2.1), current and historical groundwater conditions (Section 2.2), and the water budget (Section 2.3), and input from stakeholders during the GSP development process.The sustainable management criteria were discussed at multiple coordinating committee and stakeholder committee meetings between March 2018 and August 2018 and revisited in Spring 2019 as additional progress was made on the water allocation framework and sustainable yield analysis.

This GSP considers the six sustainability indicators defined by SGMA in the development of sustainable management criteria. SGMA allows several pathways to meet the distinct local needs of each basin, including development of sustainable management criteria, usage of groundwater levels as a proxy, and identification as not being applicable to the Subbasin.

3.1 SUSTAINABILITY GOAL

SGMA defines sustainable groundwater management as the "*management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results*" [CWC §10721(v)]. Each GSP is required to include a sustainability goal, defined by SGMA as "*the existence and implementation of one or more groundwater sustainability plans that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the applicable basin is operated within its sustainable yield*" [CWC §10721(u)]. SGMA requires the GSP to define a succinct sustainability goal statement.

The Merced Subbasin sustainability goal succinctly states Subbasin objectives and desired conditions as defined by the GSAs and other beneficial users of groundwater in the Subbasin. The Merced Subbasin is heavily reliant on groundwater, and users recognize the basin has been in overdraft for a long period of time. As discussed in greater detail below, the Subbasin has experienced historical lowering of water levels, land subsidence, and wells going dry.

The sustainability goal for the Merced Subbasin is to:

Achieve sustainable groundwater management on a long-term average basis by increasing recharge and / or reducing groundwater pumping, while avoiding undesirable results.

This goal will be achieved by allocating a portion of the estimated Subbasin sustainable yield to each GSA and coordinating the implementation of programs and projects to increase both direct and in-lieu groundwater recharge, which will, in turn, increase the groundwater and / or surface water available to each GSA.

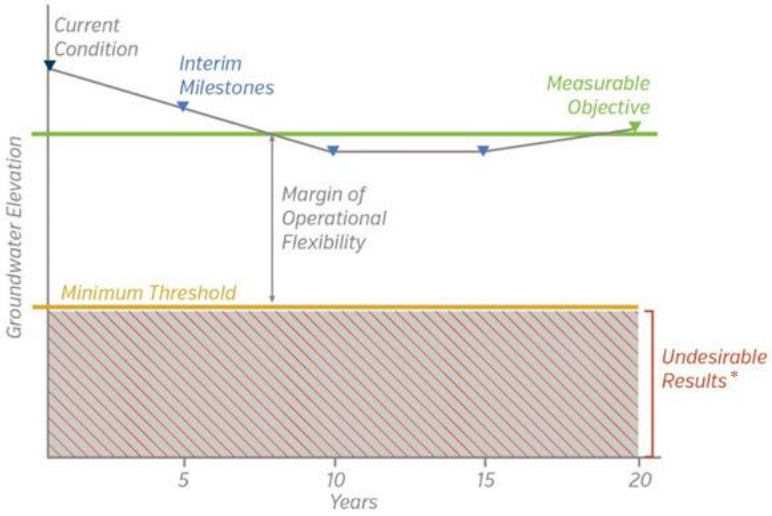
This sustainability goal is supported by the locally-defined minimum thresholds that sufficiently prevent undesirable results, presented later in this section. Achievement of the goal will be demonstrated by the avoidance of undesirable results as defined in this GSP. This will confirm that the basin is operating within its sustainable yield without experiencing undesirable results, and thus that the sustainability goal has been achieved.

Figure 3-1: Sustainable Management Criteria Conceptual Graphic (Groundwater Levels Example*)

Sustainable Management Criteria Definitions

- **Undesirable Results** – Significant and unreasonable negative impacts for each sustainability indicator that are used to guide development of GSP components
- **Minimum Thresholds** – "*A numeric value for each sustainability indicator used to define undesirable results" [*CCR Title 23, Division 2, §351(t)]
- **Measurable Objectives** – Quantitative targets that establish points above the minimum thresholds that allow for a range of active management in order to achieve the sustainability goal for the basin. Defined in the CCR as "*Specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin"* [CCR Title 23, Division 2, §351(r)]
- **Interim Milestones** – "*Target values representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan"* [CCR Title 23, Division 2, §351(q)]
- **Margin of Operational Flexibility**: The space between the measurable objective and the minimum threshold

See Figure 3-1 for a graphic that illustrates the conceptual relationship between the Sustainable Management Criteria terms.



** Note that exceeding the minimum threshold at one representative well does not necessarily trigger an undesirable result. Undesirable results are defined for each sustainability indicator in the sections below.*

3.2 MANAGEMENT AREAS

SGMA provides the option for GSAs to define management areas for portions of basins to facilitate groundwater management and monitoring. A management area is defined in SGMA as an "*area within a basin for which the [GSP] may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors*" [CCR Title 23, Division 2, §351(r)].

For example, GSAs may establish management areas where they desire a higher level of monitoring or wish to set more stringent minimum thresholds relative to the rest of the basin. Per DWR Guidance:

> *Management areas may be defined by natural or jurisdictional boundaries, and may be based on differences in water use sector, water source type, geology, or aquifer characteristics. Management areas may have different minimum thresholds and measurable objectives than the basin at large and may be monitored to a different level. However, GSAs in the basin must provide descriptions of why those differences are appropriate for the management area, relative to the rest of the basin.* (DWR, 2017a, p. 6)

Management Areas have been discussed in the Merced GSP Stakeholder and Coordinating Committee Meetings, as well as GSA Board Meetings. At this time, there are no management areas established for the purposes of defining sustainability criteria for the Subbasin.

3.3 GROUNDWATER LEVELS

3.3.1 Undesirable Results

Description of Undesirable Results

The undesirable result related to groundwater levels is defined in SGMA as:

> *Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods. [CWC §10721(x)(1)]*

The undesirable result for chronic lowering of groundwater levels in the Merced Subbasin is sustained groundwater elevations that are too low to satisfy beneficial uses within the basin over the planning and implementation horizon of this GSP. During development of the GSP, potential undesirable results identified by stakeholders included:

- Significant and unreasonable unusable and stranded groundwater extraction infrastructure
- Significant and unreasonable reduced groundwater production
- Significant and unreasonable increased pumping costs due to greater lift and deeper installation or construction of new wells
- Significant and unreasonable number of shallow domestic wells going dry

Identification of Undesirable Results

For the Merced Subbasin, an undesirable result for declining groundwater levels is considered to occur during GSP implementation when November groundwater levels at greater than 25% of representative monitoring wells (at least 6 of 21) fall below their minimum thresholds for two consecutive years.

The GSAs recognize that water levels may continue to decline during GSP implementation and that dewatering of a single domestic well is not considered significant and unreasonable and is not considered an undesirable result. Nonetheless, the GSAs recognize the importance of access to safe drinking water for all users in the basin and will evaluate during the first five years of the GSP establishing mitigation for domestic wells that might be dewatered by regional declines in groundwater levels (see Section 6.2.3 – Management Action for Domestic Well Mitigation Program).

Potential Causes of Undesirable Results

The Subbasin is currently considered to be in a state of critical overdraft per the DWR Bulletin 118 Interim 2016 Update. Projections of water levels based on the GSP implementation plan do not show groundwater levels triggering undesirable results. However, the chronic lowering of groundwater levels could cause localized or basin-wide undesirable results if GSP implementation does not achieve sufficient pumping reductions. In addition, regulatory, permitting, and funding constraints may influence implementation timing for groundwater management programs and projects in the Subbasin.

Other potential causes could be external factors such as increased groundwater outflow from the Merced Subbasin to adjacent groundwater subbasins as a result of imbalances in groundwater pumping between the subbasins. Additionally, state- or federally-driven regulatory programs could dedicate surface water resources to environmental uses in the San Joaquin River or in downstream waterbodies such as the Sacramento-San Joaquin Delta, thus reducing water available to the Merced Subbasin. For example, increased flow requirements described by the Substitute Environmental Document (SED) for the Lower San Joaquin River and Southern Delta Bay-Delta Plan Update would likely cause impacts to groundwater levels.

Potential Effects of Undesirable Results

If groundwater were to reach levels that cause undesirable results, effects could include: de-watering of a subset of the existing groundwater infrastructure, starting with the shallowest wells (which are generally domestic wells) and adverse effects on groundwater dependent ecosystems. Lowering levels to this degree could necessitate drilling deeper wells for drinking water and agricultural irrigation supplies, which could cause adverse effects to property values and the regional economy. Additionally, undesirable results for groundwater levels could adversely affect current and projected municipal uses, which rely on groundwater in the Subbasin, increasing costs for potable water supplies.

3.3.2 Minimum Thresholds

Minimum Threshold Background

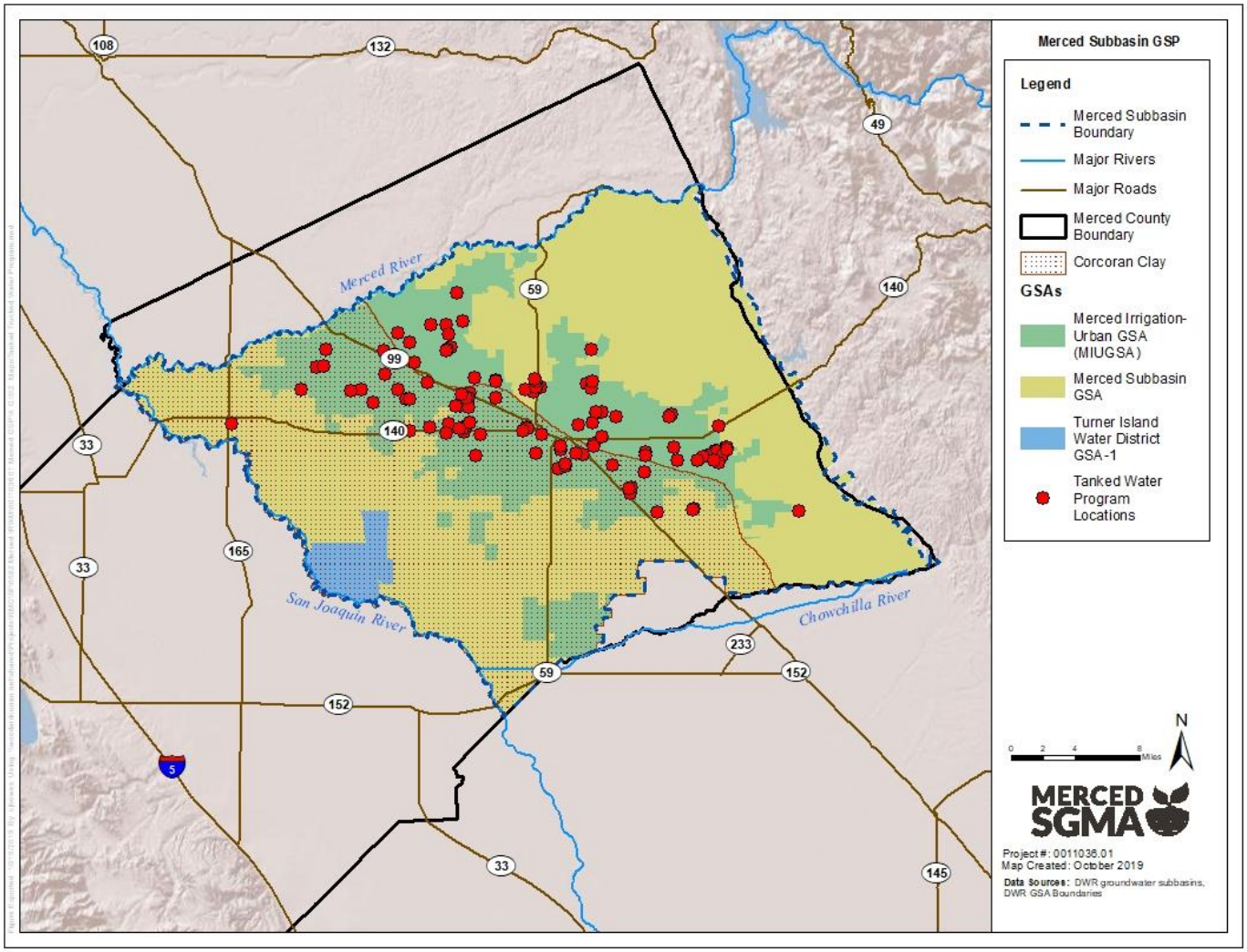
The minimum threshold definition for the chronic lowering of groundwater levels was developed to represent water levels that are above conditions that could generate significant and unreasonable undesirable results in the Merced Subbasin, to the extent possible given available information. Future data may allow for refinement of this threshold.

The Subbasin, as described in the Section 2.1 - Hydrogeologic Conceptual Model, is composed of three principal aquifers: Above, Below, and Outside of the Corcoran Clay. The minimum threshold definition was applied to each of these areas by selecting monitoring wells considered representative within each principal aquifer and establishing a threshold groundwater elevation for each well.

Within the Merced Subbasin, groundwater levels have been declining for several years (see Section 2.2 - Current and Historical Groundwater Conditions). Groundwater levels during the 2012-2016 drought declined at a faster rate, especially in the region designated as the Outside Corcoran Clay Principal Aquifer which is just east of the City of Merced, causing approximately 130 domestic wells to go dry. As an emergency measure during the drought, Merced

County facilitated a State of California tanked water program to make potable water available to domestic users whose wells had gone dry. Figure 3-2 shows a map with the location of the tanked water program deliveries. Of the participants in this program, those who were not removed from the program due to non-compliance with program requirements had new wells installed, with the exception of one who was connected to a city water system. Some participants sold their property; the current status of those properties is unknown.

Figure 3-2: Merced Subbasin Tanked Water Program Locations (through 2018)



Minimum Threshold Selection

The minimum threshold for groundwater levels is defined as the fall 2015 groundwater level measurement (November 2015, or October 2015 or December 2015 when November data are unavailable) recorded at each representative monitoring well. This threshold keeps groundwater levels generally above levels that have been experienced in the past. In this way, impacts to shallow well users and other beneficial users of groundwater will generally not exceed what has historically been experienced in the Subbasin. In some areas, groundwater levels could be lower without resulting in significant and unreasonable impacts, notably due to limited domestic wells or to generally deeper domestic wells. Further, thresholds are set at fall 2015 levels to also be consistent with the other sustainability indicators. The

groundwater level minimum threshold is consistent with the avoidance of significant and unreasonable impacts to subsidence, water quality, and depletions of interconnected surface water, as described later in this Plan.

To evaluate the impact of a fall 2015 minimum threshold, Merced County's electronic well permitting database was used to determine the shallowest domestic or Public Water System well depth within five miles of each representative monitoring well (defined as a circle around the monitoring well with radius of five miles). The Merced County well permitting database includes domestic and Public Water System wells permitted by the county since the early- to mid-1990s. While DWR's Online System for Well Completion Reports (OSWCR) contains additional wells permitted before the 1990s, the Merced County well permitting database was assumed to provide a reliable current representation of active domestic wells in the Subbasin. Additionally, it provides more specific information about these wells such as detailed location from latitude/longitude coordinates, address, or APN, as well as well status as part of the county's permit approval workflow process. The Merced County well permitting database was filtered to omit known inactive wells, resulting in approximately 3,010 wells with locations that could be plotted geographically within the Subbasin and that had a total well depth reported. 2,996 of these wells (99.5%) are located within 5 miles of one of the representative monitoring wells. Additional analysis resulted in the filtering out of additional wells from the subset of 2,996, as described in the bullets below. However, it is likely that the resulting dataset still includes wells that have become inactive but are not flagged in the county's database.

- 8 wells reviewed manually and confirmed to be associated with a later well destruction record
- 8 wells that do not meet county domestic well annular seal requirements (depth of 50 feet or less)
- 11 wells flagged as other outliers[11]

Total well depths were compared to the minimum threshold. At three out of 21 representative monitoring wells, fall 2015 elevation data are lower than the shallowest domestic well depth[12], indicating that these domestic well(s) may already have been dewatered and replaced. The three station IDs are 28392 (9 wells, equivalent to 45% of nearby wells), 38884 (1 well, equivalent to 2% of nearby wells), and 47575 (1 well, equivalent to 1% of nearby wells). Again, it is expected that these wells have likely since been deepened or abandoned and replaced given that groundwater levels have declined to this level in the past. Thus, returning to this level would not be expected to dewater these wells again. Recall that available datasets often include wells that are no longer in use for a variety of reasons.

Representative Monitoring Wells for Minimum Threshold

A subset of CASGEM wells serve as the representative monitoring wells. Minimum threshold groundwater elevations were developed for 21 out of 50 CASGEM wells in the Subbasin and are considered the best representation of the Subbasin using best available information[13]. CASGEM wells were selected as they are actively managed and have previously been identified as appropriate for regional monitoring activities. Not all CASGEM wells were selected to be

[11] Outliers that were statistically significant (much shallower than surrounding wells). Outlier Analysis: at each representative monitoring well, the interquartile range of domestic wells was calculated (75th percentile depth minus 25th percentile depth). Domestic wells were flagged as outliers and excluded from the threshold analysis if they had a depth that was shallower than: (25th percentile domestic well depth) – 1.5 * (Interquartile Range)

[12] It is acknowledged that domestic or Public Water Supply wells need additional water depth above the bottom of the well for the pump to functioning, but without information about pump settings, this was not considered in the analysis.

[13] Between November 2019 when the GSP was originally published and this July 2022 update, four representative groundwater leevel monitoring wells were removed from the network because it was discovered they either were completed in more than one aquifer or were located adjacent to nearly constant pumping operations and thus did not meet the SGMA requriements for monitoring wells. These are described in more detail in the Merced GSP Annual Reports.

representative. For instance, only one well per unique set of multiple completion wells was considered for representative monitoring.

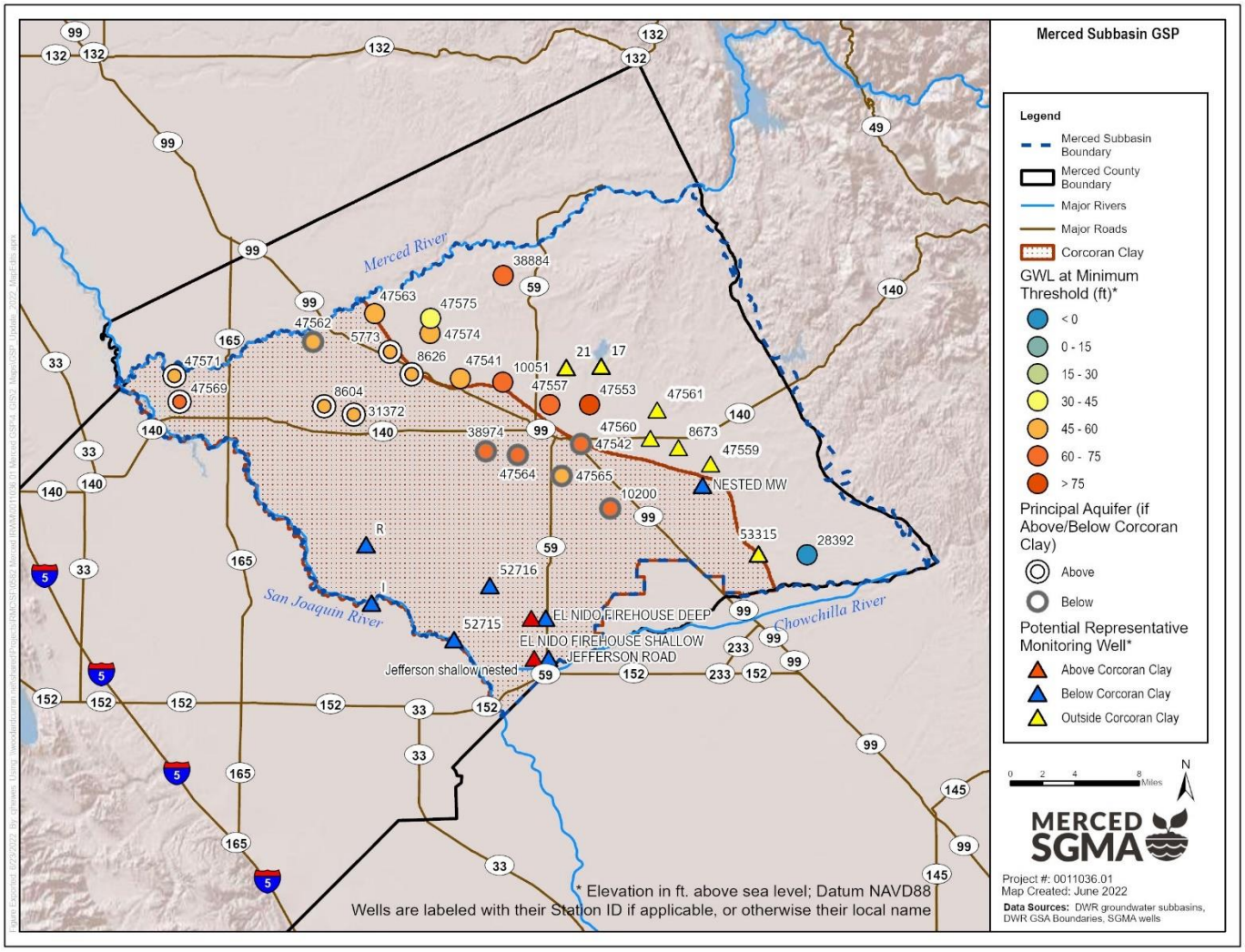
A data gap has been identified for the western portion of the Subbasin, and this is described in more detail in Section 4.5.6 - Data Gaps.

An additional 16 wells have been identified as potential representative monitoring wells, most of which came online or began recording measurements very recently between 2018-2021. Sustainable management criteria have not yet been established at these wells because most do not have a historical record from which to select a fall 2015 elevation.

As additional wells are added to the monitoring network, they will be considered for inclusion as representative monitoring wells based on their ability to contribute to characterization and management of groundwater conditions in the Subbasin. In the future, should representative wells be developed in areas of the Subbasin where there is no or limited historical data available, the GSAs will need to consider developing a new minimum threshold definition; however, this is not anticipated to occur until the five-year GSP update, if at all. At that time, the Subbasin may consider including projected groundwater levels from the MercedWRM as part of the minimum threshold definition.

Figure 3-3 shows the minimum threshold groundwater elevations for all the representative monitoring wells. Additional information about the minimum threshold and associated groundwater elevations can be found in Table 3-1 following the discussion of measurable objectives. The 16 potential representative monitoring wells are shown in Figure 3-3 with a different symbol to show where some data gaps will eventually be filled once sustainable management criteria are developed at these additional wells.

Figure 3-3: Minimum Threshold Groundwater Elevations at Representative Monitoring Well Sites



Groundwater levels are also used as a proxy indicator for depletion of interconnected surface water in Section 3.8.

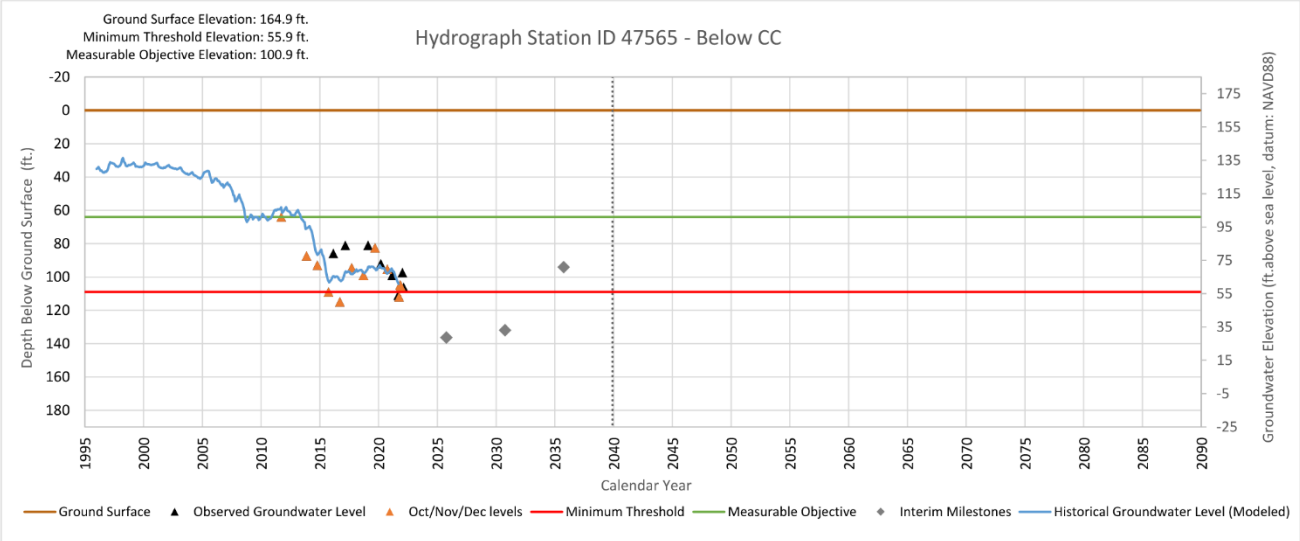
3.3.3 Measurable Objectives and Interim Milestones

Measurable objectives are quantitative targets that establish a point above the minimum threshold that allow for a range of active management of the basin in order to achieve the sustainability goal for the basin. The condition between the measurable objective and the minimum threshold is known as the margin of operational flexibility. The margin of operational flexibility is intended to accommodate droughts, climate change, conjunctive use operations, or other groundwater management activities.

The measurable objective is set at the elevation of November 2011 groundwater levels for representative monitoring wells with historical measurements available. This represents relatively high groundwater levels prior to the declines seen during the 2012-2016 drought. For representative monitoring wells without available November 2011 measurements, October or December 2011 measurements were used, as available. For representative monitoring wells without November, October, or December 2011 measurements, a value has been calculated using estimates of

historical groundwater levels in November 2011 from the MercedWRM historical conditions simulation. MercedWRM groundwater levels were adjusted vertically based on the average distance between observed and simulated levels before querying the November 2011 estimation. Table 3-1 shows the measurable objective for each representative monitoring well. Figure 3-4 contains an example hydrograph, showing the relationship between historical groundwater elevations, simulated groundwater levels, the minimum threshold groundwater level, the measurable objective, and the interim milestones. Appendix F contains the full set of hydrographs, one for each representative monitoring well in Table 3-1.

Figure 3-4: Example Hydrograph Showing Minimum Threshold and Measurable Objective



Interim milestones (IM) have been established to facilitate the Subbasin reaching its measurable objectives for groundwater levels. The GSAs expect some level of continued groundwater level decline in much of the Subbasin while projects and management actions are developed and implemented. Further, many representative monitoring wells are currently below their minimum threshold. Thus, the IMs for groundwater levels allow for temporary further groundwater level decline below the minimum threshold. IMs are defined in 5-year increments, for 2025, 2030, and 2035.

The interim milestones are developed by first calculating a range for each of the 5-year increments. The range of IMs is developed so that wet conditions are generally represented by the upper value and dry conditions are generally represented by the lower value. The final IM for each of the 5-year increments is then based on a percentage between the upper and lower values.

The range of IMs were developed as follows:

- Year 5 (2025)
    - Low value: Calculated the average annual slope between the MT (based on 2015 levels) and MO (based on 2011 levels), then projected the 2025 measurement using the average slope from the most recently recorded October or November measurement (all but Station ID 28392 last had a valid measurement recorded October 2021).
    - High value: Calculated the average annual slope in October through December groundwater levels from 2015 through 2019 (a relatively wet period), then projected the 2025 measurement using the average slope from the most recently recorded October or November measurement (all but Station

ID 28392 last had a valid measurement recorded October 2021). If the resulting value was greater than 25% of the distance from the MT to the MO, then it was placed at 25% of the way from the MT to the MO.

- Year 10 (2030):
    - Low value: Calculated the average annual slope between the MT (based on 2015 levels) and MO (based on 2011 levels), then projected the 2030 measurement using half the average slope from the 2025 IM low end.
    - High value: Calculated the average annual slope in October through December groundwater levels from 2015 through 2019 (a relatively wet period). If the slope was negative, then maintained the 2025 IM high end. If the slope was positive, then projected the 2030 measurement using the average slope from the 2025 IM high end. If the resulting value was greater than 50% of the distance from the MT to the MO, then it was placed at 50% of the way from the MT to the MO.
- Year 15 (2035):
    - Low value: Set at one third of the way between the 2030 IM and the MO. If the resulting value is greater than the MT, then it was set at the MT.
    - High value: Set at one third of the way between the 2030 IM and the MO.

The final interim milestone per representative monitoring well were developed and were calculated as follows:

- Year 5 (2025): *[2025 IM low value] + 25% * ([2025 IM high value] – [2025 IM low value])*
- Year 10 (2030): *[2030 IM low value] + 50% * ([2030 IM high value] – [2030 IM low value])*
- Year 15 (2035): *[2035 IM low value] + 75% * ([2035 IM high value] – [2035 IM low value])*

The percentage between the low value and high value increases with later years in recognition of reduced chances of predominantly dry conditions (higher potential to occur within short time periods) rather than more long-term normal conditions (higher potential to occur over longer time periods). Interim milestones are shown on Table 3-1.

Many representative monitoring wells have limited data, and many of these also show high levels of variability that make analysis difficult. Sustainable management criteria have been set using the best available data, including in some cases additional information from the MercedWRM groundwater model. In several cases, there may be influences of nearby production wells that would need to be considered when setting and monitoring for sustainable management criteria; influences that are difficult to discern from the limited data. Wells that exhibit groundwater levels that are highly variable or difficult to explain will be a focus for the installation of pressure transducers to better understand the variability, to the extent feasible. One such well is well ID 47541. Installations may be temporary or permanent. Sustainable management criteria may be modified based on future data collection and analysis.

Table 3-1: Groundwater Levels at Minimum Threshold, Measurable Objective, and Interim Milestones for Representative Wells

State Well ID	Well ID	Minimum Threshold[1]		Measurable Objective[1]			Interim Milestones[1]		
		Fall 2015 GW Level	Date of 2015 GWL	Fall 2011 GW Level[2]	Date of Fall 2011[2]	Measurable Objective[2]	2025	2030	2035
373496N1205890W001	47541	56.1	10/14/2015	-	-	66.4	29.9	25.6	39.5
370000N1200000W001	47574	56.0	10/1/2015	80.0	12/28/2011	80.0	40.0	36.7	56.4
373457N1205429W001	10051	73.7	10/12/2015	92.6	10/3/2011	92.6	48.1	45.8	65.7
373260N1204432W004	47553	87.4	10/8/2015	-	-	118.1	56.8	54.2	83.3
373243N1207424W001	8604	59.0	10/15/2015	67.0	10/3/2011	67.0	55.9	55.1	61.0
372904N1204207W001	47542	73.7	10/8/2015	-	-	112.6	38.3	35.6	71.6
373166N1207091W001	31372	50.8	10/15/2015	75.6	10/3/2011	75.6	33.9	34.6	55.9
373260N1204880W004	47557	62.4	10/8/2015	-	-	102.1	37.4	38.3	71.7
373532N1206432W001	8626	48.9	10/12/2015	78.0	10/3/2011	78.0	15.5	18.4	48.2
373278N1209054W002	47569	61.2	10/14/2015	68.2	10/15/2011	68.2	59.4	59.3	64.1
373510N1209113W001	47571	56.8	10/14/2015	66.3	11/15/2011	66.3	53.8	53.8	60.5
373732N1206679W001	5773	46.5	10/15/2015	-	-	73.8	26.8	30.6	54.8
372335N1204199W001	10200	67.2	10/29/2015	145.2	10/3/2011	145.2	11.5	13.9	81.8
372806N1205241W001	47564	70.2	10/12/2015	108.7	10/3/2011	108.7	53.5	55.1	84.4
370000N1200000W002	47575	45.0	10/1/2015	89.0	12/28/2011	89.0	26.1	27.8	61.3
374074N1206859W001	47563	50.5	10/15/2015	81.0	10/3/2011	81.0	33.1	35.7	60.8
373821N1207551W001	47562	58.8	10/15/2015	-	-	75.3	48.8	50.4	64.2
372838N1205602W001	38974	73.9	10/12/2015	104.4	10/3/2011	104.4	61.8	62.6	85.4
372617N1204747W001	47565	55.9	10/15/2015	100.9	10/3/2011	100.9	28.5	32.9	70.7
371902N1201985W001	28392	-94.5	10/14/2015	47.5	10/14/2011	47.5	-169.7	-159.4	-45.1
374421N1205407W001	38884[3]	70.7	N/A[3]	100.4	10/3/2011	100.4	40.4	38.1	66.7

Table 3-1 Notes:

1. *The Minimum Threshold, Measurable Objective, and Interim Milestones are reported as groundwater elevations in feet above sea level, datum: NAVD88.*
2. *For representative monitoring wells without observed fall 2011 measurements, a value has been calculated using estimates of historical groundwater levels in November 2011 from the MercedWRM historical conditions simulation. MercedWRM groundwater levels were adjusted vertically based on the average distance between observed and simulated levels before querying the November 2011 estimation.*
3. *Well ID 38884 does not have measurements recorded for 2012-2017. A 2015 estimate was calculated based on looking at the average difference between fall 2021 and fall 2015 measurements at representative monitoring wells in the Outside Corcoran Clay in the northern half of the Subbasin (e.g. in the region of well 38884). This average factor was applied to the 2021 measurement at 38884 to estimate the 2015 value and MT.*

3.4 REDUCTION OF GROUNDWATER STORAGE

Reduction of groundwater storage is not an applicable sustainability indicator because significant and unreasonable reduction of groundwater storage is not present and not likely to occur in the Subbasin, as described below.

The Merced Subbasin has approximately 45 million acre-feet (MAF) of fresh (non-saline) groundwater storage as of 2015 (see Section 2.2.2 - Groundwater Storage in Current and Historical Groundwater Conditions), and analysis of groundwater storage has shown a cumulative change in storage of less than -3 MAF over the 20-year period of 1995-2015. This cumulative change in storage, which includes both representative dry and wet years, reflects a rate of overdraft of approximately 0.3% per year. It is not reasonable to expect that the available groundwater in storage would be exhausted.

3.5 SEAWATER INTRUSION

Seawater intrusion is not an applicable sustainability indicator, because seawater intrusion is not present and is not likely to occur due to the distance between the Subbasin and the Pacific Ocean (and Sacramento-San Joaquin Delta).

3.6 DEGRADED WATER QUALITY

3.6.1 Undesirable Results

Description of Undesirable Results

The undesirable result related to degraded water quality is defined in SGMA as:

> *Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies. [CWC §10721(x)(4)]*

Undesirable results for degraded water quality would be impacts caused by groundwater extractions and other SGMA groundwater management activities in the Subbasin that cause significant and unreasonable reduction in the long-term viability of domestic, agricultural, municipal, or environmental uses over the planning and implementation horizon of this GSP.

In identifying undesirable results for the Subbasin, the GSAs sought input from beneficial users through multiple venues including the stakeholder advisory committee and public workshops held in locations specifically selected to provide access to disadvantaged communities. The protection of water quality for drinking and for agricultural use was identified as a priority for users in the basin. Degraded water quality is unique among the six sustainability indicators because it is already the subject of extensive federal, state, and local regulations carried out by numerous entities and SGMA does not directly address the role of GSAs relative to these other entities (Moran & Belin, 2019). The GSAs also sought input from the Merced County Division of Environmental Health as to which constituents of concern in the Subbasin could be tied to groundwater management activities and therefore managed through SGMA. While the Division of Environmental Health has identified several constituents of concern in the Subbasin (see Section 2.2.4 - Groundwater Quality in Current and Historical Groundwater Conditions), this GSP focuses on only those constituents where groundwater management activities have the potential to cause undesirable results. The GSAs and Subbasin stakeholders, in consultation with the Division of Environmental Health, determined that salinity is the only constituent of concern currently known to be directly tied to groundwater management activities and therefore appropriate to include in the GSP.

Identification of Undesirable Results

An undesirable result is considered to occur during GSP implementation when at least 25% of representative monitoring wells (6 of 22 sites) exceed the minimum threshold for degraded water quality for two consecutive years[14].

Potential Causes of Undesirable Results

Groundwater in the Merced Subbasin contains both anthropogenic and naturally-occurring constituents. While groundwater quality is typically sufficient to meet beneficial uses, some of these constituents either currently impact groundwater use within the Subbasin or have the potential to impact it in the future. Depending on the water quality constituent, the issue may be widespread or more of a localized concern. The focus of this GSP is on constituents that are exacerbated or ameliorated due to groundwater management activities.

Salinity was identified by the GSAs based on stakeholder input and the recommendation of the Merced County Division of Environmental Health as the only constituent with sustainability management criteria to monitor in the GSP because the causal nexus between salinity concentrations and groundwater management activities has been established (see Section 3.6.2 - Minimum Thresholds). Relatively high salinity groundwater in the basin has been shown to migrate due to groundwater extraction activities. These areas of relatively high salinity groundwater are primarily located along the west side of the Subbasin, adjacent to the San Joaquin River and in urban use areas such as the cities of Livingston and Atwater. High salinity groundwater is principally the result of the migration of a deep saline water body which originates in regionally-deposited marine sedimentary rocks that underlie the San Joaquin Valley. Groundwater pumping can cause the upwelling of saline brines originating from naturally-occurring marine sedimentary rocks. Though the Corcoran Clay naturally impedes high TDS groundwater, high permeability pathways through the clay from the Below Corcoran Principal Aquifer to the Above Corcoran Principal Aquifer may be created by perforated wells. In addition, this poorer-quality water can migrate across the Subbasin from the west to the east (AMEC, 2008). Better quality groundwater (less than 1,000 mg/L) in these western and southwestern areas is generally found at shallower depths (AMEC, 2008), generally in the Below Corcoran Principal Aquifer .

Note that accumulation of salts due to agricultural activities, urban wastewater, or other land use activities do not have an established causal nexus with groundwater management activities.

Potential Effects of Undesirable Results

If groundwater quality were degraded to levels causing undesirable results, the effect could potentially cause a reduction in usable supply to groundwater users, with domestic wells being most vulnerable as treatment or access to alternate supplies may be unavailable or at a high cost for small users. Water quality degradation could cause potential changes in irrigation practices, crops grown, crop productivity, adverse effects to property values, and other economic effects. Degraded water quality could have impacts on native vegetation or managed wetlands. Additionally, reaching undesirable results levels for groundwater quality could adversely affect current and projected municipal uses, and users could have to install wellhead treatment systems or seek alternate supplies.

[14] Between November 2019 when the GSP was originally published and this July 2022 update, three representative groundwater quality monitoring wells were added to the network because they were added by ESJWQC in their GQTM program specifically within the Merced Subbasin.

3.6.2 Minimum Thresholds

Minimum Threshold Applicability

Degraded water quality is unique among the six sustainability indicators because it is already the subject of extensive federal, state, and local regulations carried out by numerous entities, and SGMA does not directly address the role of GSAs relative to these other entities (Moran & Belin, 2019). SGMA does not specify water quality constituents that must have minimum thresholds. Groundwater management is the mechanism available to GSAs to implement SGMA. Establishing minimum thresholds for constituents that cannot be managed by increasing or decreasing pumping was deemed inappropriate by the GSAs and basin stakeholders. Other water quality concerns are being addressed through various water quality programs (e.g., CV-SALTS and ILRP) and agencies (e.g., RWQCB, EPA) that have the authority and responsibility to address them. The GSAs will abide by any future local restrictions that may be implemented by the agencies or coalitions managing these programs. These water quality issues without a causal nexus in the Merced Subbasin include:

- **Naturally occurring constituents such as arsenic, uranium, iron, and manganese:** the GSAs do not have control over the presence of these constituents in aquifer materials. Thresholds are not set for these constituents as there is no demonstrated local correlation between fluctuations in groundwater elevations and/or flow direction and concentrations of these constituents at wells.

- **Constituents from human activities that are not managed under SGMA:** pesticides, herbicides, and fertilizers may be present from agricultural and, to a lesser degree, urban uses. Existing programs, including CV-SALTS, ILRP, and regulation by the California Department of Pesticide Regulation, are designed to address these concerns. Thresholds are not set for these constituents as the GSAs have no authority to limit the loading of nutrients or agrochemicals. However, as mentioned above, the GSAs will abide by any future local restrictions that may be implemented by agencies managing such programs.

- **Constituents from human activities at contaminated sites managed under other regulatory authority:** constituents at the former Castle Air Force Base and other smaller contaminated sites are under cleanup orders set by state or federal agencies. The potentially responsible parties are required to contain contaminants and remediate the groundwater. Data collected as part of GSP monitoring will be provided to regulators upon request. Thresholds are not set for these constituents as the GSAs are not responsible and do not have authority for containment or cleanup of these sites.

The major water quality issue being addressed by sustainable groundwater management is the migration of relatively higher salinity water into the freshwater principal aquifers. The nexus between water quality and water supply management exists for the pumping-induced movement of low-quality water from the west and northwest to the east.

The GSAs sought input from the Merced County Division of Environmental Health (Division) during the development of water quality minimum thresholds. The Division agrees that salinity is a good indicator for water quality issues and trends that are related to Subbasin groundwater management activities. In addition, the Division recommended that the GSAs make use of resources like GeoTracker and EnviroStor and to closely coordinate with agencies that already monitor contamination plumes.

While the GSP does not set thresholds for the types of constituents described above, current conditions in the Subbasin are summarized in Section 2.2.4 (Groundwater Quality), monitoring of these constituents is included in ongoing monitoring efforts listed below, and results will be summarized in future GSP updates. The GSAs will conduct the following ongoing water quality coordination activities:

- Monthly review of data submitted to the Department of Pesticide Regulation (DPR), Division of Drinking Water (DDW), Department of Toxic Substances Control (EnviroStor), and GeoTracker as part of the Groundwater Ambient Monitoring and Assessment (GAMA) database.
- Quarterly check-ins with existing monitoring programs, such as CV-SALTS and ESJWQC GQTM.
- Annual review of annual monitoring reports prepared by other programs (such as CV-SALTS and ILRP)
- GSAs will invite representative(s) from the Regional Water Quality Control Board, Merced County Division of Environmental Health, and ESJWQC to attend an annual meeting of the GSAs to discuss constituent trends and concerns in the Subbasin in relation to groundwater pumping.
- GSAs will consider potential beneficial and adverse effects on groundwater quality in siting groundwater recharge projects and other management actions.

The purpose of these reviews will be to monitor and summarize the status of constituent concentrations throughout the Subbasin with respect to typical indicators such as applicable MCLs or SMCLs. The Merced Subbasin GSP Annual Report and 5-Year Update will include a summary of the coordination and associated analyses of conditions. The GSP 5-year updates may include evaluation of whether minimum thresholds for additional constituents are needed.

The GSAs have selected a minimum threshold for groundwater levels that corresponds with 2015 elevations. One potential concern with water quality is that declines in groundwater levels can dewater additional portions of the aquifer impacting the migration of low-quality groundwater, resulting in low-quality groundwater entering from dewatering clays or other aquifer zones, or resulting in changes in aquifer chemistry. While the interim milestones for groundwater levels allow for temporary further groundwater level decline below 2015 elevations, it is expected that groundwater levels will be above 2015 elevations by 2040. As a result of the short-term nature of potential limited declines below 2015 elevations and the desire to operate at the measurable objective rather than the minimum threshold, groundwater quality degradation due to groundwater level declines below 2015 elevations is not expected in the long-term. In the meantime, the groundwater quality minimum threshold for salinity and other groundwater quality monitoring coordination activities described above will function to monitor for groundwater quality impacts.

Minimum Threshold Selection

Salinity is a measure of the amount of dissolved particles and ions in water. Salinity can include several different ions, but the most common are chloride, sodium, nitrate, calcium, magnesium, bicarbonate, and sulfate. While there are several different ways to measure salinity, the two most frequently used are Total Dissolved Solids (TDS) and Electrical Conductivity (EC). TDS is a measure of all dissolved substances that can pass through a very small filter (typically with 2-micrometer pores) and is typically reported in milligrams per liter (mg/L). EC measures the ability of an electric current to pass through water because conductivity is proportional to the amount of dissolved salts in the water. It is generally reported in microSiemens/cm. Salinity throughout this GSP is reported in terms of TDS.

The minimum threshold for salinity is defined based on the potential impact of salinity on drinking water and agricultural beneficial uses, as aligned with state and federal regulations. The recommended drinking water secondary MCL for TDS is 500 mg/L with an upper limit of 1,000 mg/L and a short-term limit[15] of 1,500 mg/L (SWRCB, 2006). The secondary MCL was established by the USEPA and then adopted by the SWRCB. The secondary MCL is a secondary drinking water standard established for aesthetic reasons such as taste, odor, and color and is not based on public

[15] Short-term limits are acceptable only for existing community water systems on a temporary basis pending construction of treatment facilities or development of acceptable new water sources (California Code of Regulations Title 22 § 64449).

health concerns. For agricultural uses, salt tolerance varies by crop, with common crops in the Merced Subbasin (almonds, sweet potatoes, tomatoes, alfalfa, corn, and grapes (Merced County Department of Agriculture, 2017)) tolerant of irrigated water with TDS below about 1,200 mg/L at a 90% crop yield potential (Ayers & Westcot, 1985). [16]

Salinity levels within the Merced Subbasin have historically ranged from less than 90 mg/L to greater than 3,000 mg/L as TDS. Generally, similar to other basins in the eastern San Joaquin Valley, TDS tends to increase from the foothills to the trough of the Valley. TDS in the eastern two-thirds of the Subbasin is generally less than 400 mg/L. TDS increases westward and southwestward towards the San Joaquin River and southward towards the Chowchilla River. In these areas, high TDS water is found in wells deeper than 350 feet (AMEC, 2008). TDS is slightly elevated in certain urban portions of the northern Subbasin, such as beneath the Atwater and Winton areas (AMEC, 2008).

Most recent 2000-2016 TDS concentrations in the Merced Subbasin, as analyzed by the CV-SALTS program, ranged widely from 90 mg/L to 2,005 mg/L. In the northwest area of the Above Corcoran Clay, average TDS is greater than 751 mg/L. Average TDS concentration in the Below Corcoran Clay is lowest in the North (less than 501 mg/L) and increases in the Southwest to over 1,000 mg/L (Luhdorff and Scalmanini Consulting Engineers, 2016). In pockets of the Subbasin with elevated TDS (greater than 1,000 mg/L), water use behaviors have already shifted to accommodate these concentrations. For example, agriculture has focused on more salt-tolerant crops, and more saline water supplies are blended with less saline water supplies. As a result, TDS concentrations in excess of 1,000 mg/L where currently experienced are not considered to be undesirable. There is, however, a desire on the part of Subbasin stakeholders to limit increases in salinity in parts of the Subbasin where TDS is below 1,000 mg/L to prevent undesirable results such as requirements to change cropping, blending supplies, etc.

Given these conditions, the minimum threshold for salinity was defined as 1,000 mg/L as TDS to be protective against undesirable results related to elevated salinity.

Representative Monitoring Wells for Minimum Threshold

The East San Joaquin Water Quality Coalition (ESJWQC) is a group of agricultural interests and growers formed to represent dischargers who own or operate irrigated lands east of the San Joaquin River within Madera, Merced, Stanislaus, Tuolumne, and Mariposa Counties, as well as portions of Calaveras County. The ESJWQC has developed a Groundwater Quality Trend Monitoring workplan (GQTM) as part of the Irrigated Lands Regulatory Program (ILRP), which includes a targeted set of domestic wells (denoted as principal wells) supplemented by public water system wells (denoted as complementary wells) (ESJWQC, 2018). All ESJWQC GQTM program principal and complementary monitoring wells in the Merced Subbasin are used as representative monitoring wells for this GSP. Additional information about minimum thresholds can be found in Table 3-2 following the discussion of measurable objectives. More information about these representative monitoring wells and plans to fill data gaps are included in Section 4.8 - Groundwater Quality Monitoring Network.

3.6.3 Measurable Objectives and Interim Milestones

The measurable objective is a TDS concentration of 500 mg/L, which aligns with the recommended Secondary MCL for TDS. The margin of operational flexibility is 500 mg/L TDS, the difference between the measurable objective of 500 mg/L and the minimum threshold of 1,000 mg/L.

In the case of degraded water quality, specifically for salts, there is a natural tendency for salt concentrations to increase over time due to agricultural and urban uses of water, which add salts either directly or increases concentrations

[16] An average value of 1.8 dS/m was converted using University of California Agriculture and Natural Resources salinity unit conversion formula of TDS (mg/L) = Electrical Conductivity (dS/m) * 640 (applicable for electrical conductivity ranging 0.1 to 5 dS/m).

through evapotranspiration. As previously noted, such increases are not due to a causal nexus with groundwater management activities and would not constitute an undesirable result under this GSP. Continued monitoring data will be analyzed for trends, and future increasing trends will be analyzed for evidence of the sources of the trends, such as upward migration of relatively higher salinity water due to overpumping or due to continued agricultural and urban uses. If caused by upward migration, GSAs will respond accordingly due to the causal nexus with groundwater pumping.

Table 3-2 shows the measurable objective for each representative monitoring well. Interim milestones are set at the same concentrations as the measurable objectives.

Table 3-2: Groundwater Quality Minimum Threshold & Measurable Objective Concentrations

ESJWQC GQTM Well ID	Complementary or Principal?[1]	Principal Aquifer	TDS Concentration at Minimum Threshold (mg/L)	TDS Concentration at Measurable Objective (mg/L)
P06	Principal	Outside	1,000	500
P07	Principal	Below	1,000	500
P08	Principal	Outside	1,000	500
P09	Principal	Below	1,000	500
P10	Principal	Below	1,000	500
ESJQC00019	Principal	Below	1,000	500
ESJQC00022	Principal	Above	1,000	500
ESJQC00030	Principal	Below	1,000	500
C35	Complementary	Above	1,000	500
C41	Complementary	Above	1,000	500
C45	Complementary	Above	1,000	500
C38	Complementary	Below	1,000	500
C44	Complementary	Below	1,000	500
C40	Complementary	Outside	1,000	500
C42	Complementary	Outside	1,000	500
C43	Complementary	Outside	1,000	500
C46	Complementary	Outside	1,000	500
C47	Complementary	Outside	1,000	500
C39	Complementary	Outside	1,000	500
C48	Complementary	Outside	1,000	500
C49	Complementary	Unknown	1,000	500
C50	Complementary	Unknown	1,000	500

1. *Complementary and Principal wells are defined in Section 4.8.1 - Monitoring Wells Selected for Monitoring Network.*

3.7 LAND SUBSIDENCE

3.7.1 Undesirable Results

Description of Undesirable Results

The undesirable result related to land subsidence is defined in SGMA as:

> *Significant and unreasonable land subsidence that substantially interferes with surface land uses. [CWC §10721(x)(5)]*

An undesirable result for land subsidence would be significant and unreasonable reduction in the viability of the use of infrastructure over the planning and implementation horizon of this GSP. Land subsidence that substantially interferes with surface land uses causes damage to public and private infrastructure (e.g., roads and highways, flood control, canals, pipelines, utilities, public buildings, residential and commercial structures).

The largest conveyance facility that has the potential to be damaged or have reduced flood conveyance capacity due to subsidence is the Eastside Bypass, located in the southwest corner of the Merced Subbasin. Additionally, because most subsidence in the Subbasin has occurred in the vicinity of El Nido (see Figure 2-80), community infrastructure in El Nido has the potential to be damaged by subsidence.

Identification of Undesirable Results

Exceedances of minimum threshold rates of land subsidence at three or more monitoring sites out of four for two consecutive years will quantitatively indicate that the Subbasin has reached undesirable results for land subsidence.

Potential Causes of Undesirable Results

Land subsidence can be the direct result of over extraction of groundwater in the Subbasin. Subsidence has been observed in the southwestern portion of the Subbasin and encompasses areas included in all three GSAs. Subsidence in the Subbasin is thought to be caused by groundwater extraction below the Corcoran Clay and compaction of clays below the Corcoran Clay (DWR, 2017b). The transition from pasture or fallowed land to row and permanent crops adjacent to the San Joaquin River is thought to have created an increased groundwater pumping demand in an area that is not, at this time, provided with significant alternate surface water supplies (Reclamation, 2016).

Potential Effects of Undesirable Results

Compaction of subsurface materials can lead to land subsidence, which changes the ground surface and potentially impacts existing infrastructure and land use. Changes in land surface gradients due to land subsidence could impact the integrity of conveyance structures, which are typically gravity-driven. Subsidence could result in the need for higher dams or pumps to move surface water. Similarly, the capacity of flood conveyance systems can be reduced due to subsidence, resulting in a need for higher levees or other flood control infrastructure. As a result, negative impacts of land subsidence could include potential increases in the conveyance costs of irrigation water and in a decrease in ability to convey floodwater.

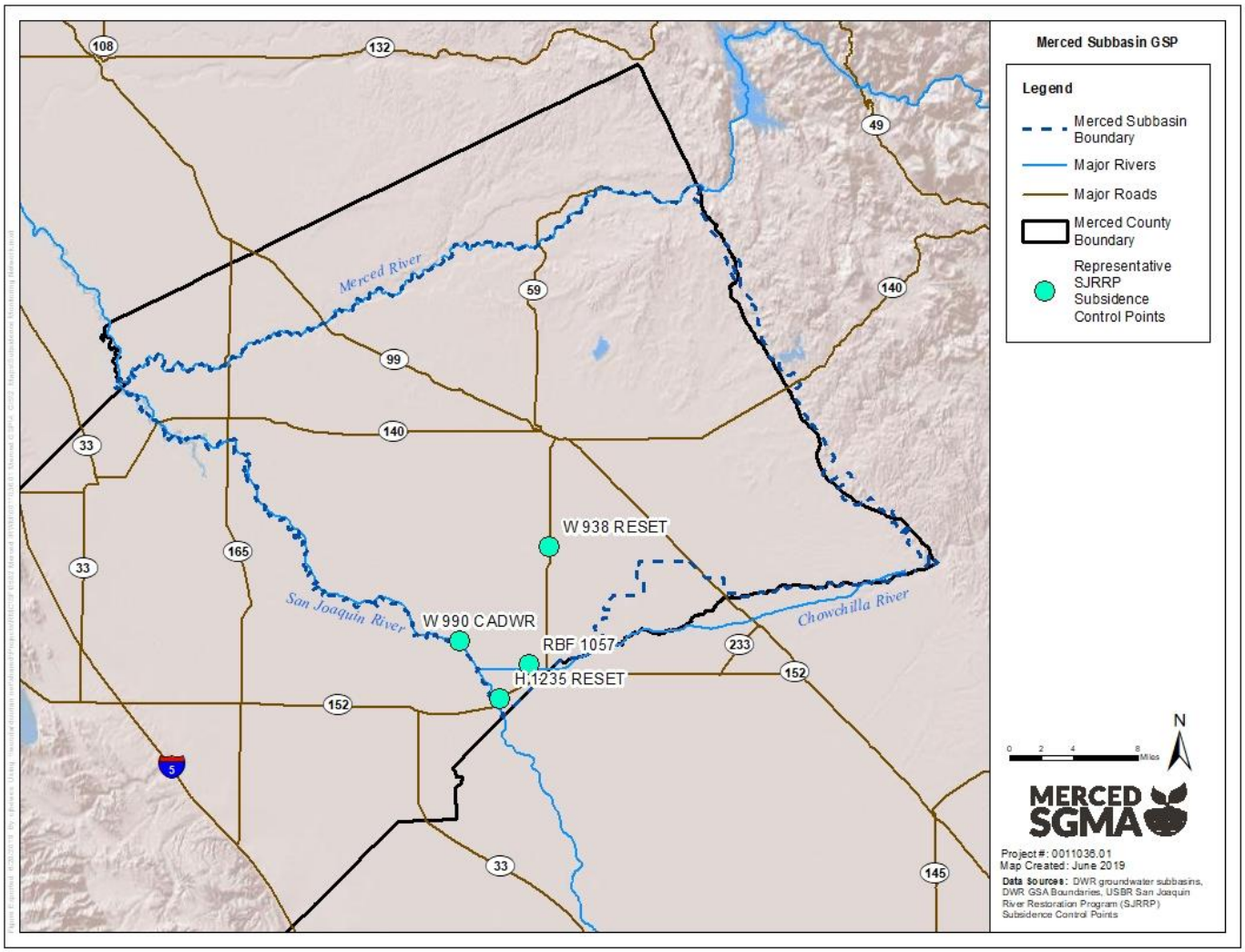
3.7.2 Minimum Threshold

The minimum threshold for land subsidence was selected to prevent undesirable results. While the sensitivity of local infrastructure to land subsidence is not well understood, the ability to convey water supplies and flood water, including the ability to maintain levees, are currently observed to be the most sensitive to land subsidence.

The minimum threshold is applied at four locations within the area of subsidence risk which are monitored for land subsidence by the US Bureau of Reclamation (USBR) on a semi-annual basis since 2011 as part of its San Joaquin River Restoration Program. These locations, and their maximum single year (December-to-December) subsidence rates recorded during USBR's monitoring period of 2011 to 2018, are listed below. A map of the locations is shown in Figure 3-5.

- W 990 CADWR: maximum recent subsidence of -0.65 ft/year (December 2014 – December 2015)
- RBF 1057: maximum recent subsidence of -0.67 ft/year (December 2012 – December 2013)
- H 1235 Reset: maximum recent subsidence of -0.61 ft/year (December 2012 – December 2013)
- W 938 Reset: maximum recent subsidence of -0.58 ft/year (December 2014 – December 2015)

Figure 3-5: Minimum Threshold Subsidence Locations



Within the Merced Subbasin, while subsidence has been recognized by the GSAs as an area of concern, it is not considered to have caused a significant and unreasonable reduction in the viability of the use of infrastructure. However, it is noted that subsidence has caused a reduction in freeboard of the Middle Eastside Bypass over the last

50 years and has caused problems in neighboring subbasins, highlighting the need for ongoing monitoring and management in the Merced Subbasin.

Despite wetter conditions, subsidence in the Merced Subbasin between December 2017 and December 2018 was approximately -0.17 ft/yr and -0.32 ft/year, depending on the location. Subsidence is a gradual process that takes time to develop and time to halt, particularly with thick, fine-grained sediments. Depending on the thickness and the hydraulic properties of a thick clay unit, inelastic compaction (and thus subsidence) can require decades or centuries to approach completion (Sneed, Brandt, & Solt, 2018) (Lees, Knight, & Smith, 2022). As a result, some level of future subsidence, potentially at rates similar to those currently experienced, is likely to be underway already and will not be able to be fully prevented, although recovery of groundwater levels may reduce the rate of subsidence.

Given the lack of historical undesirable results experienced in the Subbasin, combined with the expectation that some level of future subsidence is already underway due to continued compaction of historically dewatered subsurface materials, interim milestones are set to manage subsidence during GSP implementation. These interim milestones are described in the next section.

The land subsidence minimum threshold is set at a rate of 0 ft/year. However, compliance with this threshold will take into consideration the level of uncertainty in the measurements. The survey measurements have a vertical accuracy of +/-2.5 centimeters (Reclamation, 2011). With two measurements (before and after), the total uncertainty in the subsidence value is 5 centimeters, or approximately -0.16 ft/year. Subsidence of less than -0.16 ft/year (values that are less negative) are within the uncertainty of the measurement and would be considered compliant with the minimum threshold of 0 ft/year.

This minimum threshold is set recognizing the interconnectedness of the Merced Subbasin with surrounding subbasins, and the ability to meet this objective is dependent on the successful management of all nearby subbasins. This minimum threshold is also consistent with the sustainable management criteria for groundwater levels which seeks to keep levels above 2015 conditions. Keeping groundwater levels at or above 2015 conditions is consistent with limited or no subsidence. In addition to the minimum threshold, the Above Corcoran Sustainable Management Criteria Adjustment Consideration Management Action, described in Section 6.2.4, is developed to avoid declines in storage below historical levels. This further reduces the risk of subsidence.

This threshold may require modification in the future if residual subsidence continues to be seen approaching the 20-year GSP implementation period. Further, the minimum threshold subsidence rate may be reconsidered if additional information becomes available on the sensitivity of existing infrastructure on subsidence and for consistency with neighboring subbasins.

The Merced GSP will continue to coordinate efforts with surrounding subbasins to develop regional and local solutions to subsidence occurring in the Merced, Chowchilla, and Delta-Mendota Subbasins (described further in Section 4.9.7 - Plan to Fill Data Gaps, Subsidence Monitoring Network). The County of Merced is currently funding a project to study the potential impacts of moving pumping from below the Corcoran Clay to above the Corcoran Clay. This analysis is intended to facilitate relocating pumping to above the Corcoran Clay layer while meeting the requirements of Merced County's Groundwater Ordinance and is described further in the Projects and Management Actions section. The Projects and Management Actions section also discusses installation of monitoring stations to better characterize subsidence and the relationship of subsidence to groundwater pumping activities.

3.7.3 Measurable Objectives and Interim Milestones

The measurable objective for subsidence is based on the long-term avoidance of land subsidence: 0 ft/year, on a long-term average. This measurable objective is set recognizing the interconnectedness of the Merced Subbasin with

surrounding subbasins, and the ability to meet this objective is dependent on the successful management of all nearby subbasins.

Interim milestones are set in 5-year increments in recognition of the likely continuing compaction of aquifer materials from historical dewatering and to provide adequate time for the GSAs to address an issue that is technically complex, not well understood, and that has the potential to result in negative socioeconomic impacts depending on the ultimate solution. The interim milestones are defined as:

- 2025: -0.75 ft/year
- 2030: -0.5 ft/year
- 2035: -0.25 ft/year

The land subsidence interim milestone for 2025 was at a rate of -0.75 ft/year. This rate is slightly higher than actual subsidence rates experienced between 2011 and 2018. The subsequent interim milestones have reduced subsidence values as projects and management actions are implemented to address groundwater levels and subsidence. These interim milestones are set recognizing the interconnectedness of the Merced Subbasin with surrounding subbasins, and the ability to meet this objective is dependent on the successful management of all nearby subbasins.

3.8 DEPLETIONS OF INTERCONNECTED SURFACE WATER

Depletions of interconnected surface water are a reduction in flow or levels of surface water caused by groundwater use. This reduction in flow or levels, at certain magnitudes or timing, may have adverse impacts on beneficial uses of the surface water and may lead to undesirable results. Quantification of depletions is relatively challenging and requires significant data on both groundwater levels near streams and stage information supported by groundwater modeling.

3.8.1 Undesirable Results

Description of Undesirable Results

Undesirable results related to depletions of interconnected surface water are defined in SGMA as:

> *Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water. [CWC §10721(x)(6)]*

Undesirable results for depletions of interconnected surface water in the Merced Subbasin could include depletions that result in reductions in flow or levels of major rivers and streams that are hydrologically connected to the basin such that the reduced surface water flow or levels have a significant and unreasonable adverse impact on beneficial uses of the surface water within the Subbasin over the planning and implementation horizon of this GSP.

Major rivers and streams that potentially have a hydraulic connection to the groundwater system in certain reaches are the Merced and San Joaquin Rivers. Many of the smaller creeks and streams are used for conveyance of irrigation water and generally surface water depletions (of irrigation water) would not impact natural flows in these systems; thus, these systems have not been considered in the analysis of depletions. However, future GSP updates may include considerations of these systems in the analysis of depletions. Hydraulic connection may occasionally be associated with perched water tables which are discussed further in Section 2.1.3.5 (Groundwater Recharge and Discharge Areas) in the Hydrogeologic Conceptual Model.

Identification of Undesirable Results

As chronic lowering of groundwater levels is used as a proxy for depletions of interconnected surface water, the identification of undesirable results for the depletion of interconnected surface water sustainability indicator is

performed through the identification of undesirable results for the chronic lowering of groundwater levels sustainability indicator (see Section 3.3.1).

Potential Causes of Undesirable Results

As chronic lowering of groundwater levels is used as a proxy for depletions of interconnected surface water, the potential causes of undesirable results are the same as those for groundwater levels, e.g. groundwater pumping that lowers groundwater levels in areas where rivers and streams are hydrologically connected (see Section 3.3.1).

Potential Effects of Undesirable Results

If depletions of interconnected surface water were to reach levels causing undesirable results, effects could include reduced flow and stage within rivers and streams in the Subbasin to the extent that insufficient surface water would be available to support diversions for agricultural uses or to support regulatory environmental requirements. This could result in increased groundwater pumping, changes in irrigation practices and crops grown, and could cause adverse effects to property values and the regional economy. Reduced flows and stage, along with potential associated changes in water temperature, could also negatively impact aquatic species in the rivers and streams. Such impacts are tied to the inability to meet minimum flow requirements, which are defined for both the Merced River, and San Joaquin River, which, in turn, are managed through operations at New Exchequer Dam and other reservoirs.

Justification of Groundwater Levels as a Proxy

Because of the challenges associated with directly measuring streamflow depletions and because of the significant correlation between groundwater levels and depletions, this GSP uses groundwater levels as a proxy for the depletion of interconnected surface water sustainability indicator. Additionally, since the Merced Subbasin shares riverine borders with multiple other subbasins, additional complex inter-basin coordination will be involved in understanding and monitoring stream depletions directly. As such, the minimum thresholds for the interconnected surface water sustainability indicator are consistent with the minimum thresholds for the chronic lowering of groundwater levels sustainability indicator.

GSP regulations §354.36 allow GSAs to use groundwater levels as a proxy metric for any sustainability indicator, provided the GSP demonstrates that there is a significant correlation between groundwater levels and the other metrics. The following approach from DWR is used to justify the proxy metric:

- *Demonstrate that the minimum thresholds and measurable objectives for chronic declines of groundwater levels are sufficiently protective to ensure significant and unreasonable occurrences of other sustainability indicators will be prevented. In other words, demonstrate that setting a groundwater level minimum threshold satisfies the minimum threshold requirements for not only chronic lowering of groundwater levels but other sustainability indicators at a given site.* (DWR, 2017a)

To use the minimum thresholds for chronic lowering of groundwater levels as a proxy for depletions of interconnected surface water, the depletions that would occur when undesirable results for groundwater levels are reached must not be significant and unreasonable. In this way, the groundwater level minimum thresholds are sufficiently protective to ensure significant and unreasonable occurrences of depletions will be prevented. The analysis was performed by first considering historical depletions and then considering potential increases in depletions under conditions that are estimated to cause undesirable results for groundwater levels.

Historical depletions of interconnected surface water in the Subbasin are not considered significant and unreasonable. Therefore, the depletions in MercedWRM's historical simulation are assumed to have no associated undesirable results. If groundwater levels were to decline to the minimum threshold levels, a corresponding increase in surface water depletions would occur, above those seen historically.

Groundwater modeling results were analyzed to estimate the volume of depletions associated with groundwater levels that would constitute an undesirable result (wet, below normal, or above normal year pairings where 25% or more representative wells fall below the groundwater level minimum threshold). A hypothetical scenario was simulated to select groundwater levels that would constitute an undesirable result based on the groundwater level minimum threshold (described above in Section 3.3.2). To do this, the model simulated an 8% increase in evapotranspiration as compared to the existing conditions baseline. The additional stream losses (or decreased gains) that occurred under this scenario compared to the historical simulation are estimates of depletions, as they can be linked largely to simulated increases from existing groundwater pumping.

Model results estimate an additional 16,000 AFY of depletions on the Merced River, 10,000 AFY on the San Joaquin River, and 12,000 AFY on the combined system of canals and smaller streams. The additional depletions under this hypothetical scenario (38,000 AFY measured at the San Joaquin River) are about 1.6% of average annual surface water outflow from the Subbasin. A small percentage increase in stream depletions above historical depletion levels is not considered a significant and unreasonable amount of stream depletions. Depletions greater than this level would only occur under a condition which would create undesirable results for the groundwater level sustainability indicator. As a result, the groundwater level minimum threshold is expected to be protective against undesirable results for depletions of interconnected surface water.

The "combined system of canals and smaller streams" described above is primarily used for conveyance of irrigation water. There is an increased level of uncertainty in values calculated for this system due to many estimated model input values for certain unknown characteristics, such as bank material properties or streambed geometry. These input values are known with more certainty for the Merced River and San Joaquin River.

3.8.2 Minimum Thresholds and Measurable Objectives

As chronic lowering of groundwater levels is used as a proxy for depletions of interconnected surface water, the measurable objective and interim milestones for the depletion of interconnected surface water sustainability indicator are the measurable objective and interim milestones for the chronic lowering of groundwater levels sustainability indicator.

3.9 COORDINATION WITH ADJACENT BASINS

Adjacent subbasins are Turlock, Chowchilla, and Delta-Mendota.

A formal Memorandum of Understanding (MOU) has been finalized between the Merced and Chowchilla Subbasin GSAs (see Appendix G). Inter-subbasin modeling coordination with Chowchilla was performed to provide the basis for consistency in the way minimum thresholds are determined; however, future coordination must continue to confirm consistency. In addition, the technical approach for the sustainability analysis and its relationship to inter-basin coordination is intended to result in minimum thresholds that do not negatively impact adjacent basins.

A memorandum of intent to coordinate (MOI) has been finalized between each of the GSAs in the Turlock and Merced Subbasins (see Appendix H). The MOI outlines the intention to share data and coordinate GSPs in the Merced and Turlock Subbasins without adversely impacting the adjacent basin. The MOI also recognizes that the Turlock Subbasin is on a different timeline and will not have a GSP complete until 2022; thus, the GSAs intend to work together to develop and refine common knowledge and understanding over time.

Coordination meetings with Delta-Mendota continue and an MOU was also under development at the time of preparation of this document.

4 MONITORING NETWORKS

This section discusses the monitoring networks identified to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions that occur through implementation of the Plan. Monitoring networks are established for each sustainability indicator relevant to monitoring in the Merced Subbasin: groundwater levels, groundwater storage, groundwater quality, subsidence, and depletions of interconnected surface waters. While undesirable results related to groundwater storage are not present and are not likely to occur in the Subbasin, a monitoring network based on groundwater levels is still developed to support development of groundwater budgets, including an estimate of the change in annual groundwater in storage, and to support overall characterization of the Subbasin. Similarly, while groundwater levels are used as a proxy for the sustainable management criteria for depletions of interconnected surface water, a monitoring network is still developed to allow for continued characterization of the system. Of the six sustainability indicators under SGMA, only seawater intrusion is not covered by a monitoring network in this plan, as undesirable results related to seawater intrusion are not present and are not likely to occur in the Subbasin (see Section 3.5 - Seawater Intrusion).

This section includes the monitoring network objectives, the existing monitoring networks, the rationale for monitoring, details on representative monitoring, and a description of a monitoring network for each applicable sustainability indicator. Data gaps and a plan to fill them are provided for each monitoring network.

4.1 MONITORING NETWORK OBJECTIVES

The primary objective of these monitoring networks is to allow for evaluation of the effects and effectiveness of Plan implementation, including detection of undesirable results using the minimum thresholds described in Chapter 3 of this Groundwater Sustainability Plan (GSP). Other related objectives of the monitoring network as defined in the Sustainable Groundwater Management Act (SGMA) regulations include:

- Demonstrating progress toward achieving measurable objectives
- Monitoring impacts to the beneficial uses or users of groundwater
- Monitoring changes in groundwater conditions relative to measurable objectives and minimum thresholds
- Quantifying annual changes in water budget components

4.2 EXISTING SUBBASIN MONITORING

The monitoring networks described in this section were designed by first evaluating available data and existing monitoring in the Subbasin, to leverage the substantial historical and ongoing monitoring activities. Existing monitoring programs were previously described in Section 1.2.2 - Water Resources Monitoring and Management Programs.

4.3 MONITORING RATIONALES

The Merced Subbasin GSP monitoring networks were developed to meet the objectives described above. This will allow for the detection of changes in Subbasin conditions so the GSAs can adaptively manage the Subbasin to meet sustainability goals.

Monitoring networks were developed from existing wells, or other facilities, that were selected specifically to provide an adequate amount of temporal frequency and spatial density to detect short-term, seasonal, and long-term trends in groundwater conditions. This data is necessary to evaluate the effectiveness of projects and management actions undertaken by the GSAs.

Data gaps, where additional monitoring information is necessary, were also identified. Plans or projects to install additional monitoring sites to fill these data gaps are included as a management action or project in the Implementation Section of the GSP.

Additional details on the monitoring rationales are described within each monitoring network.

4.4 REPRESENTATIVE MONITORING

Representative monitoring sites are a subset of the Subbasin's total monitoring network specifically selected to represent groundwater conditions in the Subbasin and track sustainability. Minimum thresholds and measurable objectives are defined only at representative monitoring locations. Representative monitoring locations are selected by evidence that the site reflects typical conditions in the area, can provide monitoring data that are representative of that area, and has access suitable for long-term monitoring. By selecting specific monitoring locations that reflect the Subbasin's typical conditions and monitoring established parameters, the GSAs can monitor the sustainability indicators and collect targeted data.

Additional monitoring facilities are included in the monitoring network to characterize conditions at a more detailed level across the Subbasin and to verify that the representative monitoring locations continue to be representative of typical conditions. This information can be used to inform the 5-year GSP updates and can support other groundwater management needs, such updates and refinements to the groundwater model. Note that, in some cases, these monitoring facilities are not designated as representative because they do not meet minimum criteria, such as known construction information or adequate historical data to develop minimum thresholds and measurable objectives.

Should additional monitoring sites be added to a particular monitoring network in the future, each may be evaluated against the criteria or methodology used to develop existing minimum thresholds to determine if the additional site is applicable as a representative monitoring site in addition to providing value to the monitoring network as a whole.

4.5 GROUNDWATER LEVEL MONITORING NETWORK

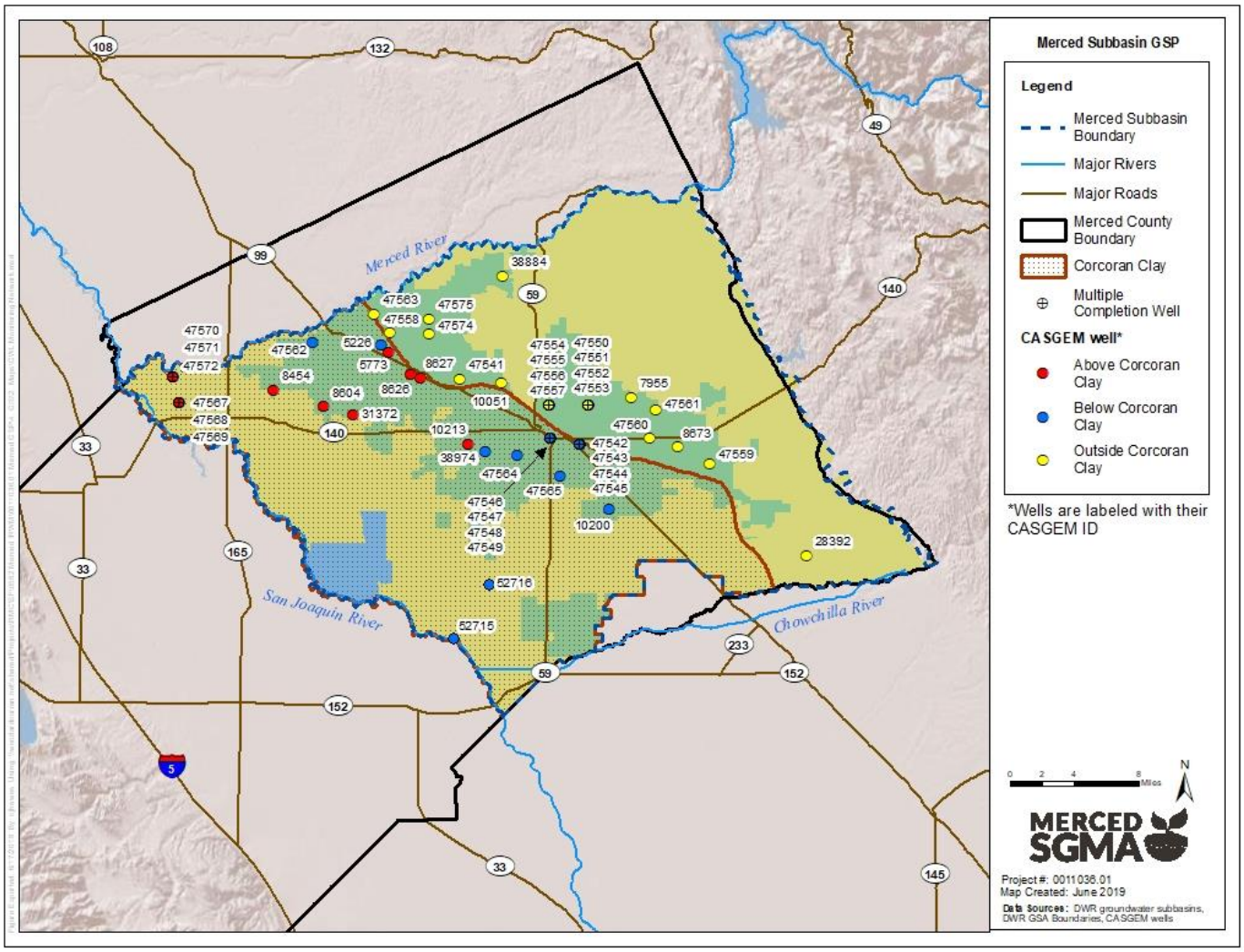
Groundwater level monitoring is conducted through a groundwater well monitoring network. The network allows for demonstration of groundwater occurrence, general flow directions, and hydraulic gradients between the principal aquifers and surface water features. Further, the network allows for characterization of the groundwater table or potentiometric surface of each of the three principal aquifers.

4.5.1 Monitoring Wells Selected for Monitoring Network

Wells for the monitoring network were selected as the entirety of the existing California Statewide Groundwater Elevation Monitoring (CASGEM) network within the Subbasin. CASGEM was established by the State of California and implemented locally to develop a permanent, locally-managed program of regular and systematic monitoring in all of California's alluvial groundwater basins. With regards to groundwater level monitoring, CASGEM has many similarities with the requirements of SGMA. While there are gaps in the overall coverage for the CASGEM network, it is appropriate for the existing monitoring network in the Merced Subbasin to be the nucleus of a comprehensive network for this GSP.

The Merced Subbasin GSP groundwater level monitoring network totals 50 wells from the CASGEM program. This includes 13 wells in the Above Corcoran Clay Principal Aquifer, 16 wells in the Below Corcoran, and 21 wells in the Outside Corcoran. 22 out of 50 CASGEM wells are grouped into six sets of multiple completion wells. Figure 4-1 shows the well locations.

Figure 4-1: Merced Subbasin GSP Groundwater Level Monitoring Network Wells



4.5.2 Monitoring Frequency

The monitoring frequency is selected to allow the monitoring network to adequately interpret short and long-term groundwater level trends and conditions. These fluctuations may be the result of seasonality, pumping, or climatic variations such as storm events and drought. According to SGMA regulations, monitoring frequency must occur, at a minimum, at the Subbasin's seasonal high and low. In the Merced Subbasin these seasonal peaks generally occur during March and October.

DWR's *Monitoring Networks and Identification of Data Gaps BMP* provides non-regulatory guidance for monitoring frequency based on based on aquifer properties and degree of use, as shown in Table 4-1.

Table 4-1: Summary of DWR Guidance on Monitoring Frequency

Aquifer Type	Nearby Long-Term Aquifer Withdrawals		
	Small Withdrawals	*Moderate Withdrawals*	*Large Withdrawals*
Unconfined Aquifer			
"low" recharge (<5 inches/year)	Quarterly	Quarterly	Monthly
"high" recharge (>5 inches/year)	Quarterly	Monthly	Daily
Confined Aquifer			
"low" hydraulic conductivity (<200 feet/day)	Quarterly	Quarterly	Monthly
"high" hydraulic conductivity (>200 feet/day)	Quarterly	Monthly	Daily

Source: (DWR, 2016c)

According to Table 4-1, the three Merced Subbasin Principal Aquifers fall under two categories:

- **Above Corcoran Clay Principal Aquifer:** unconfined, low recharge where unirrigated, high recharge where irrigated, moderate to large withdrawals.
- **Below Corcoran Clay Principal Aquifer**: confined, low hydraulic conductivity, moderate to large withdrawals.
- **Outside Corcoran Clay Principal Aquifer**: unconfined, low recharge where unirrigated, high recharge where irrigated, moderate to large withdrawals.

While existing CASGEM monitoring currently records groundwater levels biannually at the seasonal peaks (typically March and October) as well as December, DWR's best management practice (BMP) suggests all three principal aquifers should be monitored at least quarterly, potentially monthly, and daily in some situations.

Monitoring will occur on or near the second week of each month for all CASGEM wells, with re-assessment of the frequency at the 5-year update, or sooner, if needed. At that time, the frequency may be changed, particularly if quarterly sampling can be shown to adequately capture the variability or if irrigation-season measurements are shown to be too impacted by nearby groundwater pumping to be useful.

4.5.3 Spatial Density

A sufficient density of monitoring wells is necessary to characterize the groundwater table or potentiometric surface for each principal aquifer. DWR's *Monitoring Networks and Identification of Data Gaps BMP* (DWR, 2016b) provides multiple sources to guide monitoring network well density, as shown in Table 4-2.

Table 4-2: Monitoring Well Density Considerations

Reference	Monitoring Well Density (wells per 100 miles^2)
Heath (1976)	0.2-10
Sophocleous (1983)	6.3
Hopkins (1994)	
Basins pumping more than 10,000 AFY per 100 square miles	4.0
Basins pumping between 1,000 and 10,000 AFY per 100 square miles	2.0
Basins pumping between 250 and 1,000 AFY per 100 square miles	1.0
Basins pumping between 100 and 250 AFY per 100 square miles	0.7

Source: (DWR, 2016b)

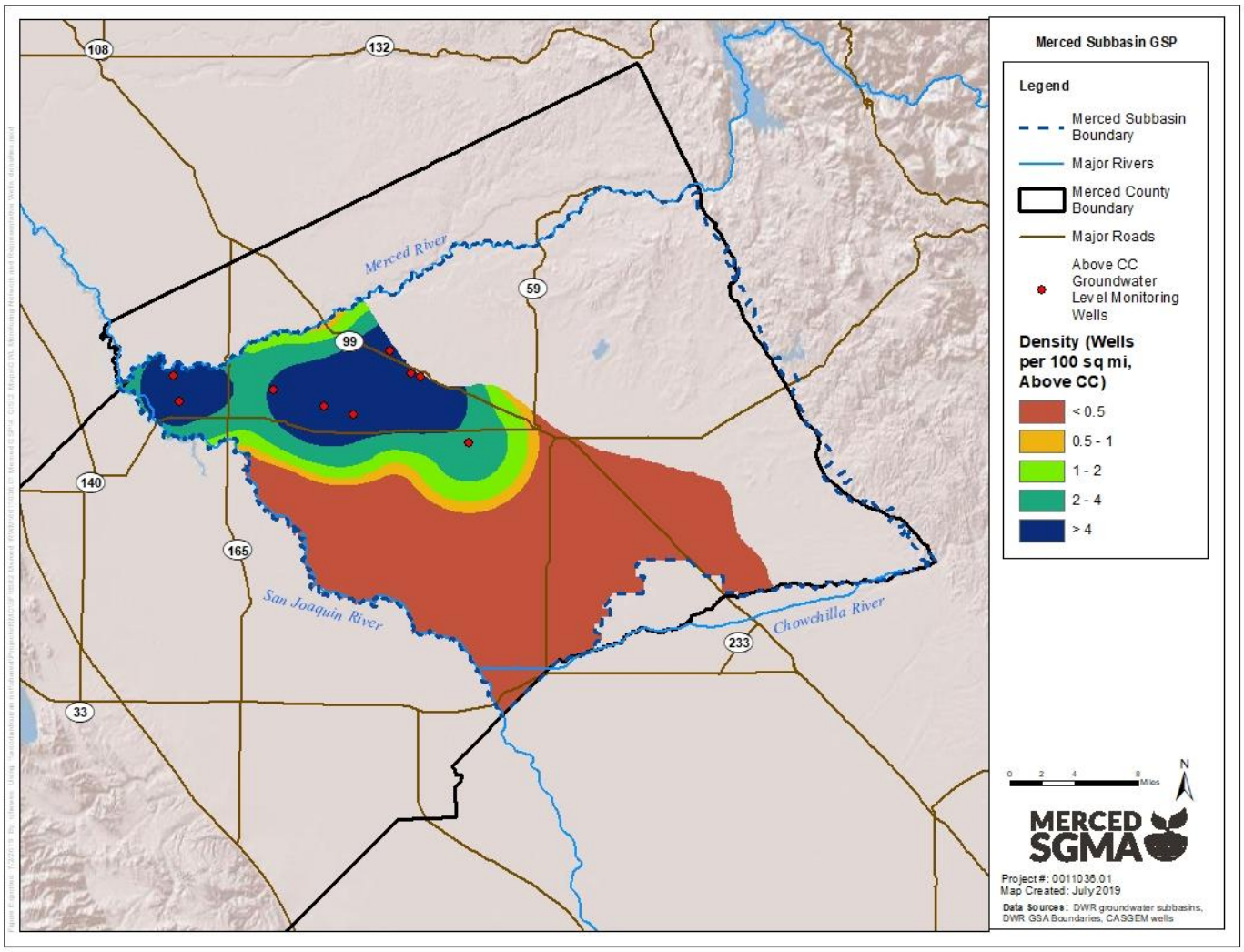
According to the Historical Conditions Water Budget (WYs 2006-2015), the Subbasin pumps approximately 723,000 AF annually. The Subbasin has an area of 801 square miles of area which leads to approximately 90,000 AF pumped per 100 square miles. Based on Hopkins (1994) well density estimate guidelines, the Subbasin should have 4 monitoring wells per 100 square miles. Based on Sophocleous (1983) well density estimate guidelines, the Subbasin should have 6.3 monitoring wells per 100 square miles. Based on Heath (1976), the Subbasin should have between 0.2 and 10 monitoring wells per 100 square miles.

The well density is within the ranges presented in DWR's guidance. Table 4-3 shows the density of wells by principal aquifer, with three following figures showing the variability in well density across the Subbasin: Figure 4-2 for the Above Corcoran Clay Principal Aquifer, Figure 4-3 for the Below Corcoran Clay Principal Aquifer and Figure 4-4 for the Outside Corcoran Clay Principal Aquifer. The density of wells in the Above Corcoran Clay Principal Aquifer (2.1 wells/100 mi^2) and Below Corcoran Clay (2.3 wells/100 mi^2) are roughly half of the density of wells in the Outside Corcoran Clay (4.1 wells/100 mi^2). These densities are lower than those recommended by Sophocleous (1983) and Hopkins (1994) but are within the ranges of Heath (1976) and are considered sufficient to characterize conditions in most of the Subbasin. Spatial data gaps are acknowledged and described further in Section 4.5.6.

Table 4-3: Density of Groundwater Level Monitoring Wells by Principal Aquifer

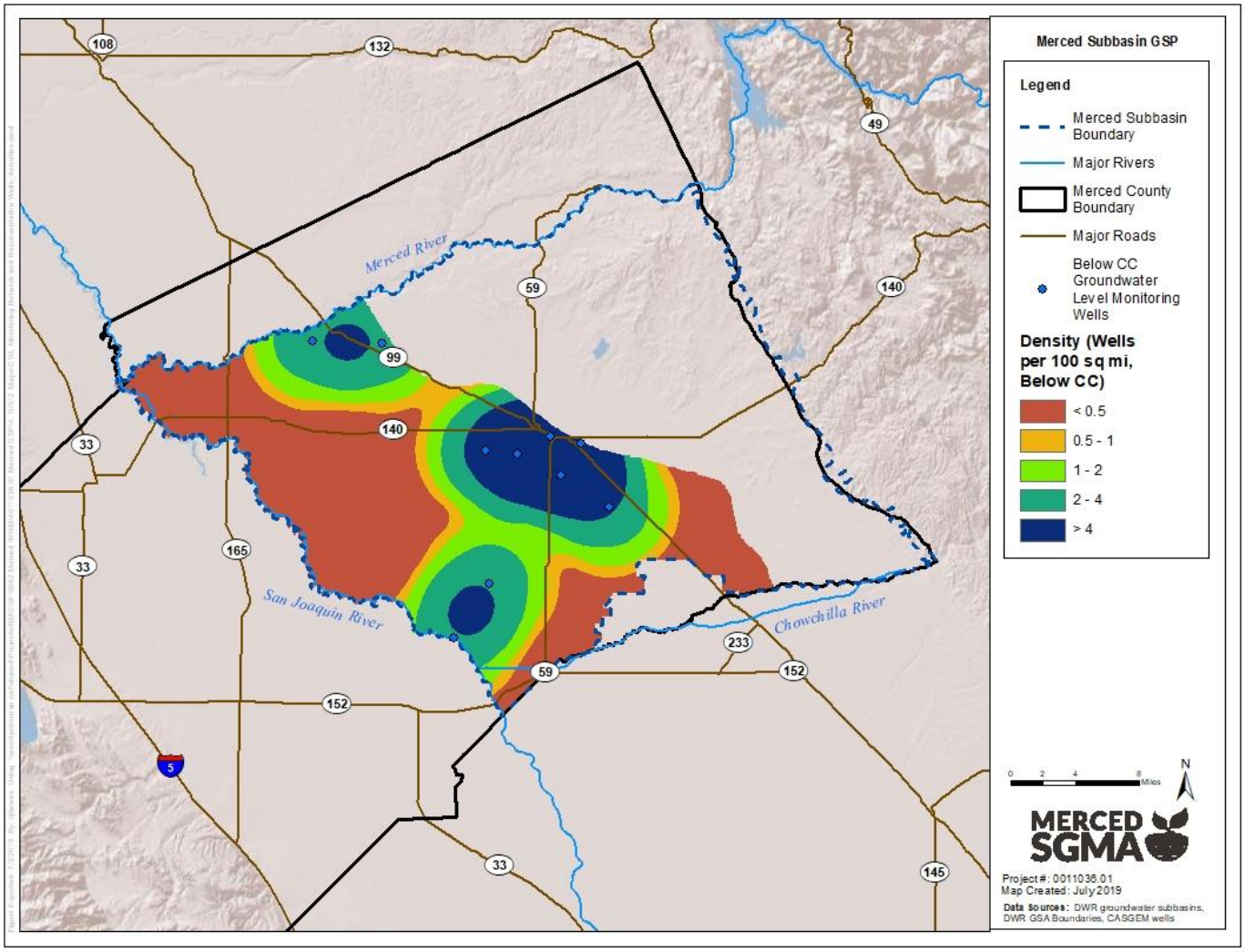
	Principal Aquifer			Total
	Above Corcoran Clay (Figure 4-2)	Below Corcoran Clay (Figure 4-3)	Outside Corcoran Clay (Figure 4-4)	
Total Number of Unique Well IDs	13	16	21	50
Subset of Total That Are Multiple Completion Wells	6	8	8	22
Total Number of Geographically Unique Well Locations	9	10	15	34
Area of Principal Aquifer (mi^2)	437	437	364	801
Density (number of wells per 100 mi^2)	2.1	2.3	4.1	4.2

Figure 4-2: Density of Groundwater Level Monitoring Network – Above Corcoran Clay Principal Aquifer



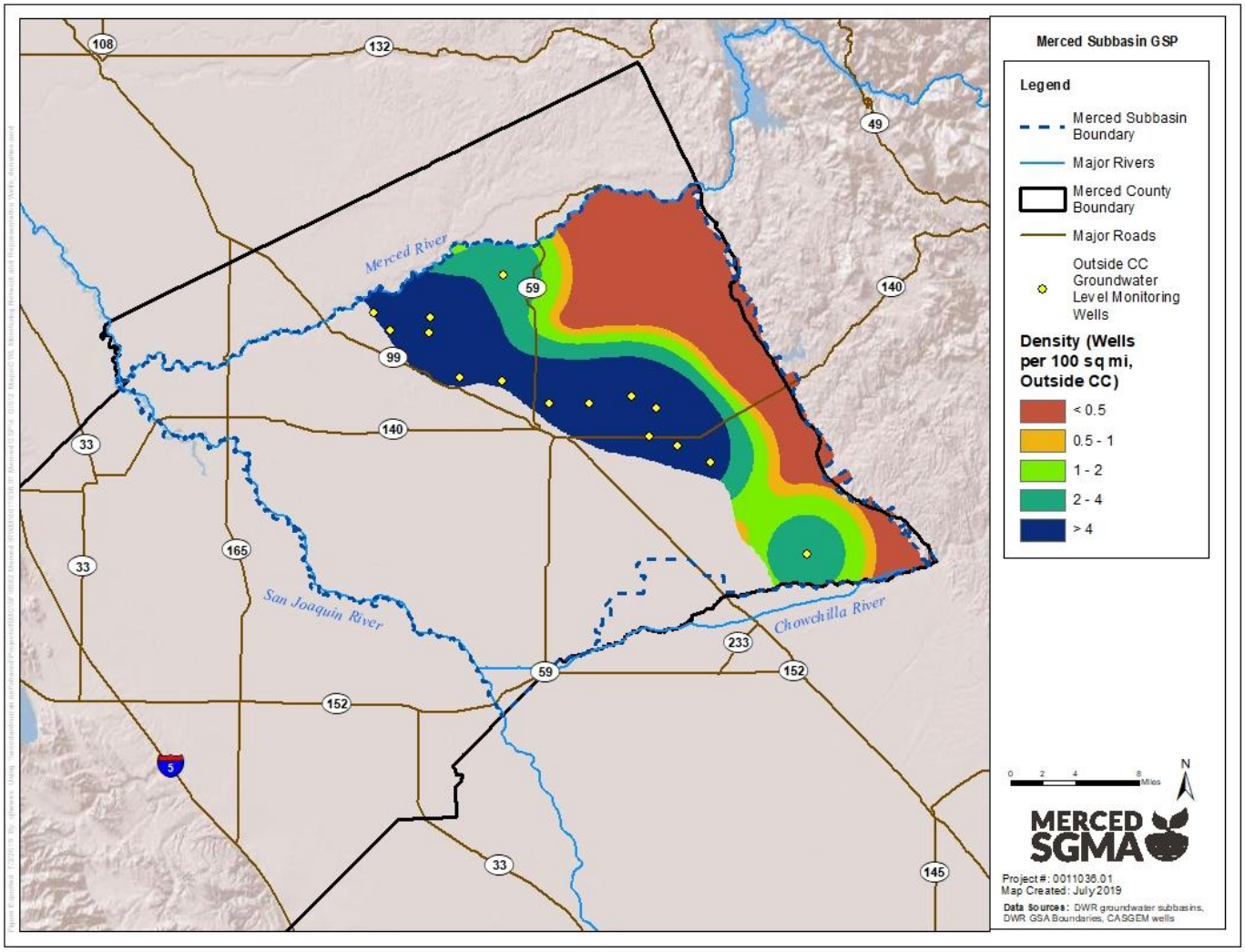
Note – voluntary wells without construction information (e.g., not sorted into a Principal Aquifer) are not shown.

Figure 4-3: Density of Groundwater Level Monitoring Network – Below Corcoran Clay Principal Aquifer



Note – voluntary wells without construction information (e.g., not sorted into a Principal Aquifer) are not shown.

Figure 4-4: Density of Groundwater Level Monitoring Network – Outside Corcoran Clay Principal Aquifer



4.5.4 Representative Monitoring

The Merced Subbasin GSP groundwater levels monitoring network totals 50 wells, 21 of which are designated as representative wells. Representative monitoring wells were selected specifically in conjunction with the minimum threshold selection methodology described in Section 3.3.2. Wells included are CASGEM wells that are screened within the portion of the principal aquifer typically accessed for groundwater production and that are reflective of typical aquifer conditions, based on information from the Merced Water Resources Model (MercedWRM).

Figure 4-5 shows the locations of the groundwater level monitoring network monitoring and representative wells.

Table 4-4 details the groundwater level monitoring network monitoring and representative wells, with Table 4-5 showing locations in a tabular format. Representative wells are identified with an asterisk (*) next to their State Well Number.

Figure 4-5: Merced Subbasin GSP Groundwater Level Monitoring Network Monitoring and Representative Wells

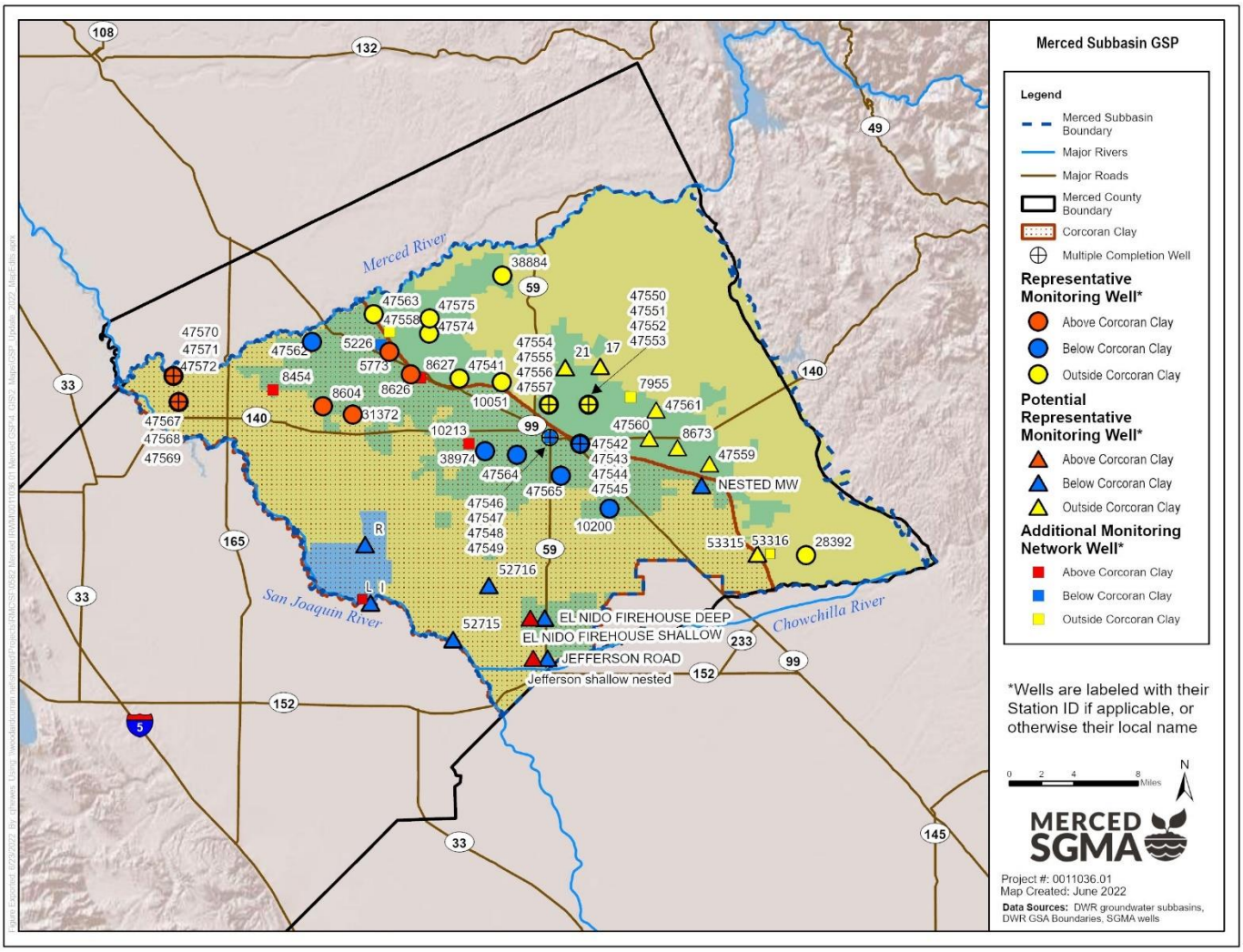


Table 4-4: Merced Subbasin GSP Groundwater Level Monitoring Network Well Details

State Well Number	CASGEM ID	Principal Aquifer	Well Depth (ft bgs)	Top of Screen Interval (ft bgs)	Bottom of Screen Interval (ft bgs)	First Measure-ment Date	Last Measure-ment Date	Measure-ment Period (Years)	Measure-ment Count[1]
06S11E27F001M*	47562	Below	127	108	127	10/16/2014	10/5/2018	4	16
06S12E17M001M*	47563	Outside	202	192	202	10/3/2011	3/9/2018	6	20
06S12E21M001M	47558	Outside	140	58	84	10/3/2011	3/21/2016	4	2
06S12E23C001M*	47575	Outside	930	660	680	12/28/2011	10/17/2018	7	18
06S12E23P001M*	47574	Outside	368	220	270	12/28/2011	10/17/2018	7	18
06S12E29L002M	5226	Below	237	56	115	11/1/1974	3/1/2012	37	36
06S12E33D001M*	5773	Above	111	66	111	11/1/1974	10/8/2018	44	108
06S13E04H001M*	38884	Outside	574	-	-	11/1/1974	10/1/2018	44	37
07S10E06K002M*	47571	Above	53	38	48	11/15/2011	10/15/2018	7	16
07S10E06K003M	47572	Above	155	140	150	10/15/2011	10/15/2018	7	16
07S10E11A001M	47570	Above	22	12	22	10/15/2011	10/15/2018	7	16
07S10E17D001M	47567	Above	30	20	30	10/15/2011	10/15/2018	7	16
07S10E17D002M	47568	Above	50	40	50	10/15/2011	10/15/2018	7	16
07S10E17D003M*	47569	Above	85	70	80	10/15/2011	10/15/2018	7	16
07S11E07H001M	8454	Above	232	40	57	11/1/1974	12/1/2013	39	36
07S11E15H001M*	8604	Above	105	90	105	11/1/1974	10/3/2018	44	63
07S11E24A001M*	31372	Above	87	1	60	11/1/1974	10/3/2018	44	54
07S12E03F001M*	8626	Above	183	62	95	11/1/1974	10/8/2018	44	66
07S12E03J001M	8627	Above	100	1	100	3/1/2011	3/18/2016	5	0
07S12E07C001M*	47541	Outside	450	425	440	10/1/2014	3/15/2018	3	13
07S13E09A001M*	10051	Outside	139	128	136	11/1/1974	10/1/2018	44	58
07S13E13H001M	47554	Outside	184	88	184	2/15/2012	10/26/2018	7	20
07S13E13H002M	47555	Outside	340	194	340	2/15/2012	10/26/2018	7	20
07S13E13H003M	47556	Outside	424	350	424	2/15/2012	10/26/2018	7	20
07S13E13H004M*	47557	Outside	580	434	580	2/15/2012	10/26/2018	7	20
07S13E30R002M	10213	Above	150	30	60	11/1/1974	12/1/2013	39	47
07S13E32H001M*	38974	Below	412	132	137	11/1/1974	10/1/2018	44	50
07S13E34G001M*	47564	Below	394	230	394	10/3/2011	10/2/2018	7	22

State Well Number	CASGEM ID	Principal Aquifer	Well Depth (ft bgs)	Top of Screen Interval (ft bgs)	Bottom of Screen Interval (ft bgs)	First Measure-ment Date	Last Measure-ment Date	Measure-ment Period (Years)	Measure-ment Count[1]
07S14E12N001M	7955	Outside	341	196	341	11/1/1974	3/8/2018	43	69
07S14E16F001M	47550	Outside	235	180	235	2/15/2012	10/26/2018	7	20
07S14E16F002M	47551	Outside	385	330	385	2/15/2012	10/26/2018	7	20
07S14E16F003M	47552	Outside	505	400	505	2/15/2012	10/26/2018	7	20
07S14E16F004M*	47553	Outside	605	550	605	2/15/2012	10/26/2018	7	20
07S14E30R001M	47546	Below	110	60	110	2/15/2012	10/30/2018	7	20
07S14E30R002M	47547	Below	160	120	160	2/15/2012	10/30/2018	7	20
07S14E30R003M	47548	Below	245	175	245	2/15/2012	10/30/2018	7	20
07S14E30R004M	47549	Below	600	460	600	2/15/2012	10/30/2018	7	20
07S14E35E001M*	47542	Below	170	89	170	2/15/2012	10/26/2018	7	20
07S14E35E002M	47543	Below	260	190	260	5/15/2012	10/26/2018	6	20
07S14E35E003M	47544	Below	500	300	500	2/15/2012	10/23/2018	7	20
07S14E35E004M	47545	Below	690	520	690	2/15/2012	10/26/2018	7	20
07S15E15N001M	47559	Outside	510	165	343	10/20/2014	10/15/2018	4	10
07S15E18G001M	47561	Outside	550	84	550	10/3/2011	12/1/2013	2	6
07S15E30D001M	47560	Outside	642	80	188	10/3/2011	10/3/2018	7	21
07S15E32A001M	8673	Outside	650	52	76	1/2/1958	10/1/2018	61	80
08S14E06G001M*	47565	Below	225	148	225	10/3/2011	10/4/2018	7	17
08S14E15R002M*	10200	Below	265	230	240	11/1/1974	10/2/2018	44	65
08S16E34J001M*	28392	Outside	639	50	639	12/11/1961	3/15/2018	56	83
-	52715	Below	812	770	806	10/23/2018	10/23/2018	0	1
-	52716	Below	500	360	480	10/24/2018	10/24/2018	0	1

1. Count of measurements excludes any measurements with a data quality flag.
* indicates representative monitoring well
ft bgs: feet below ground surface

Table 4-5: Merced Subbasin GSP Groundwater Level Monitoring Network Locations

State Well Number	CASGEM ID	Latitude	Longitude
06S11E27F001M*	47562	37.38207	-120.75511
06S12E17M001M*	47563	37.40737	-120.68591
06S12E21M001M	47558	37.39134	-120.66778
06S12E23C001M*	47575	37.40341	-120.62281
06S12E23P001M*	47574	37.38973	-120.62316
06S12E29L002M	5226	37.37970	-120.67740
06S12E33D001M*	5773	37.37326	-120.66816
06S13E04H001M*	38884	37.44218	-120.54066
07S10E06K002M*	47571	37.35102	-120.91133
07S10E06K003M	47572	37.35103	-120.91128
07S10E11A001M	47570	37.35101	-120.91138
07S10E17D001M	47567	37.32781	-120.90538
07S10E17D002M	47568	37.32772	-120.90538
07S10E17D003M*	47569	37.32776	-120.90538
07S11E07H001M	8454	37.33880	-120.79882
07S11E15H001M*	8604	37.32412	-120.74238
07S11E24A001M*	31372	37.31670	-120.70898
07S12E03F001M*	8626	37.35311	-120.64383
07S12E03J001M	8627	37.35001	-120.63260
07S12E07C001M*	47541	37.34955	-120.58897
07S13E09A001M*	10051	37.34607	-120.54089
07S13E13H001M	47554	37.32603	-120.48801
07S13E13H002M	47555	37.32603	-120.48801
07S13E13H003M	47556	37.32603	-120.48801
07S13E13H004M*	47557	37.32603	-120.48801
07S13E30R002M	10213	37.29077	-120.57812
07S13E32H001M*	38974	37.28390	-120.56008
07S13E34G001M*	47564	37.28060	-120.52411
07S14E12N001M	7955	37.33278	-120.39575
07S14E16F001M	47550	37.32603	-120.44316
07S14E16F002M	47551	37.32603	-120.44316
07S14E16F003M	47552	37.32603	-120.44316
07S14E16F004M*	47553	37.32603	-120.44316
07S14E30R001M	47546	37.29639	-120.48671
07S14E30R002M	47547	37.29639	-120.48671
07S14E30R003M	47548	37.29639	-120.48671
07S14E30R004M	47549	37.29639	-120.48671
07S14E35E001M*	47542	37.29038	-120.45288
07S14E35E002M	47543	37.29038	-120.45288
07S14E35E003M	47544	37.29038	-120.45288
07S14E35E004M	47545	37.29038	-120.45288
07S15E15N001M	47559	37.27332	-120.30705
07S15E18G001M	47561	37.32199	-120.36716
07S15E30D001M	47560	37.29644	-120.37487
07S15E32A001M	8673	37.28800	-120.34320
08S14E06G001M*	47565	37.26173	-120.47461
08S14E15R002M*	10200	37.23238	-120.42003
08S16E34J001M*	28392	37.19020	-120.19850
-	52715	37.11533	-120.59578
-	52716	37.16396	-120.55557

* indicates representative monitoring well

4.5.5 Groundwater Level Monitoring Protocols

Groundwater monitoring protocols are essential to producing quality data measurements and protecting the water quality of monitoring wells. Existing protocol resources include DWR's *Groundwater Elevation Monitoring Guidelines* (DWR, 2010) and United States Geological Survey's (USGS's) *National Field Manual* (Wilde, 2015). Protocols are established to improve consistency in data and ensure comparable methodologies.

Typical groundwater level measurement equipment used by agencies include electric sounders, data loggers, steel tapes, and air gauges. Regardless of the instrumentation used in the field, each groundwater level data measurement must include: well identification number, measurement date, reference point and land surface elevation, depth to water, method of measuring water depth, and measurement quality codes.

DWR released a BMP for monitoring protocols in the Best Management Practices for the Sustainable Management of Groundwater - Monitoring Protocols, Standards, and Sites, included as Appendix I. The monitoring protocols described in DWR's BMP recommend that groundwater level measurements are taken in a manner to ensure data are:

- Taken from the correct location, well ID, and screen interval depth
- Accurate and reproducible
- Representative of conditions that inform appropriate basin management data quality objectives
- Recorded with all salient information to correct, if necessary, and compare data
- Handled in a way that ensures data integrity.
- Taken using a CASGEM-approved water-level measurement methods to ensure consistency across measurements. Methods include:
    - Establishing a reference point
    - Using one of four approved methods (steel tape, electric sounding tape, sonic water-level meter, or pressure transducer) to measure groundwater levels

Additionally. if monitoring wells are also production wells, monitoring should occur after at least 48 hours of no extraction activities.

Existing wells, monitored under the CASGEM program, already use these procedures in the collection of groundwater level data. The protocols included in Appendix I will also be used for monitoring under this GSP.

4.5.6 Data Gaps

Data gaps can be the result of poor spatial (horizontal and/or vertical) distribution of the monitoring wells or a lack of well construction information needed for accurate monitoring data collection.

DWR has identified the data gap areas described below and identified in Figure 4-6 as part of the CASGEM program compliance (Merced Area Groundwater Pool Interests (MAGPI), 2014).

1. **Data Gap #1:** Located northwest of Merced and northeast of Atwater, this area contains relatively fewer existing wells, which often have limited construction information, and the wells are generally privately owned and require coordination with well owners to obtain permission and data.
2. **Data Gap #2:** Located along the western edge of the Subbasin, this area has virtually no known wells; overall well coverage needs to be enhanced through outreach to well owners to identify wells that can be used for monitoring purposes.

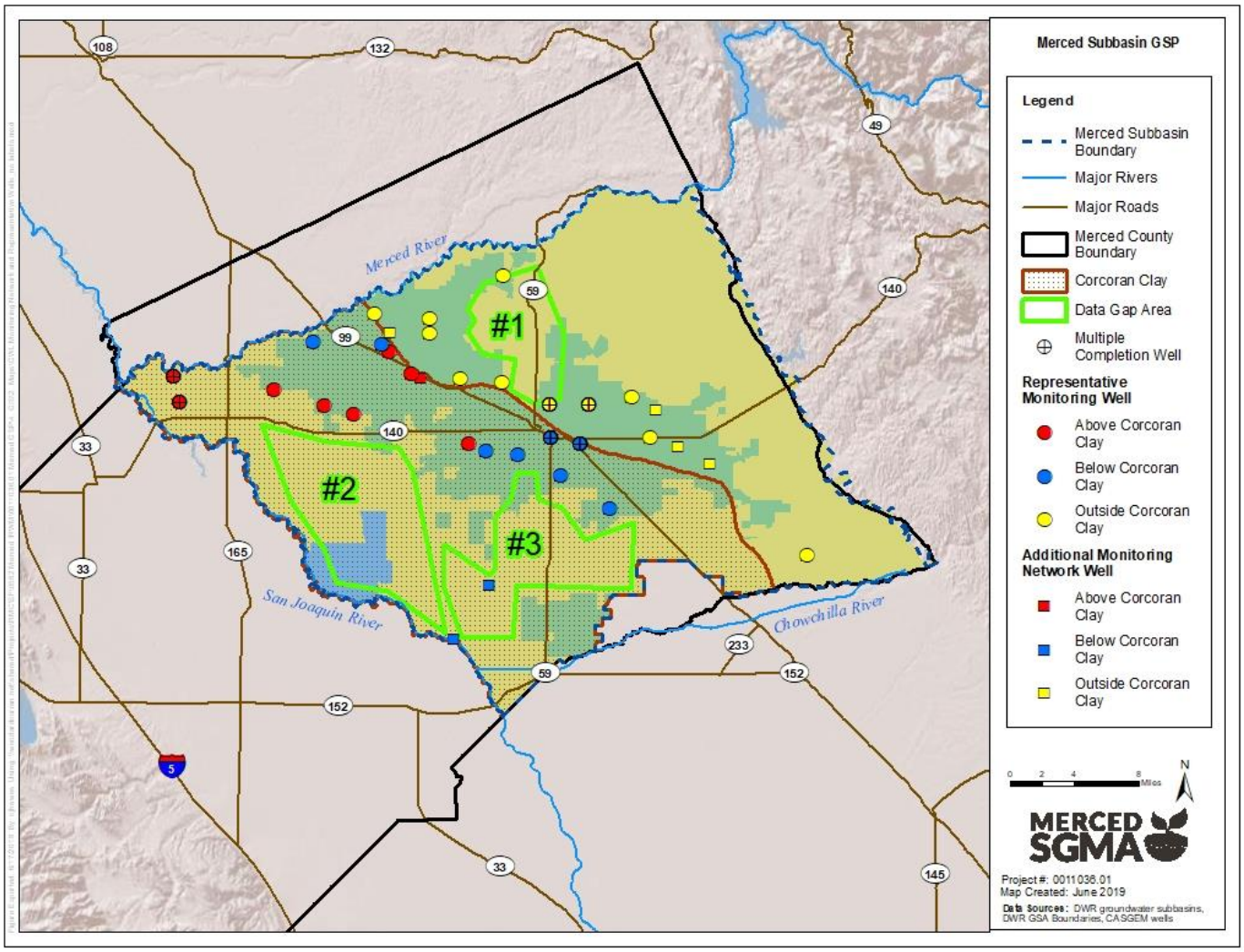
3. **Data Gap #3:** Located along the southern portion of the Subbasin just east of Data Gap #2, there are known potential wells to monitor but acquiring data from these wells is associated with technical or funding issues. These wells are primarily located within a federal wildlife refuge.

Overall, there is a data gap of monitoring wells for groundwater levels along the western edge of the Subbasin (see spatial density maps in Figure 4-2 and Figure 4-3). In addition to providing valuable groundwater elevation data, wells along this area would help improve the understanding of subsurface groundwater flow between adjacent subbasins, depletions of interconnected surface waters, subsidence, and connection between principal aquifers.

Note that data gaps associated with depth-discrete groundwater elevation data near rivers, streams, and Natural Communities Commonly Associated with Groundwater (NCCAGs) are discussed in Section 4.10.6.

Finally, many representative monitoring wells have limited data, and many of these also show high levels of variability that make analysis difficult. Sustainable Management Criteria have been set using that best available data, including in some cases additional information from the MercedWRM groundwater model. In several cases, there may be influences of nearby production wells that would need to be considered when setting and monitoring for sustainable management criteria; influences that are difficult to discern from the limited data. Wells that exhibit groundwater levels that are highly variable or difficult to explain will be a focus for the installation of pressure transducers to better understand the variability, to the extent feasible. One such well is 47541. Installations may be temporary or permanent. Sustainable management criteria may be modified based on future data collection and analysis.

Figure 4-6: Merced Subbasin GSP Groundwater Level Monitoring Network Data Gaps



4.5.7 Plan to Fill Data Gaps

The GSAs are currently evaluating opportunities to address the data gaps. Initial progress has been made to site one well within Data Gap #3 and another between Data Gaps #2 and #3. Additionally, two monitoring wells are nearing the completion of permitting and planning and will be constructed soon in the El Nido area, adjacent to Data Gap #3. The GSAs are evaluating other existing wells for additional construction information (where missing) and/or permission for access to wells to collect data. Additionally, the GSAs are seeking funding to construct additional monitoring wells, which are preferred to active wells due to shorter screened intervals and lack of groundwater production to interfere with measurements.

The GSAs will strive towards the following initial priority enhancements of the groundwater level monitoring network:

- Add representative wells in the Above and Below Corcoran Principal Aquifers in the southwesterly portion of the Subbasin.

- Except for two wells in the Stevinson area, there are no monitoring wells within the current monitoring network located in the northwest area of the Subbasin along the basin boundary. Integrating new wells in these areas will be crucial in obtaining fair and a meaningful basin management given the likely changes in subsurface groundwater flow between adjacent subbasins and their impact on sustainability.

The GSAs will introduce a comprehensive plan for filling gaps two years from the time the GSP is approved by DWR, based on the data gaps discussed above. The plan will prioritize areas for priority implementation and identify a timeline for filling gaps.

4.6 GROUNDWATER STORAGE MONITORING NETWORK

While undesirable results related to groundwater storage are not present and are not likely to occur in the Subbasin, a monitoring network is developed to support development of groundwater budgets, including an estimate of the change in annual groundwater in storage, and to support overall characterization of the Subbasin. The monitoring network is the same as that developed for groundwater levels, as groundwater storage is a function of groundwater levels and aquifer properties.

4.7 SEAWATER INTRUSION MONITORING NETWORK

The Merced Subbasin is geographically and geologically isolated from the Pacific Ocean and any other large source of seawater. Thus, the Subbasin is not at risk for seawater intrusion and does not require an associated monitoring network.

4.8 GROUNDWATER QUALITY MONITORING NETWORK

Groundwater quality monitoring is conducted through a groundwater well monitoring network. While the sustainable management criteria established in Section 3.6 (Degraded Water Quality) focuses on salinity (by total dissolved solids [TDS]), the water quality monitoring network is established for a broader spectrum of constituents to characterize water quality conditions throughout the basin, regardless of relevance to management under this GSP. This broader focus allows for documentation of issues which could then be resolved through the appropriate program, such as this GSP, Irrigated Lands Regulatory Program (ILRP), Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS), Regional Water Quality Control Board (RWQCB), or others (see Section 1.2.2.2 - Groundwater Quality Monitoring). Within that broad focus is monitoring for salinity (by TDS) to determine trends and provide representative information about groundwater conditions as necessary to evaluate GSP implementation.

4.8.1 Monitoring Wells Selected for Monitoring Network

The Merced Subbasin GSP groundwater quality monitoring network totals 287 wells, with 8 wells from the East San Joaquin Water Quality Coalition (ESJWQC) Groundwater Quality Trend Monitoring (GQTM) program and 279 wells sourced from Public Water System (PWS) wells that report data to the State Water Resources Control Board (SWRCB), Division of Drinking Water (DDW).

Groundwater quality monitoring network wells are opportunistically selected, in that they both meet the needs of GSP monitoring for the Subbasin and are being actively monitored for other purposes. The selected wells (e.g., wells from which data are collected in the future for reporting) are not necessarily the specific wells listed in the following subsections, but rather the wells that continue to be monitored under the ESJWQC and DDW programs. Thus, monitoring would not continue if wells were removed from the ESJWQC program or if wells were not sampled for DDW compliance. Additionally, wells added to the ESJWQC program or wells newly sampled for DDW compliance would be added to the monitoring network.

Each group is described in the subsection below.

4.8.1.1 ESJWQC GQTM Principal Wells

ESJWQC was formed in response to the adoption of the ILRP by the Central Valley RWQCB in 2003. The ILRP was initiated to regulate discharges from irrigated agriculture to surface waters and groundwater. To comply with this new regulation, owners or operators of irrigated cropland in the Central Valley could either obtain an individual permit for each farming operation or join a group that represents farmers across a specific geographic region. ESJWQC was formed to give growers an option for complying with ILRP. The ESJWQC encompasses the lower Stanislaus, Tuolumne, and Merced River watersheds and includes the irrigated farmland in Stanislaus and Merced counties. Through this designation the ESJWQC monitors the Merced Subbasin along with the Turlock and Chowchilla Subbasins (ESJWQC, 2018).

ESJWQC's GQTM Phase III workplan is the final part of a multi-phase approach to establish a network of wells to use for the GQTM program. ESJWQC initially selected five principal wells within the Merced Subbasin which meet the requirements of the waste discharge requirements (WDRs) and can be accessed for annual sampling. These are all domestic wells owned by ESJWQC members that have been vetted for construction details, accessibility, and condition. An additional three principal wells have been added within the Merced Subbasin in subsequent ESJWQC GQTM annual reports.

4.8.1.2 PWS Wells That Report to DDW

The SWRCB DDW requires monitoring of PWS wells for Title 22 requirements (such as organic and inorganic compounds, metals, microbial, and radiological analytes). Data is available for active and inactive drinking water sources for water systems that serve the public: defined as serving 15 or more connections or more than 25 people per day. Wells are monitored for Title 22 requirements, including pH, alkalinity, bicarbonate, calcium, magnesium, potassium, sulfate, barium, copper, iron, zinc, and nitrate.

There are 279 PWS wells within the Merced Subbasin that report water quality data to DDW. Out of these 279, 14 are classified as complementary wells in the ESJWQC's GQTM Phase III workplan. These 14 wells are expected to add substantial value to the GQTM program due to availability of historical data, but they may not satisfy the criteria for principal wells (ESJWQC, 2018).

The remaining 265 PWS wells also report water quality data to DDW but are not included in the group of complementary wells selected by the ESJWQC GQTM program.

4.8.1.3 Overall Monitoring Network

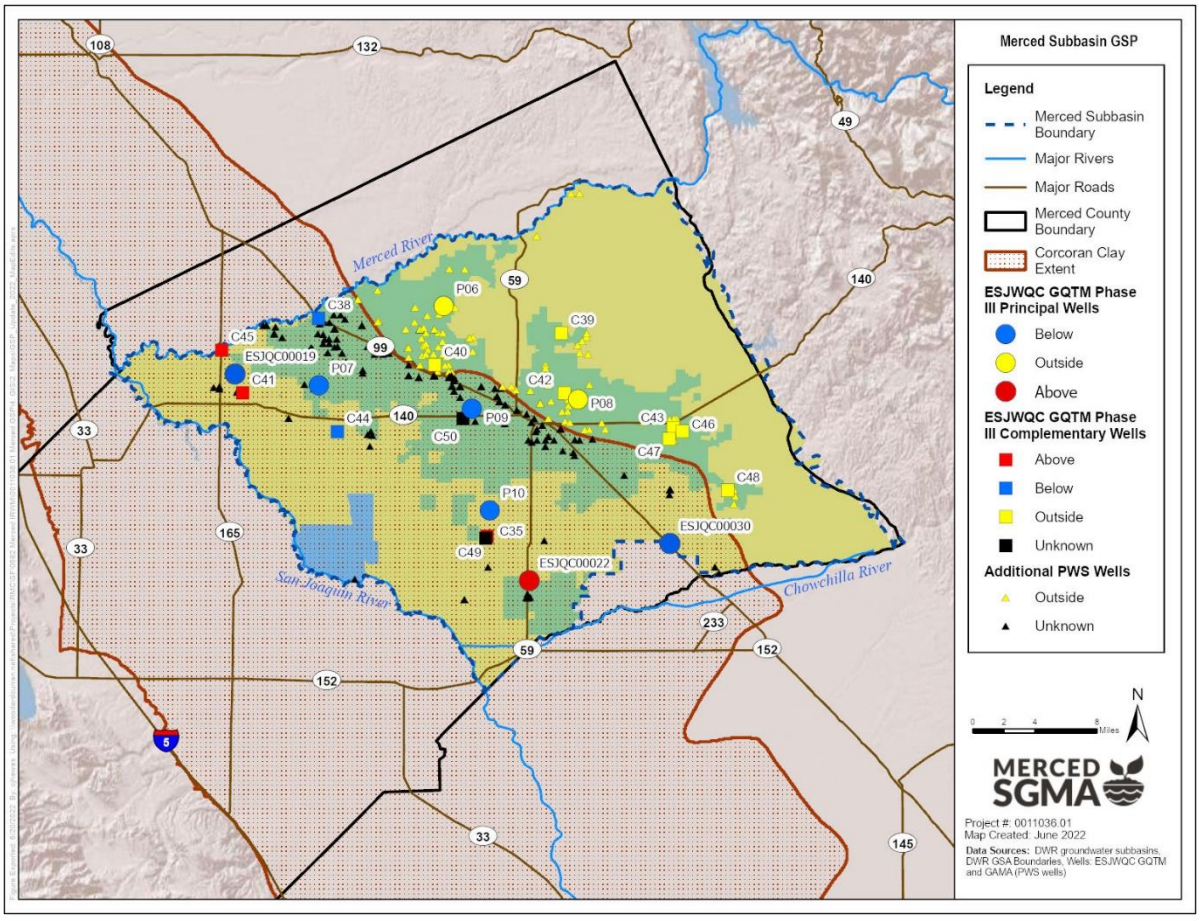
Table 4-6 lists the monitoring sites selected for the groundwater quality monitoring network by category and principal aquifer. The monitoring network is composed of 4 wells located within the Above Corcoran Clay Principal Aquifer, 7 wells within the Below Corcoran Clay Principal Aquifer, 131 wells within the Outside Corcoran Clay Principal Aquifer, and 145 wells in an unknown principal aquifer (either Above Corcoran Clay or Below Corcoran Clay, unknown due to lack of depth information).

Figure 4-7 shows the Merced Subbasin GSP Groundwater Quality Monitoring Network.

Table 4-6: Merced GSP Groundwater Quality Monitoring Well Selection by Principal Aquifer

Category	Principal Aquifer				Total Wells
	Above Corcoran Clay	Below Corcoran Clay	Outside Corcoran Clay	Unknown	
ESJWQC GQTM Principal Wells	1	5	2	0	8
ESJWQC GQTM Complementary Wells	3	2	7	2	14
Other PWS Wells	0	0	122	143	265
Total	**4**	**7**	**131**	**145**	**287**

Figure 4-7: Merced Subbasin GSP Groundwater Quality Monitoring Network Wells



4.8.2 Monitoring Frequency

Sampling of GQTM principal wells will be conducted by ESJWQC at approximately the same time each year, per the WDRs, and will occur in the fall (ESJWQC, 2018). The GSAs will coordinate with ESJWQC to obtain the necessary TDS results for GSP reporting.

PWS wells are sampled according to DDW requirements which will vary by well and by constituent.

4.8.3 Spatial Density

DWR's *Monitoring Networks and Identification of Data Gaps BMP* states "The spatial distribution [of the groundwater quality monitoring network] must be adequate to map or supplement mapping of known contaminants" (DWR, 2016b). The selected groundwater quality monitoring network wells provide adequate coverage of the Outside Corcoran Clay Principal Aquifer for purposes of mapping salinity. The lack of depth information for many wells located in the Above and Below Corcoran Clay Principal Aquifers is a significant data gap described further in Section 4.8.7.

Various spatial considerations were considered in designing the GQTM network (ESJWQC, 2015). These considerations focused on where and how to representatively monitor groundwater quality trends relative to agricultural activities. Spatial factors relating to the GQTM design include:

- **Prioritization of high vulnerability areas.** High vulnerability areas are monitoring areas where physical conditions make groundwater more vulnerable to impacts from overlying land use activities
- **Well characteristics (pumping rate and depth) and the aquifer properties in the area.** Larger-capacity (higher pumping rates) wells such as irrigation wells and public water supply wells provide a better representation of regional groundwater conditions because these wells have relatively larger groundwater captures zones drawing groundwater from a greater contributing area and minimizing the degree to which a well reflects highly localized groundwater conditions.
- Well construction characteristics (e.g., well completion reports), the accessibility of wells and willing cooperation of well owners for inclusion in the monitoring program, and the desired spatial distribution and adequacy to provide the information needed to fulfill the objectives of the GQTM.

PWS wells that report to DDW are located throughout the Subbasin but are concentrated in urban areas where water suppliers have wells for municipal uses.

4.8.4 Representative Monitoring

The Merced Subbasin GSP groundwater quality monitoring network totals 287 wells, eight of which are designated as representative wells. The eight GQTM principal wells are the eight wells where minimum thresholds have been established, and they are committed to annual sampling and reporting. The remaining GQTM complementary wells and other PWS wells all report to DDW on a variety of schedules and serve as general trend monitoring wells for the GSP.

Figure 4-7 shows the locations of the groundwater quality monitoring network monitoring and representative wells. Table 4-7 details additional information about the 22 GQTM program wells that are part of the groundwater quality monitoring network. The eight representative wells (GQTM principal wells) are identified with an asterisk (*) next to the ESJWQC ID. The additional 265 PWS wells are shown in Table 4-8.

Table 4-7: Merced Subbasin GSP Groundwater Quality Monitoring Network GQTM Well Details

Principal or Complementary?[1]	ESJWQC ID	Owner	Principal Aquifer	Well Depth (ft)	Depth to Top of Screen Interval (ft)	Depth to Bottom of Screen Interval (ft)	Latitude	Longitude
Principal	P06*	(domestic)	Outside	185	215	235	37.40480	-120.58900
Principal	P07*	(domestic)	Below	195	220	230	37.33080	-120.73500
Principal	P08*	(domestic)	Outside	150	170	180	37.31780	-120.43200
Principal	P09*	(domestic)	Below	150	170	180	37.30920	-120.55600
Principal	P10*	(domestic)	Below	Unknown	Unknown	180	37.21440	-120.53500
Principal	ESJQC00019*	(domestic)	Below	162	142	162	37.34129	-120.833
Principal	ESJQC00022*	(domestic)	Above	124	112	122	37.14877	-120.489
Principal	ESJQC00030*	(observation)	Below	290	105	280	37.18317	-120.325
Complementary	C35	Sandy Mush Detention Center d.b.a. John	Above	140	100	140	37.19042	-120.53781
Complementary	C41	Stevinson Ranch Golf Club	Above	115	95	115	37.32350	-120.82392
Complementary	C45	Hagaman County Park (MCDPW)	Above	138	113	138	37.36339	-120.84869
Complementary	C38	City of Livingston	Below	233	160	233	37.39336	-120.73563
Complementary	C44	Foster Farms Fertilizer Plant	Below	268	248	268	37.28760	-120.71300
Complementary	C40	City of Atwater	Outside	146	86	146	37.35009	-120.59938
Complementary	C42	Black Rascal Water Company	Outside	154	124	154	37.32372	-120.44803
Complementary	C43	Planada CSD	Outside	180	130	180	37.29125	-120.32081
Complementary	C46	Planada CSD	Outside	Unknown	140	170	37.28806	-120.30972
Complementary	C47	Oasis Ranch (closed)	Outside	230	115	135	37.28104	-120.32534
Complementary	C39	Merced Golf & Country Club	Outside	Unknown	Unknown	Unknown	37.37980	-120.45101
Complementary	C48	Le Grand Community Services District	Outside	304	234	304	37.23290	-120.25738

Complementary	C49	Sandy Mush Detention Center d.b.a. John	Unknown	Unknown	Unknown	Unknown	37.18858	-120.53975
Complementary	C50	McSwain Elementary School	Unknown	Unknown	Unknown	Unknown	37.30021	-120.56643

[1] Principal and Complementary wells in the ESJWQC GQTM Program are defined in Section 4.8.1 - Monitoring Wells Selected for Monitoring Network.

Table 4-8: PWS Wells Not Part of GQTM Program

Global ID	Well ID	Principal Aquifer	Latitude	Longitude
W0602410010	2410010-007	Outside	37.38333	-120.63333
W0602410010	2410010-006	Outside	37.38333	-120.61667
W0602410001	2410001-013	Outside	37.36458	-120.60758
W0602410001	2410001-017	Outside	37.36007	-120.60114
W0602410001	2410001-003	Outside	37.35000	-120.60000
W0602400084	2400084-001	Outside	37.38017	-120.59571
W0602410001	2410001-019	Outside	37.36693	-120.59526
W0602400010	2400010-002	Outside	37.36000	-120.57000
W0602410009	2410009-048	Outside	37.32665	-120.50420
W0602410009	2410009-049	Outside	37.31611	-120.46333
W0602410009	2410009-022	Outside	37.32476	-120.44327
W0602400114	2400114-003	Outside	37.37618	-120.42206
W0602400315	2400315-001	Outside	37.29604	-120.40428
W0602410011	2410011-004	Outside	37.22722	-120.24833
W0602400128	2400128-001	Outside	37.41087	-120.68957
W0602400011	2400011-001	Outside	37.36605	-120.63034
W0602400069	2400069-001	Outside	37.38000	-120.61000
W0602410001	2410001-011	Outside	37.35000	-120.58333
W0602400182	2400182-011	Outside	37.43971	-120.58267
W0602410700	2410700-010	Outside	37.36603	-120.57631
W0602400344	2400344-001	Outside	37.29762	-120.44728
W0602400151	2400151-001	Outside	37.51000	-120.44000
W0602400047	2400047-001	Outside	37.51000	-120.43000
W0602400230	2400230-001	Outside	37.33156	-120.41886
W0602410007	2410007-003	Outside	37.30000	-120.31667
W0602400067	2400067-001	Outside	37.22000	-120.25000
W0602400013	2400013-003	Outside	37.39166	-120.66542
W0602410010	2410010-003	Outside	37.38333	-120.61667
W0602400143	2400143-001	Outside	37.37193	-120.59045
W0602410001	2410001-016	Outside	37.35758	-120.58588
W0602400117	2400117-001	Outside	37.34350	-120.57929
W0602400136	2400136-001	Outside	37.35000	-120.47000
W0602410009	2410009-019	Outside	37.33110	-120.46667
W0602410009	2410009-009	Outside	37.30000	-120.46667
W0602410009	2410009-054	Outside	37.30639	-120.45083
W0602410009	2410009-014	Outside	37.32456	-120.44398
W0602400114	2400114-002	Outside	37.37236	-120.42708
W0602410007	2410007-007	Outside	37.28722	-120.32641
W0602400013	2400013-002	Outside	37.39009	-120.66547
W0602400011	2400011-012	Outside	37.36605	-120.63112
W0602400011	2400011-011	Outside	37.35713	-120.62988
W0602410010	2410010-012	Outside	37.39006	-120.62322
W0602410010	2410010-015	Outside	37.40367	-120.62256
W0602410010	2410010-005	Outside	37.38333	-120.61667

Global ID	Well ID	Principal Aquifer	Latitude	Longitude
W0602410010	2410010-008	Outside	37.38333	-120.61667
W0602410001	2410001-014	Outside	37.35865	-120.61438
W0602410001	2410001-004	Outside	37.35000	-120.60000
W0602410010	2410010-010	Outside	37.38333	-120.60000
W0602410001	2410001-012	Outside	37.35000	-120.58333
W0602410001	2410001-021	Outside	37.37593	-120.55440
W0602410009	2410009-016	Outside	37.32610	-120.48792
W0605000433	5000433-008	Outside	37.47022	-120.48009
W0602400046	2400046-001	Outside	37.32025	-120.44492
W0602400176	2400176-001	Outside	37.31196	-120.44300
W0602410009	2410009-017	Outside	37.28972	-120.41861
W0602410007	2410007-001	Outside	37.28917	-120.32419
W0602410007	2410007-004	Outside	37.28981	-120.31499
W0602410011	2410011-003	Outside	37.23151	-120.25492
W0602410011	2410011-002	Outside	37.22723	-120.24856
W0602410010	2410010-019	Outside	37.37464	-120.61543
W0602400234	2400234-001	Outside	37.36803	-120.61289
W0602400061	2400061-001	Outside	37.36000	-120.61000
W0602410010	2410010-001	Outside	37.38333	-120.60000
W0602410001	2410001-009	Outside	37.34418	-120.59608
W0602400149	2400149-001	Outside	37.39728	-120.59471
W0602410001	2410001-018	Outside	37.34958	-120.58724
W0602410700	2410700-002	Outside	37.36333	-120.57222
W0602410700	2410700-004	Outside	37.36278	-120.57111
W0602410700	2410700-003	Outside	37.36278	-120.57056
W0602410700	2410700-006	Outside	37.37472	-120.55972
W0602410009	2410009-013	Outside	37.32448	-120.44418
W0602400112	2400112-011	Outside	37.28000	-120.32000
W0602400152	2400152-001	Outside	37.30000	-120.32000
W0602400013	2400013-004	Outside	37.39022	-120.66602
W0602400011	2400011-013	Outside	37.36605	-120.63032
W0602410001	2410001-002	Outside	37.35000	-120.61667
W0602410001	2410001-001	Outside	37.35000	-120.61667
W0602410010	2410010-013	Outside	37.39580	-120.60839
W0602410010	2410010-002	Outside	37.38333	-120.60000
W0602400203	2400203-001	Outside	37.36000	-120.59000
W0602400117	2400117-014	Outside	37.34403	-120.58270
W0602410700	2410700-007	Outside	37.35944	-120.57639
W0602410700	2410700-005	Outside	37.37528	-120.55861
W0602400130	2400130-001	Outside	37.33000	-120.52000
W0602410009	2410009-001	Outside	37.31445	-120.47598
W0602410009	2410009-002	Outside	37.31429	-120.47572
W0602400114	2400114-014	Outside	37.36856	-120.43252
W0602400031	2400031-001	Outside	37.29000	-120.40000
W0602400240	2400240-002	Outside	37.29697	-120.35523

Global ID	Well ID	Principal Aquifer	Latitude	Longitude
W0602400112	2400112-001	Outside	37.28000	-120.32000
W0602400162	2400162-001	Outside	37.41087	-120.68957
W0602400307	2400307-001	Outside	37.41960	-120.66652
W0602410001	2410001-007	Outside	37.35000	-120.61667
W0602410010	2410010-009	Outside	37.38333	-120.61667
W0602410010	2410010-004	Outside	37.38333	-120.61667
W0602410010	2410010-011	Outside	37.38472	-120.61222
W0602400159	2400159-001	Outside	37.37000	-120.61000
W0602410001	2410001-008	Outside	37.35000	-120.60000
W0602410001	2410001-010	Outside	37.35000	-120.60000
W0602400059	2400059-001	Outside	37.36000	-120.58000
W0602410010	2410010-014	Outside	37.40323	-120.57577
W0602400010	2400010-003	Outside	37.36000	-120.57000
W0602400111	2400111-001	Outside	37.33000	-120.51000
W0602400148	2400148-001	Outside	37.31779	-120.44311
W0602400219	2400219-001	Outside	37.29641	-120.44126
W0602410009	2410009-043	Outside	37.36144	-120.43006
W0602400114	2400114-004	Outside	37.37926	-120.42189
W0602400212	2400212-001	Outside	37.36000	-120.42000
W0602400340	2400340-001	Outside	37.29461	-120.32531
W0602410007	2410007-014	Outside	37.29917	-120.32503
W0602410007	2410007-006	Outside	37.28436	-120.32268
W0602410001	2410001-005	Outside	37.35000	-120.60000
W0602400021	2400021-001	Outside	37.38000	-120.59000
W0602400009	2400009-001	Outside	37.36097	-120.58305
W0602400010	2400010-001	Outside	37.36000	-120.57000
W0602400071	2400071-001	Outside	37.43944	-120.56431
W0602410700	2410700-012	Outside	37.36245	-120.55520
W0602410009	2410009-003	Outside	37.31411	-120.47622
W0602410009	2410009-042	Outside	37.34703	-120.46995
W0602400327	2400327-001	Outside	37.30675	-120.44400
W0602410009	2410009-018	Outside	37.28944	-120.42438
W0602410011	2410011-001	Outside	37.23333	-120.25000
W0602400169	2400169-022	Unknown	37.38656	-120.79612
W0602400190	2400190-001	Unknown	37.30000	-120.77000
W0602400331	2400331-001	Unknown	37.36471	-120.74270
W0602410004	2410004-013	Unknown	37.37885	-120.73622
W0602410004	2410004-009	Unknown	37.38945	-120.72261
W0602400097	2400097-001	Unknown	37.35219	-120.71900
W0602410004	2410004-006	Unknown	37.38333	-120.71667
W0602410004	2410004-004	Unknown	37.38333	-120.71667
W0602400206	2400206-002	Unknown	37.28791	-120.67396
W0602400104	2400104-002	Unknown	37.34000	-120.63000
W0602400052	2400052-002	Unknown	37.33816	-120.61802
W0602400138	2400138-003	Unknown	37.34000	-120.60000

Global ID	Well ID	Principal Aquifer	Latitude	Longitude
W0602400034	2400034-011	Unknown	37.33047	-120.57905
W0602400134	2400134-001	Unknown	37.32569	-120.57706
W0602400003	2400003-001	Unknown	37.33000	-120.57000
W0602410008	2410008-005	Unknown	37.33003	-120.54522
W0602410008	2410008-001	Unknown	37.32097	-120.52637
W0602400007	2400007-002	Unknown	37.31597	-120.52411
W0602400007	2400007-012	Unknown	37.31594	-120.52383
W0602410008	2410008-004	Unknown	37.32815	-120.52263
W0602400053	2400053-002	Unknown	37.13261	-120.49133
W0602400103	2400103-001	Unknown	37.28000	-120.49000
W0602410009	2410009-010	Unknown	37.30000	-120.48333
W0602400248	2400248-001	Unknown	37.18627	-120.47135
W0602410009	2410009-007	Unknown	37.28333	-120.46667
W0602410009	2410009-023	Unknown	37.28997	-120.45246
W0602400065	2400065-001	Unknown	37.23358	-120.32453
W0602410004	2410004-003	Unknown	37.38333	-120.71667
W0602400027	2400027-001	Unknown	37.36000	-120.66000
W0602400052	2400052-001	Unknown	37.33840	-120.61816
W0602400138	2400138-002	Unknown	37.34000	-120.60000
W0602400135	2400135-001	Unknown	37.33000	-120.58000
W0602400005	2400005-001	Unknown	37.33548	-120.57731
W0602400015	2400015-001	Unknown	37.33000	-120.57000
W0602400172	2400172-013	Unknown	37.19044	-120.53694
W0602400153	2400153-001	Unknown	37.31282	-120.51708
W0602400140	2400140-001	Unknown	37.31282	-120.51708
W0602400053	2400053-001	Unknown	37.13278	-120.49028
W0602400186	2400186-001	Unknown	37.24699	-120.37804
W0602400065	2400065-002	Unknown	37.23333	-120.32500
W0602410004	2410004-015	Unknown	37.38822	-120.73409
W0602410004	2410004-010	Unknown	37.37838	-120.72994
W0602410004	2410004-012	Unknown	37.37392	-120.72326
W0602410004	2410004-001	Unknown	37.38333	-120.71667
W0602400024	2400024-001	Unknown	37.36000	-120.67000
W0602400110	2400110-001	Unknown	37.36108	-120.65328
W0602400104	2400104-001	Unknown	37.34000	-120.63000
W0602410001	2410001-015	Unknown	37.33970	-120.60093
W0602400227	2400227-002	Unknown	37.29760	-120.55214
W0602410008	2410008-003	Unknown	37.32989	-120.54517
W0602400033	2400033-001	Unknown	37.29391	-120.47374
W0602400139	2400139-001	Unknown	37.26850	-120.43750
W0602410009	2410009-020	Unknown	37.28002	-120.43593
W0602400300	2400300-001	Unknown	37.22893	-120.32553
W0602400064	2400064-001	Unknown	37.32861	-120.85781
W0602400215	2400215-001	Unknown	37.32350	-120.82392
W0602400169	2400169-016	Unknown	37.38517	-120.78578

Global ID	Well ID	Principal Aquifer	Latitude	Longitude
W0602410004	2410004-028	Unknown	37.37376	-120.72826
W0602400249	2400249-002	Unknown	37.36151	-120.72452
W0602400333	2400333-001	Unknown	37.36995	-120.72289
W0602400113	2400113-014	Unknown	37.38650	-120.68466
W0602400138	2400138-004	Unknown	37.34000	-120.60000
W0602400036	2400036-001	Unknown	37.32000	-120.57000
W0602400160	2400160-001	Unknown	37.13120	-120.56470
W0602400075	2400075-002	Unknown	37.13325	-120.48805
W0602410009	2410009-008	Unknown	37.29638	-120.48643
W0602410009	2410009-006	Unknown	37.28333	-120.46667
W0602400139	2400139-011	Unknown	37.26560	-120.43607
W0602400101	2400101-001	Unknown	37.28000	-120.43000
W0602400250	2400250-001	Unknown	37.15592	-120.26774
W0602400082	2400082-001	Unknown	37.32715	-120.85080
W0602400169	2400169-017	Unknown	37.38626	-120.80024
W0602400169	2400169-004	Unknown	37.37840	-120.78717
W0602400122	2400122-001	Unknown	37.35221	-120.71902
W0602410004	2410004-002	Unknown	37.36667	-120.71667
W0602410004	2410004-007	Unknown	37.37389	-120.71389
W0602400336	2400336-001	Unknown	37.36715	-120.71305
W0602400255	2400255-002	Unknown	37.35321	-120.70358
W0602400174	2400174-011	Unknown	37.15000	-120.69254
W0602410001	2410001-020	Unknown	37.33831	-120.58296
W0602400156	2400156-001	Unknown	37.33000	-120.57000
W0602400079	2400079-012	Unknown	37.30203	-120.56837
W0602410009	2410009-021	Unknown	37.29529	-120.51748
W0602410009	2410009-015	Unknown	37.30801	-120.50360
W0602410009	2410009-011	Unknown	37.30417	-120.49220
W0602400053	2400053-013	Unknown	37.13318	-120.49173
W0602400102	2400102-001	Unknown	37.28000	-120.47000
W0602400223	2400223-001	Unknown	37.16147	-120.27222
W0602400326	2400326-001	Unknown	37.36130	-120.74053
W0602400127	2400127-001	Unknown	37.36000	-120.74000
W0602400025	2400025-001	Unknown	37.37000	-120.73000
W0602410004	2410004-008	Unknown	37.39660	-120.71777
W0602410004	2410004-005	Unknown	37.38333	-120.71667
W0602400328	2400328-001	Unknown	37.36099	-120.70770
W0602400113	2400113-013	Unknown	37.38669	-120.68462
W0602400232	2400232-002	Unknown	37.34237	-120.68359
W0602400334	2400334-001	Unknown	37.36722	-120.67821
W0602400206	2400206-001	Unknown	37.28484	-120.67785
W0602400206	2400206-004	Unknown	37.27421	-120.67524
W0602700592	2700592-001	Unknown	37.13120	-120.56470
W0602410008	2410008-010	Unknown	37.32097	-120.52658
W0602400053	2400053-014	Unknown	37.13365	-120.49200

Global ID	Well ID	Principal Aquifer	Latitude	Longitude
W0602400211	2400211-012	Unknown	37.27799	-120.48603
W0602400030	2400030-001	Unknown	37.28000	-120.46000
W0602410009	2410009-004	Unknown	37.29035	-120.45244
W0602410009	2410009-005	Unknown	37.29048	-120.45244
W0602410009	2410009-041	Unknown	37.28081	-120.41505
W0602400077	2400077-001	Unknown	37.32947	-120.85127
W0602400169	2400169-002	Unknown	37.37933	-120.78710
W0602400191	2400191-001	Unknown	37.30000	-120.77000
W0602400118	2400118-001	Unknown	37.39000	-120.73000
W0602400081	2400081-001	Unknown	37.39000	-120.73000
W0602410004	2410004-025	Unknown	37.39663	-120.70962
W0602410004	2410004-014	Unknown	37.39278	-120.70467
W0602400129	2400129-001	Unknown	37.37056	-120.67444
W0602400206	2400206-003	Unknown	37.28430	-120.67212
W0602400114	2400114-001	Unknown	37.36108	-120.65328
W0602400138	2400138-001	Unknown	37.34000	-120.60000
W0602400001	2400001-001	Unknown	37.34000	-120.58000
W0602400320	2400320-001	Unknown	37.33750	-120.57646
W0602400222	2400222-001	Unknown	37.16147	-120.53686
W0602400007	2400007-001	Unknown	37.31592	-120.52344
W0602400116	2400116-001	Unknown	37.28000	-120.48000
W0602400099	2400099-001	Unknown	37.36339	-120.84869
W0602400215	2400215-011	Unknown	37.32426	-120.83073
W0602400169	2400169-018	Unknown	37.38661	-120.79704
W0602400169	2400169-014	Unknown	37.37522	-120.77818
W0602400337	2400337-001	Unknown	37.33155	-120.75172
W0602400331	2400331-002	Unknown	37.36601	-120.74422
W0602400323	2400323-001	Unknown	37.32783	-120.74053
W0602400232	2400232-003	Unknown	37.34514	-120.68349
W0602400146	2400146-001	Unknown	37.35000	-120.63000
W0602400117	2400117-011	Unknown	37.33958	-120.58188
W0602400001	2400001-002	Unknown	37.34000	-120.58000
W0602400079	2400079-002	Unknown	37.29995	-120.56646
W0602400175	2400175-001	Unknown	37.19042	-120.53781
W0602410008	2410008-002	Unknown	37.32804	-120.52938
W0602400318	2400318-001	Unknown	37.13659	-120.49135
W0602410009	2410009-012	Unknown	37.28794	-120.48125
W0602400054	2400054-001	Unknown	37.29000	-120.48000
W0602410009	2410009-057	Unknown	37.27389	-120.47028
W0602400144	2400144-001	Unknown	37.27000	-120.45000
W0602400075	2400075-001	Unknown	37.23358	-120.32453

4.8.6 Groundwater Quality Monitoring Protocols

Sampling protocols for the ESJWQC GQTM principal wells will follow the guidelines presented in the ESJWQC GQTM Phase I Workplan, consistent with requirements specified in the WDRs and detailed in the Quality Assurance Protection Plan which is still pending review by the RWQCB and State Board QA Officer (MLJ Environmental, 2019) (see Appendix J which includes both the draft Central Valley Groundwater Monitoring Collaborative Quality Assurance Program Plan and the draft Quality Assurance Project Plan specific to the ESJWQC GQTM Program).

GQTM data will be compiled in a database. Data will be compiled and used to develop five-year update reports, beginning January 2019 (ESJWQC, 2018). GQTM workplans Phase I (ESJWQC, 2015) and Phase II (ESJWQC, 2016) describe the annual reporting, data analysis, and presentations that will be submitted annually and on five-year intervals.

Water quality monitoring performed for PWS wells that report to DDW will be performed to DDW protocols which are specific based on the contaminant being sampled.

4.8.7 Data Gaps

Two significant data gaps exist:

- There are relatively few monitoring wells closer to the San Joaquin River and closer to Mariposa County.
- Many wells used for monitoring do not have construction information, which notably limits the ability to distinguish whether wells are below or above the Corcoran Clay.

4.8.8 Plan to Fill Data Gaps

The ESJWQC GQTM plan already includes a plan to add additional principal wells, stating that "[t]he spatial representation and statistical validity of the GQTM well network will be evaluated on an annual basis with respect to the objectives of the program" (ESJWQC, 2018). The Phase III Workplan design approach recognizes the importance for the monitoring program to adapt based on consideration of data derived through continuous evaluation of program implementation. Some additional goals discussed in the GQTM plan's network refinement section include:

- Verification of construction information for complementary wells.
- Locating wells in the Chowchilla region where domestic and public supply wells are less common or most often deeper than expected for Upper Zone wells (this region overlaps with the very southern corner of the Merced Subbasin).
- Identification of network wells in "lower vulnerability agricultural areas, especially in the more eastern portions of the Coalition region" (ESJWQC, 2018) through focused outreach efforts to Coalition members, which includes the eastern portion of the Merced Subbasin.

The GSAs plan to obtain additional construction information for at least 20 PWS wells located throughout the Subbasin to determine the completion information for these wells so they can be assigned to Above or Below Corcoran Clay for the purpose of analyzing salinity. Additionally, the GSAs will work with the ESJWQC to identify monitoring opportunities and associated funding opportunities in the data gap areas.

Within two years after the approval of the GSP by DWR, the GSAs will provide a plan to fill identified gaps, with a timeline for priorities of implementation.

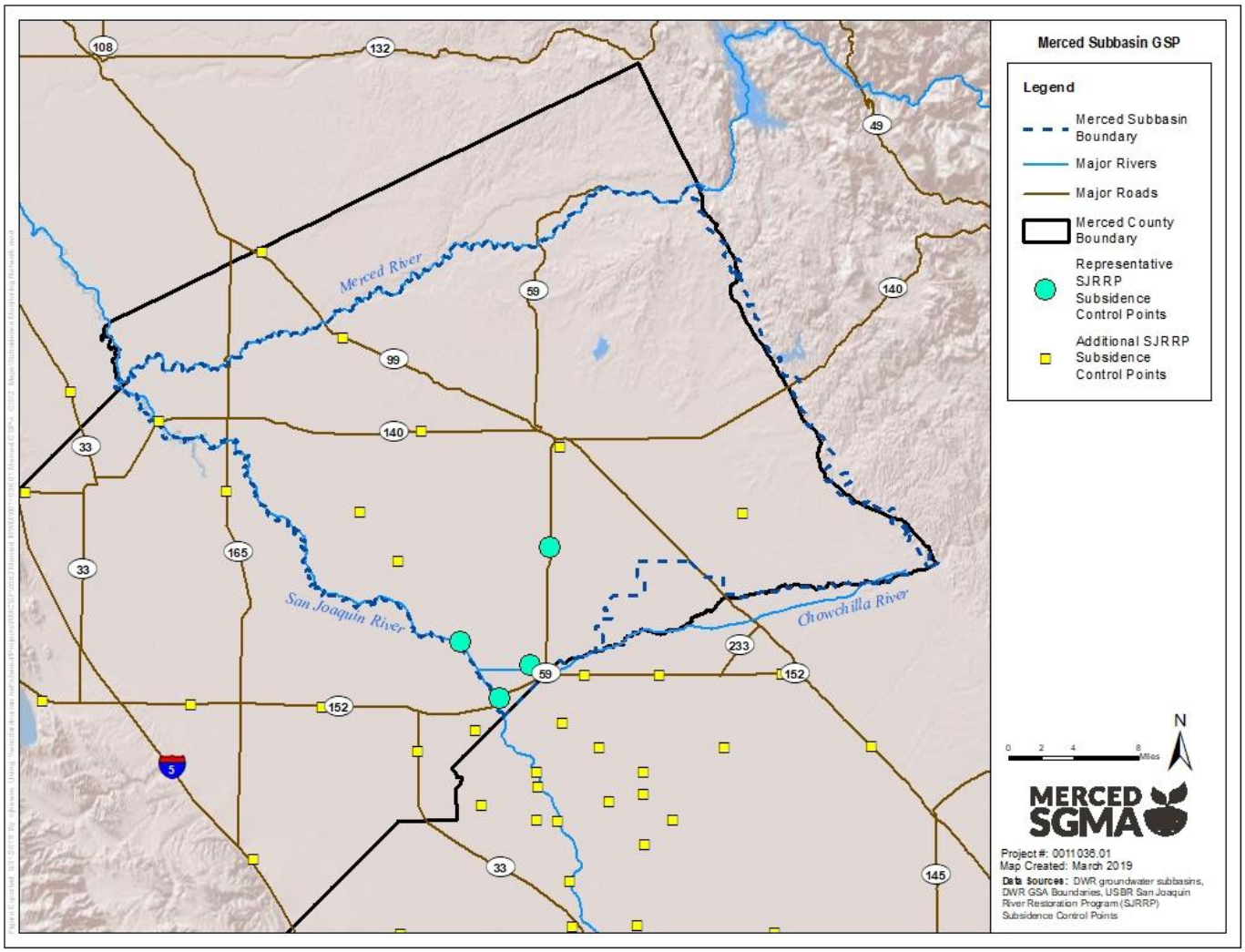
4.9 SUBSIDENCE MONITORING NETWORK

4.9.1 Monitoring Sites Selected for Monitoring Network

The Merced Subbasin GSP subsidence monitoring network includes all 71 subsidence control points monitored by the United States Bureau of Reclamation (USBR) as part of the SJRRP, noting that many of these are outside of the Subbasin, but provide regional context. The control points outside the Subbasin are opportunistically selected, in that they both meet the needs of GSP monitoring for the Subbasin and are being actively monitored for other purposes. The selected sites are not necessarily the specific sites shown and listed below, but rather the sites that continue to be monitored under SJRRP monitoring program. Thus, monitoring would not continue if sites were removed from the program. Additionally, sites added to the program would be added to the monitoring network.

Figure 4-8 shows the Merced Subbasin GSP Subsidence Monitoring Network sites.

Figure 4-8: Merced Subbasin GSP Subsidence Monitoring Network Sites



4.9.2 Monitoring Frequency

USBR conducts subsidence measurements on a semiannual basis. Measurements are recorded in the middle of July and the middle of December as part of the SJRRP.

4.9.3 Spatial Density

DWR's *Monitoring Networks and Identification of Data Gaps BMP* does not provide specific spatial density guidelines for subsidence monitoring networks and thus relies on professional judgment on site identification. The subsidence monitoring network stations provide an adequate spatial coverage of the Subbasin, being specifically developed to characterize regional subsidence in support of the SJRRP. However, the locations provide only information on the elevation of the land surface and do not provide information on the depths at which compaction is occurring. Depth of compaction is an important consideration when managing groundwater elevations to avoid dewatering of sensitive clays. Extensometers are needed within the basin and in the nearby portions of neighboring subbasins to provide this information.

4.9.4 Representative Monitoring

The Merced Subbasin GSP subsidence monitoring network includes four representative monitoring sites at which minimum thresholds and measurable objectives were defined. Representative monitoring sites were selected for the subsidence monitoring network because of their proximity to the region of known subsidence in the southern corner of the Subbasin. Other subsidence control points within and outside of the Merced Subbasin will be used to construct maps of regional subsidence rates for ongoing monitoring, tracking, and analysis.

Figure 4-8 (above) shows the locations of the land subsidence monitoring network monitoring and representative sites in the vicinity of the Merced Subbasin. Additional SJRRP subsidence control points are located as far south as Fresno County.

Table 4-9 details the land subsidence monitoring network sites. Representative sites are identified with an asterisk (*) next to the SJRRP ID and Local ID.

Table 4-9: Merced Subbasin GSP Subsidence Monitoring Network and Representative Site Details

SJRRP ID	Local ID	Elevation (ft above MSL)	Latitude	Longitude
119	109.28	111.03	37.46356	-120.81269
121	375 USE	127.64	36.98302	-120.50087
170	4S3	97.9	37.22997	-120.70143
HS2494	57.95 USBR	183.31	37.24608	-121.07802
120	604.164	606.63	36.99646	-119.70152
122	ALEX 5	167.37	36.77005	-120.39230
2160	BLYTHE	232.29	36.53247	-119.87233
2147	BURNSIDE	195.1	36.48785	-120.15206
124	D 158 RESET	146.55	37.08372	-120.44936
125	DWIGHT	183.51	36.82226	-120.50180
2362	DWR 154.33	146.69	37.01822	-120.43325
126	E1420	167.16	37.28817	-120.47662
2076	F 158 RESET 1967	178.59	37.08358	-120.36555
128	F 928	619.26	36.62403	-120.65904
129	FIREPORT	145.42	36.85731	-120.46284

SJRRP ID	Local ID	Elevation (ft above MSL)	Latitude	Longitude
130	FREMONT	73.14	37.31065	-120.92791
131	G 706 RESET	242.93	37.22833	-120.27055
132	G 990	124.4	36.99616	-120.50295
133*	H 1235 RESET*	119.82	37.06187	-120.54345
2348	HARMON	112.54	37.01497	-120.63602
2562	HETFIELD	131.82	36.95189	-120.47907
62	HPGN 06 06	288.74	36.69844	-119.75773
63	HPGN 06 07	328.99	36.50107	-120.35386
135	HPGN CA 06 03	234.65	37.08448	-120.22755
137	HPGN CA 10 01	100.37	37.05472	-120.74308
138	HPGN CA 10 04	238.97	37.46425	-121.17791
139	HPGN D CA 06 NF	185.65	36.59009	-120.06086
141	HPGN D CA 06 RF	284.97	36.88701	-119.98165
142	HPGN D CA 06 RG	430.37	36.97544	-119.79378
143	HPGN D CA 06 SG	1107.13	37.09489	-119.75237
144	HPGN D CA 10 BK	314.06	36.91701	-120.82034
AA4259	HPGN D CA 10 FP	1289.23	37.42909	-120.10257
GU0278	J 1074	704.59	36.78119	-120.81158
145	J 1233	494.09	36.86675	-119.56149
146	K 361	285.34	37.05889	-121.05689
GT1871	KAKTUS	506.69	36.71553	-119.35207
147	KELLIE	123.28	36.96627	-120.56499
GU0492	L 928	1103.55	36.53750	-120.56144
104	LIFESON	179.59	36.77410	-120.28436
148	LIVINGSTON RESET	134.13	37.38675	-120.72109
2107	MARTIN 2008	174.89	36.58926	-120.16264
DH6665	MATTHEW	189.6	36.85084	-120.65533
2378	MELISSA	179.76	37.01834	-120.29259
2149	MURIETTA	164.61	36.63206	-120.31785
150	NEWMAN NW BASE	97.26	37.33715	-121.02848
29	NOTARB	277.64	37.01818	-120.12660
DH6671	PEYTON	233.37	36.70719	-120.45965
1108	R940 RESET	123.59	37.30241	-120.63321
1007R	RBF 1007 RESET	145.34	36.93077	-120.38222
1009	RBF 1009	127.84	36.95265	-120.50342
159	RBF 1027	150.99	36.82490	-120.37284
160R	RBF 1047 RESET	215.34	36.82212	-120.14185
1053R	RBF 1053 RESET	151.35	36.97609	-120.38301
1054R	RBF 1054 RESET	149.15	36.99620	-120.38328
1055R	RBF 1055 RESET	124.96	37.04002	-120.47373
162*	RBF 1057*	119.54	37.09215	-120.51025
158	RBF1026	149.65	36.85772	-120.39088
152	SALT RM1	84.04	37.19244	-120.83978
153	SHAWN	154.1	36.81757	-120.43339
154	SPEAK AZ MK	229.61	36.72608	-120.02468
108	SSH	78.63	37.24767	-120.85146
155	T 987 CADWR	109.39	37.18612	-120.65872
127	USHER	181.93	36.85100	-120.23693

SJRRP ID	Local ID	Elevation (ft above MSL)	Latitude	Longitude
2448	V513	197.46	36.48511	-120.00531
2065*	W 938 RESET*	144.43	37.19818	-120.48807
156*	W 990 CADWR*	111.2	37.11342	-120.58833
123	WES	159.71	36.95263	-120.35004
157	WILLIAM 3	113.61	37.03363	-120.57226
101	X 989	140.54	36.89757	-120.46509
AC5729	X1235	137.94	37.05653	-120.89083
2062	Y 549	139.42	36.96987	-120.42216

* indicates representative monitoring site
Source: San Joaquin River Restoration Program subsidence control points.

4.9.5 Monitoring Protocols

Subsidence monitoring will continue to be performed by USBR in accordance with agency protocols (Appendix K).

4.9.6 Data Gaps

As noted in Section 4.9.3, data gaps exist regarding an understanding of the depth at which subsidence is occurring. It is recommended that one or more extensometers be installed to collect this type of data in or near the Merced Subbasin.

4.9.7 Plan to Fill Data Gaps

The GSAs recognize the importance of managing pumping volumes below the Corcoran Clay, as this is the depth range believed to be causing subsidence. The Projects and Management Actions section includes a project designed to study the potential impacts of moving pumping from below the Corcoran Clay to above the Corcoran Clay. This analysis is intended to facilitate moving pumping within the requirements of Merced County's Groundwater Ordinance. To help inform this study, the Projects and Management Actions section also discusses installation of additional subsidence monitoring that may include installation of extensometers or other measurement methods to help characterize the magnitude, extent, and depth of subsidence and the relationship of subsidence to groundwater pumping activities.

The number and location of extensometers or other measurement methods will be developed in coordination with the SJRRP, the USGS, and other entities associated with subsidence studies, such as the State Water Project, Central Valley Project, California High Speed Rail Authority, and the Central Valley Flood Protection Board. Interbasin coordination will include efforts to coordinate on subsidence monitoring in the Chowchilla and Delta-Mendota Subbasins to better understand trends and any potential correlation to groundwater levels in the different principal aquifers across all subbasins. Subsidence monitoring located nearby but outside of the Subbasin may still fill the existing data gap.

Given the expense of extensometers and some other measurement methods, they may be installed in a phased manner, as funding is available. Funding of a collective effort will be a major component in proceeding with these installations.

Within two years after the approval of the GSP by DWR, the GSAs will provide a plan to fill identified gaps, with a timeline for priorities of implementation.

4.10 DEPLETIONS OF INTERCONNECTED SURFACE WATER MONITORING NETWORK

Sustainable management criteria for depletions of interconnected surface waters are monitored by proxy through the measurement of groundwater levels (see Section 3.8 for rationale), and the same monitoring network is used to support overall characterization of the Subbasin. The monitoring network is intended to characterize the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions.

The monitoring network is developed to characterize the following:

- Flow conditions including surface water discharge, surface water head, and baseflow contribution.
- Temporal change in depletions due to variations in stream discharge and regional groundwater extraction.
- Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.

Based on current understanding, ephemeral or intermittent flowing streams are largely located in the eastern portions of the Subbasin and are not thought to be interconnected with the groundwater system (see Figure 2-10 in Section 2.1.3.5 - Groundwater Recharge and Discharge Areas). So, characterization of the date and location at which they cease to flow has been deemed not associated with groundwater conditions and not applicable for monitoring.

4.10.1 Monitoring Sites Selected for Monitoring Network

Monitoring sites include the groundwater level sites identified in Section 4.5 and the stream gage locations described in 1.2.2.4. The stream gage sites are opportunistically selected, in that they both meet the needs of GSP monitoring for the Subbasin and are being actively monitored for other purposes. The selected sites are not necessarily these specific sites, but rather the sites that continue to be monitored under the DWR, USGS, Merced Irrigation District (MID), and United States Army Corps of Engineers (USACOE) monitoring programs. Thus, monitoring would not continue if sites were removed from one of these programs. Additionally, sites added to one of these agency programs would be added to the monitoring network.

Figure 4-9 shows the locations of the stream gages. Table 4-10 shows details about the stream gages.

Figure 4-9: Merced Subbasin GSP Interconnected Surface Water Depletions Monitoring Network Sites

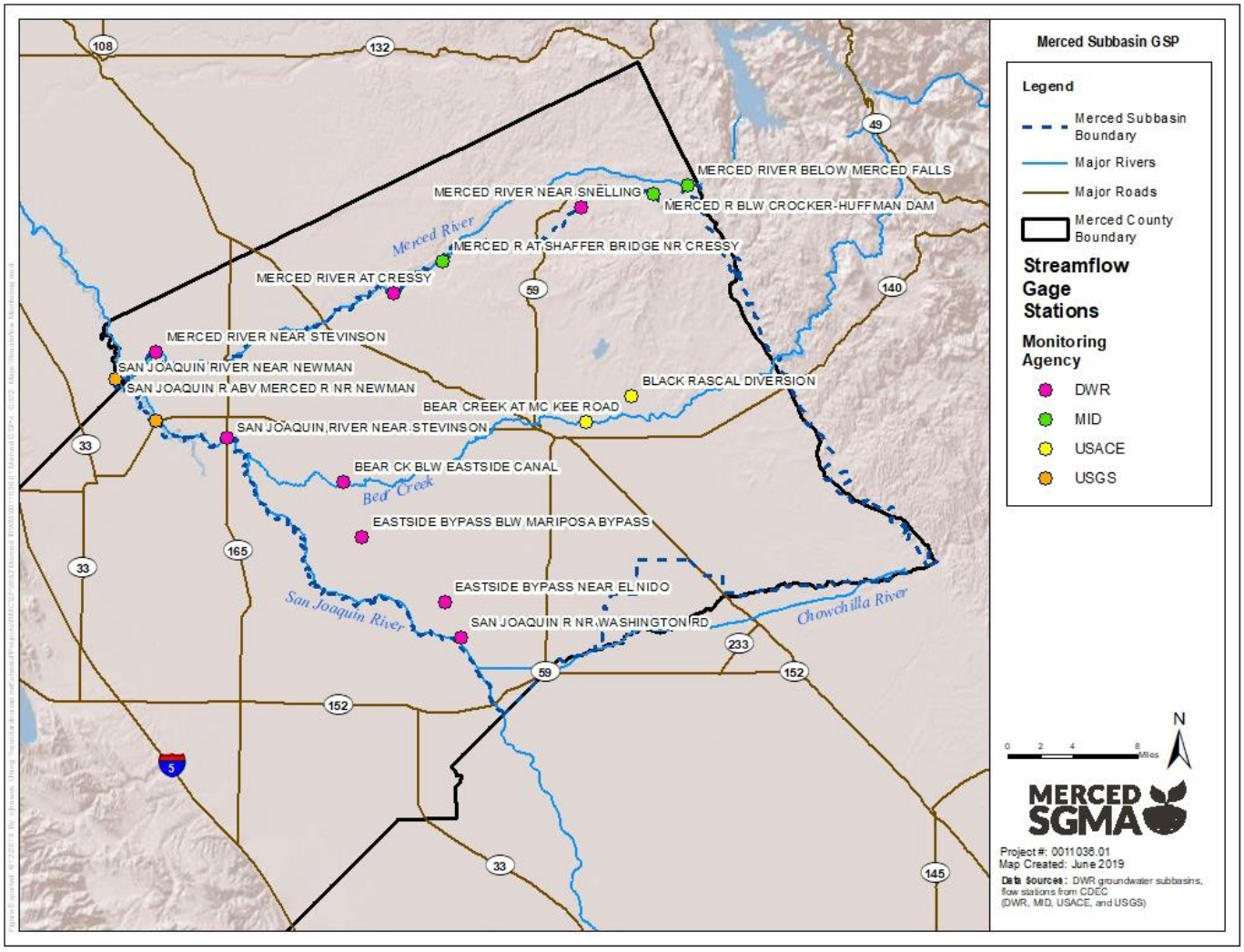


Table 4-10: Merced Subbasin GSP Interconnected Surface Water Depletions Monitoring Network Site Details

Station Code	Station Name	Latitude	Longitude	Monitoring Agency
BSD	BEAR CK BLW EASTSIDE CANAL	37.25470	-120.71940	DWR
MCK	BEAR CREEK AT MC KEE ROAD	37.30920	-120.44560	USACOE
BDV	BLACK RASCAL DIVERSION	37.33280	-120.39440	USACOE
EBM	EASTSIDE BYPASS BLW MARIPOSA BYPASS	37.20500	-120.69810	DWR
ELN	EASTSIDE BYPASS NEAR EL NIDO	37.14750	-120.60530	DWR
MBN	MERCED R AT SHAFFER BRIDGE NR CRESSY	37.45417	-120.60778	MID
MBH	MERCED R BLW CROCKER-HUFFMAN DAM	37.51500	-120.37000	MID
CRS	MERCED RIVER AT CRESSY	37.42500	-120.66300	DWR
MMF	MERCED RIVER BELOW MERCED FALLS	37.52200	-120.33100	MID
MSN	MERCED RIVER NEAR SNELLING	37.50200	-120.45100	DWR
MST	MERCED RIVER NEAR STEVINSON	37.37100	-120.93100	DWR
SMN	SAN JOAQUIN R ABV MERCED R NR NEWMAN	37.34721	-120.97618	USGS
FFB	SAN JOAQUIN R AT FREMONT FORD BRIDGE	37.30994	-120.93104	USGS
SWA	SAN JOAQUIN R NR WASHINGTON RD	37.11532	-120.58700	DWR
NEW	SAN JOAQUIN RIVER NEAR NEWMAN	37.35049	-120.97715	USGS & DWR
SJS	SAN JOAQUIN RIVER NEAR STEVINSON	37.29500	-120.85100	DWR

4.10.2 Monitoring Frequency

Groundwater level data are collected at the frequency noted in Section 4.5.2. Streamflow data is collected on a more frequent basis, with daily measurement relevant for use in depletion analyses.

4.10.3 Spatial Density

DWR's *Monitoring Networks and Identification of Data Gaps BMP* does not provide specific spatial density guidelines for networks monitoring depletions of interconnected surface water and thus relies on professional judgment on site identification. The depletion monitoring network stations provide an adequate spatial coverage of the Subbasin, allowing for development and calibration of a numerical model to support analysis.

4.10.4 Representative Monitoring

As depletions are managed via a proxy, representative monitoring is completed through the groundwater level sustainability indicator.

4.10.5 Monitoring Protocols

Groundwater level monitoring protocols are discussed in Section 4.5.5. Streamflow monitoring protocols will be followed according to the agencies that implement monitoring. DWR and USGS both follow protocols published in USGS Water Supply Paper 2175 (Rantz, Measurement and Computation of Streamflow: Volume 1. Measurement of Stage and Discharge., 1982a) and (Rantz, Measurement and Computation of Streamflow: Volume 2. Computation of Discharge., 1982b).

4.10.6 Data Gaps

The understanding of depletions of interconnected surface water could be improved through additional depth-discrete groundwater elevation data near some rivers and streams.

4.10.7 Plan to Fill Data Gaps

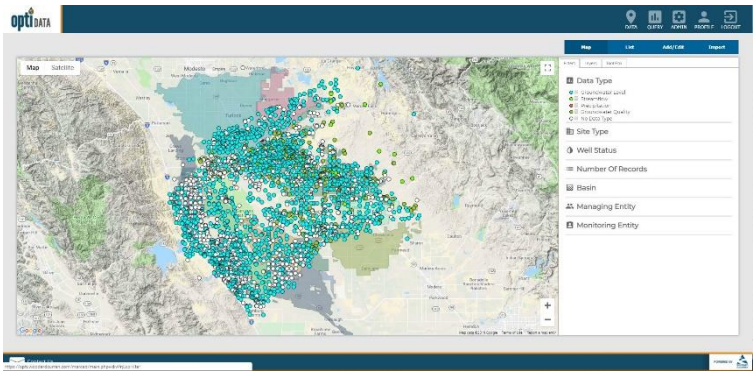
Multi-level monitoring wells may be developed to better characterize conditions near rivers and streams, subject to funding availability.

Within two years of the acceptance of the GSP by DWR, the GSAs will develop a plan to address potential data gaps with a timeline for implementation based on priority and funding availability.

5 DATA MANAGEMENT SYSTEM

5.1 OVERVIEW OF THE MERCED SUBBASIN DATA MANAGEMENT SYSTEM

The Merced Subbasin Data Management System (DMS) is implemented using the Opti platform. The DMS serves as a data sharing portal to enable utilization of the same data and tools for visualization and analysis to support sustainable groundwater management and transparent reporting of data and results.



The DMS is web-based and publicly accessible using common web browsers including Google Chrome, Firefox, and Microsoft Edge. It is a flexible and open software platform that utilizes familiar Google maps and charting tools for analysis and visualization. The site may be accessed here: https://opti.woodardcurran.com/merced

5.2 FUNCTIONALITY OF THE DATA MANAGEMENT SYSTEM

The DMS is a modular system that includes numerous tools to support Groundwater Sustainability Plan (GSP) development and ongoing implementation, including:

- User and Data Access Permissions
- Data Entry and Validation
- Visualization and Analysis
- Query and Reporting

The DMS can be configured for additional tools and functionality as the needs of the Groundwater Sustainability Agencies (GSAs) change over time. The following sections briefly describe the currently configured tools. For more detailed instructions on the usage of the DMS, please refer to the Opti User Guide (see Appendix L).

5.2.1 User and Data Access Permissions

User access permissions are controlled through several user types that have different roles in the DMS as summarized in Table 5-1 below. These user types are broken into three high-level categories:

- System Administrator users manage information at a system-wide level, with access to all user accounts and entity information. System Administrators can set and modify user access permissions when an entity is unable to do so.
- Managing Entity (Administrator, Power User, User) users are responsible for managing their entity's site/monitoring data and can independently control access to this data. Entity users can view and edit their entity's data and view (not edit) shared or published data of other entities. An entity's site information (wells, gages, etc.) and associated data may only be edited by Administrators and Power Users associated with the entity. Note: "Merced Subbasin GSAs", which represents all three GSAs in the Subbasin, is currently configured as the Managing Entity for all datasets.

- Public users may view data that is published but may not edit any information. These users may access the DMS using the Guest Login feature on the login screen.

Monitoring sites and their associated datasets are added to the DMS by Managing Entity Administrators or Power Users. In addition to the user permissions, access to the monitoring datasets is controlled through three options:

- Private data is monitoring data that is only available for viewing, depending on user type, by the entity's associated users in the DMS.
- Shared data is monitoring data that is available for viewing by all users in the DMS (excludes Public Users).
- Public data is monitoring data that is available publicly and can be viewed by all user types in the DMS and may be published to other sites or DMSs as needed.

The Managing Entity Administrators have the ability to set and maintain the data access options for each dataset associated with their entity.

Table 5-1: Data Management System User Types

Modules/Submodules	System Administrators	Entity			Public
		Admin	Power User	User	
Data: Map	●	●	●	●	○
Data: List	●	●	●	●	○
Data: Add/Edit	●	●	●		
Data: Import	●	●	●		
Query	●	●	●	●	○
Admin	●				
Profile	●	●	○	○	○

● Indicates access to all functionality, ○ Indicates access to partial functionality (see explanations in following sections)

5.2.2 Data Entry and Validation

To encourage agency and user participation in the DMS, data entry and import tools are easy to use, accessible over the web, and help maintain data consistency and standardization. The DMS allows Entity Administrators and Power Users to enter data either manually via easy-to-use interfaces, or through an import tool utilizing Excel templates, ensuring data may be entered into the DMS as soon as possible after collection. The data is validated by Managing Entity's Administrators or Power Users using a number of quality control checks prior to inclusion in the DMS.

5.2.2.1 Data Collection Sites

Site information is input for groundwater wells, stream gages, and precipitation meters manually either through the Data Entry tool or when prompted in the Import tool. In the Data Entry tool, new sites may be added by clicking on New Site. Existing sites may be updated using the Edit Site tool. During data import, the sites associated with imported data are checked by the system against the existing site list in the DMS. If the site is not in the existing site list, the user is prompted to enter the information via the New Site tool before the data import can proceed.

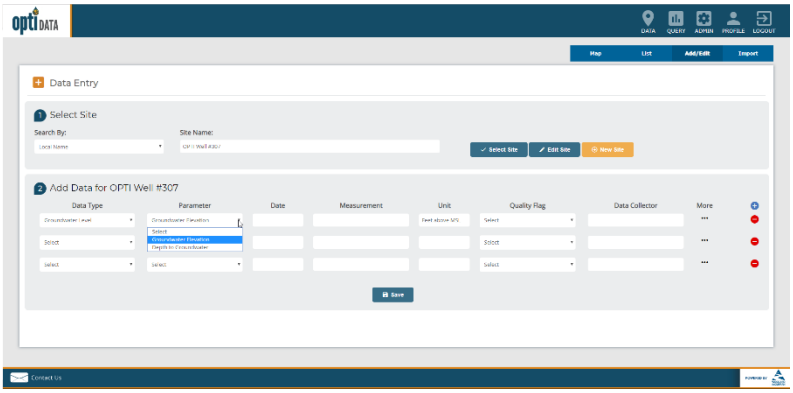
The information that is collected for sites is shown in Table 5-2. Required fields are indicated with an asterisk.

Table 5-2: Data Collection Site Information

Basic Info	Well Info	Construction Info
Site Type*	State Well ID	Total Well Depth
Local Site Name*	CASGEM ID	Borehole Depth
Local Site ID	Ground Surface Elevation	Casing Perforations
Latitude/Longitude*	Reference Point	Casing Diameter
Description	Reference Point Elevation	Casing Modifications
County	Reference Point Location	Well Capacity
Managing Entity*	Reference Point Description	Well Completion Report Number
Monitoring Entity*	Well Use	Comments
Type of Monitoring	Well Status	
Type of Measurement	Well Type	
Monitoring Frequency	Aquifers Monitored	
	Groundwater Basin Name/Code	
	Comments	
	Upload File	

* Required fields; all other fields are optional

5.2.2.2 Monitoring Data Entry



Monitoring data, including but not limited to groundwater elevation, groundwater quality, streamflow, and precipitation, may be input either manually through the Data Entry tool or using templates in the Import tool. The Data Entry tool allows users to select a site and add data for the site using a web-based tool. The following information is collected:

- Data Type (e.g., groundwater elevation, groundwater quality, streamflow, or precipitation)
- Parameter for selected Data Type; units populate based on selection
- Date of Measurement
- Measurement Value
- Quality Flag (e.g., quality assurance description for the measurement such as “Pumping”, “Can’t get tape in casing”, etc., as documented by the Data Collector)
- Data Collector
- Supplemental Information based on Data Type (e.g., Reference Point Elevation, Ground Surface Elevation, etc.)

Data import templates include the same data entry fields and are available for download from the DMS. The Excel-based templates contain drop-down options and field validation similar to the data entry interface.

5.2.2.3 Data Validation

Quality control helps ensure the integrity of the data added to the DMS. The entities that maintain the monitoring data that were loaded into the DMS may have performed previous validation of that data; no effort was made to check or correct that previous validation and it was assumed that all data provided was valid. While it is nearly impossible to determine complete accuracy of the data added to the DMS since the DMS cannot detect incorrect measurements due to human error or mechanical failure, it is possible to verify that the data input into the DMS meets some data quality standards. This helps promote user confidence in the data stored and published for visualization and analysis.

Upon saving the data in the data entry interface or importing the data using the Excel templates, the following data validation checks are performed by the DMS:

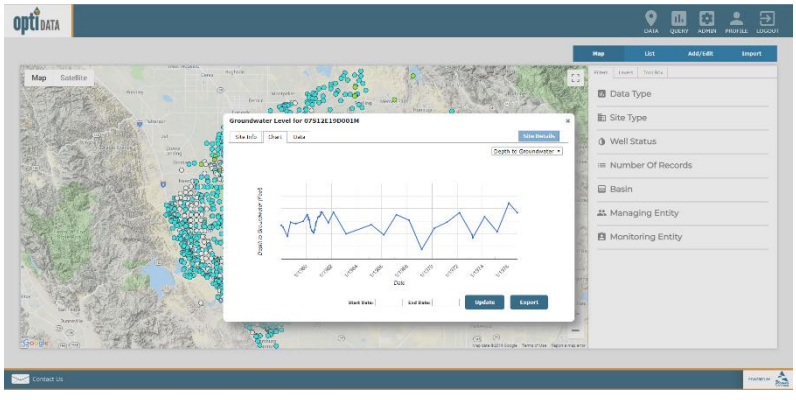
- Duplicate measurements: The database checks for duplicate entries based on the unique combination of site, data type, date, and measurement value.
- Inaccurate measurements: The database compares data measurements against historical data for the site and flags entries that are outside the historical minimum and maximum values.
- Incorrect data entry: Data field entries are checked for correct data type (e.g., number fields do not include text, date fields contain dates, etc.)

Users are alerted to any validation issues and may either update the data entries or accept the values and continue with the entry/import. Users may access partially completed import validation through the import logs that are saved for each data import. The partially imported data are identified in the Import Log with an incomplete icon under the Status field. This allows a second person to also access the imported data and review prior to inclusion in the DMS.

5.2.3 Visualization and Analysis

Transparent visualization and analysis tools enable utilization of the same data and methodologies, allowing stakeholders and neighboring GSAs to use the same data and methods for tracking and analysis. In the Merced DMS, data visualization and analysis are performed in both Map and List views.

5.2.3.1 Map View



The Map view displays all sites (groundwater wells, stream gages, precipitation meters, etc.) in a map-based interface. The sites are color coded based on associated data type and may be filtered by different criteria such as number of records or monitoring entity. Users may click on a site to view the site detail information and associated data. The monitoring data is displayed in both chart and table formats. In these views, the user may select to view different parameters for the data type. The chart and table may be updated to display selected date ranges, and the data may be exported to Excel.

5.2.3.2 List View

The List view displays all sites (groundwater wells, stream gages, precipitation meters, etc.) in a tabular interface. The sites are listed according to site names and associated entities. The list can be sorted and filtered by different criteria such as number of records or monitoring entity. Similar to the Map view, users may click on a site to view the site detail information and associated data. The monitoring data is displayed in both chart and table formats. In these views, the user may select to view different parameters for the data type. The chart and table may be updated to display selected date ranges, and the data may be exported to Excel.

5.2.3.3 Analysis Tools

The Toolbox is available in the Map view and offers Administrative and Entity users access to the Well Tiering tool to support monitoring plan development. The flexibility of the DMS platform allows for future analysis tools, including contouring, total water budget visualization, and management area tracking.

5.2.4 Query and Reporting

The DMS has the ability to format and export data and analysis at different levels of aggregation, and in different formats, to support local decision making and for submission to various statewide and local programs (i.e., Sustainable Groundwater Management Act [SGMA], California Statewide Groundwater Elevation Monitoring Program [CASGEM], Groundwater Ambient Monitoring and Assessment [GAMA], etc.).

5.2.4.1 Ad-hoc Query

The data in the DMS can be queried and reported using the Query Tool. The Query Tool includes the ability to build ad-hoc queries using simple options. The data can be queried by:

- Monitoring or Managing Entity
- Site Name
- Data Type

Once the type of option is selected, the specific criteria may be selected (e.g., groundwater elevation greater than 100 ft.) Additionally, users may include time periods as part of the query. The query options can build upon each other to create reports that meet specific needs. Queries may be saved and will display in the saved query drop-down for future use.

The query results are displayed in a map format and a list format. In both the map and list views, the user may click on a well to view the associated data. The resulting data of the query may be exported to Excel.

5.2.4.2 Standard Reports

The DMS can be configured to support wide-ranging reporting needs through the Reports Tool. Standard report formats may be generated based on a predetermined format and may be created at the click of a button. These report formats may be configured to match state agency requirements for submittals, including annual reporting of monitoring data that must be submitted electronically on forms provided by the Department of Water Resources (DWR).

5.3 DATA INCLUDED IN THE DATA MANAGEMENT SYSTEM

Many monitoring programs exist at both the local and state/federal levels. A cross-sectional analysis was conducted within the basin to document and assess the availability of data within the basin, as well as statewide or federal databases that provide data relevant to the Basin.

The DMS can be configured to include a wide variety of monitoring data types and associated parameters. Based on the analysis of existing datasets within the basin and the GSP needs, the data types shown in Table 5-3 below were identified and are currently configured in the DMS.

Table 5-3: Data Types and Their Associated Parameters Configured in the DMS

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Elevation	Depth to Groundwater	Feet	Yes
	Groundwater Elevation	Feet above MSL	Yes
Groundwater Quality	1,1,1-Trichloroethane	µg/L	Yes
	1,1,2,2-Tetrachloroethane	µg/L	Yes
	1,1,2-Trichloroethane	µg/L	Yes
	1,1-Dichloroethylene	µg/L	Yes
	1,2-Dibromo-3-chloropropane	µg/L	Yes
	1,2-Dichloroethane	µg/L	Yes
	1,2-Dichloropropane	µg/L	Yes
	Alachlor	µg/L	Yes
	Aluminum	mg/L	Yes
	Antimony	µg/L	Yes
	Arsenic	µg/L	Yes
	Atrazine	µg/L	Yes
	Barium	mg/L	Yes
	Barium	µg/L	Yes
	Benzene	µg/L	Yes
	Beryllium	µg/L	Yes
	Bicarbonate	mg/L	Yes
	Cadmium	µg/L	Yes
	Calcium	mg/L	Yes
	Carbofuran	µg/L	Yes
	Carbon tetrachloride	µg/L	Yes
	Chloride	mg/L	Yes
	Dicamba	µg/L	Yes
	Dinoseb	µg/L	Yes
	Endrin	µg/L	Yes
	Fluoride	mg/L	Yes
	Glyphosate	µg/L	Yes
	Heptachlor	µg/L	Yes

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Quality (Continued)	Heptachlor epoxide	µg/L	Yes
	Magnesium	mg/L	Yes
	Manganese	µg/L	Yes
	MBAS	mg/L	Yes
	Methoxychlor	µg/L	Yes
	Molinate	µg/L	Yes
	Nitrate	mg/L	Yes
	Pentachlorophenol	µg/L	Yes
	Picloram	µg/L	Yes
	Potassium	mg/L	Yes
	Sodium	mg/L	Yes
	Sulfate	mg/L	Yes
	Thiobencarb	µg/L	Yes
	Toxaphene	µg/L	Yes
	Dissolved Nitrate	mg/L as N	Yes
	Dissolved Nitrate	mg/L as NO_3	Yes
	1,1-Dichloroethane	TON	Yes
	1,2,4-Trichlorobenzene		Yes
	1,2-Dibromoethane (EDB)	µg/L	Yes
	1,3-Dichloropropene (Total)	mg/L	Yes
	1,4-Dichlorobenzene	µg/L	Yes
	2,4,5-TP (Silvex)	µg/L	Yes
	2,4'-D	µg/L	Yes
	Aluminum - Total	µg/L	Yes
	Antimony - Total	µg/L	Yes
	Apparent Color		Yes
	Arsenic - Total	µg/L	Yes
	Atrazine (Aatrex)	µg/L	Yes
	Barium - Total	µg/L	Yes
	Bentazon	µg/L	Yes
	Benzo(a)pyrene	µg/L	Yes
	Beryllium - Total	µg/L	Yes
	Bicarbonate Alkalinity	µg/L	Yes
	Boron - Total	µg/L	Yes
	Cadmium - Total	µg/L	Yes
	Calcium	NTU	Yes
	Calcium - Total	mg/L	Yes
	Carbonate Alkalinity	µg/L	Yes
	Chloride	µg/L	Yes

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Quality (Continued)	Chromium - Total	µg/L	Yes
	Chromium (Total)	pCi/L	Yes
	Chromium (VI)	µg/L	Yes
	cis-1,2-Dichloroethylene	pCi/L	Yes
	Copper - Total	µg/L	Yes
	Cyanide, Total	µg/L	Yes
	Dalapon	µg/L	Yes
	DBCP	µg/L	Yes
	Di(2-ethylhexyl)adipate	µg/L	Yes
	Di(2-Ethylhexyl)phthalate	µg/L	Yes
	Diquat	µg/L	Yes
	EDB	µg/L	Yes
	Endothall	µg/L	Yes
	gamma-BHC (Lindane)	µg/L	Yes
	Hexachlorobenzene	µg/L	Yes
	Hexachlorocyclopentadiene	µg/L	Yes
	Iron - Total	µg/L	Yes
	Lab Turbidity	NTU	Yes
	Lead - Total	µg/L	Yes
	Magnesium - Total	mg/L	Yes
	Manganese - Total	µg/L	Yes
	Mercury - Total	µg/L	Yes
	Nickel - Total	µg/L	Yes
	Nitrate - N	mg/L	Yes
	Nitrate (as N)	mg/L	Yes
	Nitrate (as N)	µg/L	Yes
	Odor Threshold	TON	Yes
	Oxamyl (Vydate)	µg/L	Yes
	pH		Yes
	Potassium - Total	mg/L	Yes
	Radium 228	mg/L	Yes
	Selenium - Total	µg/L	Yes
	Silica - Total	mg/L	Yes
	Silver - Total	µg/L	Yes
	Simazine (Princep)	µg/L	Yes
	Sodium - Total	mg/L	Yes
	Specific Conductance	umhos/cm	Yes
	Specific Conductance	mg/L	Yes
	Strontium - Total	µg/L	Yes

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Quality (Continued)	TDS	mg/L	Yes
	Technical Chlordane	µg/L	Yes
	Thallium - Total	µg/L	Yes
	Total Alkalinity	mg/L	Yes
	Total Hardness	mg/L	Yes
	Total PCBs	µg/L	Yes
	Uranium - Total	µg/L	Yes
	Vanadium - Total	µg/L	Yes
	Zinc - Total	µg/L	Yes
	TDS	tons/acre-foot	Yes
	NO_3N	mg/L	Yes
	NO_3-N	mg/L	Yes
	Total Nitrate	mg/L as NO_3	Yes
	Total Nitrate	mg/L as N	Yes
	1,2-Dichlorobenzene	µg/L	Yes
	Dissolved Nitrate	mg/L	Yes
	Various Parameters	Various	
Surface Water Quality	Various Parameters	Various	
Streamflow	Streamflow	cfs	Yes
Precipitation	Precipitation	inches	Yes
	Reference Evapotranspiration (ETo)	inches	Yes
	Average Air Temperature	Degrees F	Yes

Additional data types and parameters can be added and modified as the DMS grows over time.

The data was collected from a variety of sources, as shown in Table 5-4 below. Each dataset was reviewed for overall quality and consistency prior to consolidation and inclusion in the database.

The groundwater wells shown in the DMS are those that are included in data sets provided by the monitoring data sources shown below for groundwater elevation and quality. These do not include all wells currently used for production and may include wells historically used for monitoring that do not currently exist. Care was taken to minimize duplicative wells in the DMS. As datasets were consolidated, sites were evaluated based on different criteria (e.g., naming conventions, location, etc.) to determine if the well was included in a different dataset. Datasets for the wells were then associated with the same well, where necessary.

After the data was consolidated and reviewed for consistency, it was loaded into the DMS. Using the DMS data viewing capabilities, the data was reviewed for completeness and consistency to ensure the imports were successful.

Table 5-4: Sources of Data Included in the DMS

Data Source	Datasets Collected	Date Collected	Activities Performed
CV-SALTS (includes data from CDPH, DWR, CVDRMP, GAMA, and USGS)	Well Location Well Type (Limited) Well Depth (Limited) Groundwater Quality	8/13/2018	• Removed duplicate records • Matched existing records with other data sources (GAMA, DWR) • Determined if well was screened above, below, or outside of Corcoran Clay (for wells with depth data)
Central Valley Dairy Representative Monitoring Program (CVDRMP)	Well Location Well Type Groundwater Quality	9/14/2018	• Converted well addresses to Lat/Long • Matched records to wells in CV-SALTS
Department of Water Resources (DWR)	Well Location Well Type Groundwater Quality	9/2018	• Removed duplicate records
HydroDMS	Well Location Well Type Well Depth (Limited) Groundwater Elevation Groundwater Quality	Data collected as part of the 2015 IRWMP	• Determined if well was screened above, below, or outside of Corcoran Clay
Groundwater Ambient Monitoring and Assessment (GAMA) (includes data from DHS, DWR, and USGS)	Well Type Well Location Well Depth (Limited) Groundwater Quality	9/10/2018	• Removed duplicate records • Determined if well was screened above, below, or outside of Corcoran Clay (for wells with depth data)
Local Data (Le Grand CSD, Meadowbrook Water Company, Santa Nella Water District)	Well Type Well Depth Well Location Groundwater Quality	5/2017 - 7/2017	• Tabulated lab results
National Water Information System (NWIS)	Well Type Well Depth (Limited) Well Relation to Corcoran Clay (Limited) Well Location Groundwater Quality	9/2018	• Removed duplicate records • Determined if well was screened above, below, or outside of Corcoran Clay (for wells with depth data)

6 PROJECTS AND MANAGEMENT ACTIONS TO ACHIEVE SUSTAINABILITY GOAL

6.1 INTRODUCTION

This chapter of the Merced Subbasin Groundwater Sustainability Plan (GSP) includes relevant Management Actions and Projects information to satisfy §354.42 and §354.44 of the Sustainable Groundwater Management Act (SGMA) regulations.[17] The first several sections of this chapter focus on Management Actions and describe the framework under discussion for the initial basinwide groundwater pumping allocation. The allocation framework will be established by the Groundwater Sustainability Agencies (GSAs) as a first step in establishing limits on groundwater extraction for the Subbasin that will eventually be implemented and enforced by authority granted under SGMA to the GSAs. The framework also helps establish a clearer understanding of the gap that projects and management actions should fill in balancing supply and demand. Management actions will also include rewarding GSAs based on their extracted volumetric groundwater extraction, since 2015, proportioned to other GSAs in the basin. The Projects and Management Actions described in this chapter will help achieve the Merced Subbasin Sustainability Goal.

6.2 MANAGEMENT ACTIONS

Management Actions are generally administrative, locally implemented actions that the Merced GSAs or member agencies could take that affect groundwater sustainability. Typically, Management Actions do not require outside approvals, nor do they involve capital projects.

6.2.1 Initial Groundwater Allocation Framework

Description: As described in Chapter 1 (Introduction and Plan Area) and Chapter 2 (Basin Setting) of this GSP, the Basin is in overdraft conditions. While the projects identified in later sections of this chapter would increase the water available to users in the Basin, they are not expected to reduce the groundwater overdraft sufficiently to achieve the Basin's sustainability goals. Given these circumstances, the Merced GSAs plan to allocate the sustainable yield of native groundwater in the basin to each GSA and establish groundwater extraction limits. This section describes the initial framework currently under discussion by the GSAs which will be further refined and developed prior to implementation.

Legal Authority: Under SGMA, GSAs have authority to establish groundwater extraction allocations. Specifically, SGMA authorizes GSAs to control groundwater by regulating, limiting, or suspending extractions from individual wells or extractions in the aggregate.[18] SGMA and GSPs adopted under SGMA cannot alter water rights. With input from multiple Stakeholder and Coordinating Committee meeting discussions, the GSAs agreed to use the framework described below as the initial basis for establishing allocations to each GSA with the understanding that work remains to fill data gaps, refine and document sustainable yield and developed supply estimates, and develop the details of implementation for each GSA.

How the Action Will Be Accomplished: The water allocation framework is intended to generally align with water rights concepts and provide an equitable and transparent means to share the Basin's[19] Sustainable Yield. The framework described below outlines a process that deals exclusively with water allocations and does not affect water rights. The steps of the framework are:

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[17] SGMA requirements for GSPs can be read here: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GSP_Emergency_Regulations.pdf

[18] California Water Code § 10726.4(a)(2)

[19] The terms "basin" and "subbasin" are used interchangeably in this GSP chapter (and are interchangeable under the definition in SGMA).

1. Determine the Sustainable Yield of the Basin
2. Subtract groundwater originating from Developed Supply to obtain Sustainable Yield of Native Groundwater
3. Allocate Sustainable Yield of Native Groundwater to GSAs (the specifics of how this will be done, taking into account land area, historical use, appropriative use, and other considerations are still being worked out by the GSAs)

Each step of the framework is described in greater detail below:

1. Determine the Sustainable Yield of the Basin

Per SGMA, Sustainable Yield is "the maximum quantity of water, calculated over a base period representative of long-term conditions in the Basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result."[20] As the first step in the allocation framework, the Sustainable Yield for the Basin was estimated by using the Merced Water Resources Model (MercedWRM) simulations for projected basin conditions and reducing pumping until the long-term average change in storage was zero. This analysis is further described in the Water Budget Information Section, in Section 2.3 of this GSP. Based on this analysis, the Sustainable Yield of the Basin is approximately 570,000 acre-feet per year (AFY).

2. Subtract groundwater originating from Developed Supply to obtain Sustainable Yield of Native Groundwater

A portion of the groundwater in the Merced Subbasin originates as surface water supplies imported from outside the Subbasin. This water belongs to the entities that developed the surface supplies and is referred to in this GSP as "Developed Supply."

> *"Water for which a credit is derived is water from outside the watershed or water which is captured that would have been otherwise lost to the subbasin and which is recharged into the groundwater basin…Assuming no prescriptive rights have attached to imported water used to recharge a basin, the imported water generally belongs solely to the importer, who may extract it (even if the basin is in overdraft) and use or export it without liability to other basin users. There are well defined rules regarding leave behinds to address migration of water necessary to keep the subbasin whole."*[21]

In this step of the framework, the portion of Developed Supply that reaches the groundwater basin is estimated and subtracted from the Sustainable Yield estimate. This results in an estimate of the **Sustainable Yield of Native Groundwater** available for allocation to Basin users.

For this GSP, the Developed Supply reaching the groundwater basin was estimated based on seepage from unlined canals conveying surface water. There are other potential sources of developed supply to the groundwater basin including deep percolation of applied surface water and leakage from lined/piped conveyance.

However, given current available information it is not possible to estimate these flows with confidence at this time. Future refinements of GSP estimates of the developed supplies reaching the groundwater basin may include these and other additional considerations. The full definition and ownership of developed water needs to be agreed upon by GSAs after GSP adoption, future work needed includes developing, refining and documenting estimates of developed supply and determining rights to confirmed estimates of developed supply.

[20] California Water Code §10721(v)

[21] Groundwater Pumping and Allocations under California's Sustainable Groundwater Management Act. 2018. Environmental Defense Fund and New Current Water and Land LLC. Page 3

The agencies that import developed surface water into the Basin and experience seepage due to conveyance via unlined canals are: Merced Irrigation District (MID), Stevinson Water District (SWD), and Turner Island Water District (TIWD). The estimate of Developed Supply reaching the Basin aquifer via seepage from unlined conveyance canals was based on information provided by MID, TIWD, and SWD in early 2019 as shown in Table 6-1.

Table 6-1: Estimated long-term annual average seepage from developed supplies

Water Purveyor	Unlined Canals	Stream Diversions	Seepage Estimate	Data Source
Merced Irrigation District	593 miles	393,000 AFY	121,000 AFY	MID AWMP (2013&2015)
Stevinson Water District	18 miles	17,200 AFY	6,000 AFY	TM prepared by GEI
Turner Island Water District	24 miles	20,600 AFY	3,000 AFY	Email/PDF by LSCE
Total Estimated Seepage of Developed Supply Reaching Groundwater			130,000 AFY	

The long-term annual average seepage shown in the seepage estimate column is used in this chapter to illustrate the water allocation framework.

3. Allocate Sustainable Yield of Native Groundwater to GSAs (the specifics of how this will be done, taking into account land area, historical use, appropriative use, and other considerations are still being worked out by the GSAs)

SGMA does not alter water rights. The process for sharing the Basin's Sustainable Yield was developed to align with water rights concepts to achieve fairness and transparency. While there is no legal determination of overdraft for the Merced Subbasin, DWR has classified the Subbasin as critically overdrafted.

The types of groundwater use being considered in the allocation framework can generally be described as:

Overlying Use (Overlying Rights)

> *"Overlying rights are used by the landowner for reasonable and beneficial uses on land they own overlying the subbasin from which the groundwater is pumped."*[22]

Appropriative Use

> *"…Any party that 1) does not own land overlying the basin, 2) owns overlying land but uses the water on nonoverlying land, or 3) sells the water to another party, or to the public, generally is considered an "appropriator" and not an overlying user…….If a pumper extracts water for a non-overlying use… from an overdrafted basin, the right may ripen into a prescriptive right if the basin overdraft is notorious and continuous for at least five years."*[23]

Prescriptive Rights

> *"A prescriptive right (a groundwater right acquired adversely by appropriators) is acquired by taking*

[22] Groundwater Pumping and Allocations under California's Sustainable Groundwater Management Act. 2018. Environmental Defense Fund and New Current Water and Land LLC. Page 2

[23] Groundwater Pumping and Allocations under California's Sustainable Groundwater Management Act. 2018. Environmental Defense Fund and New Current Water and Land LLC. Page 2 and 3

groundwater adverse to existing right holders for a period of normally 5 years). Prescriptive rights do not accrue until a condition of overdraft exists….If a pumper extracts water for a non-overlying use(i.e., pursuant to an appropriative right) from an overdrafted basin, the right may ripen into a prescriptive right if the basin overdraft is notorious and continuous for at least five years."[24]

The Sustainable Yield of Native Groundwater available for allocation to groundwater users would be approximately:

- Sustainable Yield: ~570,000 AFY
- Developed Supply Reaching Basin: ~130,000 AFY
- **"Native Groundwater" Available for Allocation: ~440,000 AFY**

Some of the next steps needed in first five years of GSP to begin implementation of allocations include:

- Agreeing upon details of how allocations to each GSA will be established
- Developing, refining, and documenting estimates of developed supply and determining rights to confirmed estimates of developed supply
- Determining how pumping will be measured through metering program or equivalent
- Establishing sustainable allocation trading and crediting rules
- Implementation schedule and timing
- Conducting outreach and communications

Time-Table for Initiation and Completion: The time-table for implementation of the basinwide allocation framework is identified in Table 6-2 below.

[24] Groundwater Pumping and Allocations under California's Sustainable Groundwater Management Act. 2018. Environmental Defense Fund and New Current Water and Land LLC. Page 2 and 3.

Table 6-2: GSP Implementation Timeline

2020	2025	2030	2035	2040
Monitoring and Reporting	**Preparation for Allocations and Low Capital Outlay Projects**	**Prepare for Sustainability**	**Implement Sustainable Operations**	
• Establish monitoring network • Install new monitoring wells • Reduce/fill data gaps	• Conduct 5-year evaluation/update • Monitoring and reporting continue	• Conduct 5-year evaluation/update • Monitoring and reporting continue	• Conduct 5-year evaluation/update • Monitoring and reporting continue	
• GSAs allocated initial allocations • GSAs establish their allocation procedures and demand reduction efforts • Develop metering program	• As-needed demand reduction to reach Sustainable Yield allocation • Metering program continues	• As-needed demand reduction to reach Sustainable Yield allocation	• Full implementation demand reduction as needed to reach Sustainable Yield allocation by 2040	
• Funded and smaller projects implemented	• Planning/ design/ construction for small to medium sized projects	• Planning/ design/ construction for larger projects begins	• Project implementation completed	
• Extensive public outreach regarding GSP and allocations	• Outreach regarding GSP and allocations continues	• Outreach continues	• Outreach continues	

The allocation programs for each GSA are expected to be developed in the first 5 years of the GSP. A phase-in between the 2025 - 2035 time horizon is anticipated for all GSAs, with full implementation and enforcement in place by 2040. Implementation of the allocation framework within each GSA is expected to address all relevant sustainability indicators. The framework also provides a basis from which GSAs can better manage groundwater extractions and plan for and implement recharge projects. Evaluation of expected benefits is expected to occur during the 5-year evaluation and updates. The Merced Subbasin GSA will be implementing demand reduction approaches, including early voluntary actions, to ensure its demand reduction goals are achieved by 2040 (see Section 6.2.2).

6.2.2 **Merced Subbasin GSA Groundwater Demand Reduction Management Action**

Description: To balance with the Sustainable Yield of Native Groundwater in the basin, the Merced Subbasin GSA's consumptive use from current pumping will need to decrease substantially. The Merced Subbasin GSA (MSGSA) has evaluated their ability to meet demands within the basinwide Sustainable Yield of Native Groundwater and has recognized there is an annual deficit when compared to current groundwater use. To remedy this deficit and work toward sustainability, the MSGSA plans to implement a demand reduction program to gradually reduce pumping at a consistent annual rate during the 20-year implementation period in order to reach the Native Groundwater allocation objective by 2040. The MSGSA will immediately begin with outreach and educational efforts in 2020 to begin achieving voluntary reductions. Formalized methods to achieve the desired GSA-wide reductions may be in place by 2025. The MSGSA anticipates reductions will incrementally increase annually for the entire MSGSA area, until the total annual reduction achieves the needed balance. Further information on the framework for allocation to each GSA will provide additional data for the MSGSA to determine an approximate annual deficit and necessary demand reductions. Achieving these reductions will likely require the MSGSA to utilize available methods, which may include: establishing a per-acre pumping allocation for water users in the MSGSA, possibly with a trading market; establishing fee structures tied to extracted volumes; and establishing easement or contract programs to pay for reduced groundwater use. During the first years of implementation, the MSGSA Governing Board will evaluate options and adopt necessary approaches. In order to implement a demand reduction program, the MSGSA will be required to develop a mechanism for reporting, monitoring and enforcement of demand reduction actions, likely on a parcel-by-parcel basis.

The potential demand reduction program will be complemented by water supply enhancement projects and efficiency projects conducted within the management area of the MSGSA that seek to increase the available water supply (see "Projects" discussed in the following subsection 6.3).

Measurable Objective: This program would have measurable benchmarks throughout the 20-year implementation horizon. The program may be adaptively managed to reflect the progress of water supply enhancement projects in the MSGSA area, which may result in a recalculation of the estimated reduction target necessary to balance groundwater use.

Public Noticing: This demand reduction program has been considered at public meetings of the MSGSA Governing Board and discussed at meetings of the Merced Groundwater Sustainability Agency Technical and Advisory Committees. The Merced Subbasin GSA anticipates that public outreach and education on the potential structure of the program, as well as feasible monitoring and enforcement mechanisms, would be necessary to enable a successful program. Outreach may include public notices, meetings, potential website presence and email announcements. Initial program implementation will focus on voluntary compliance while the MSGSA considers the necessary elements to begin enforcing the program by 2025.

Permitting and Regulatory Process: Development of a demand reduction program is not a project as defined by the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) and would therefore not trigger either. Reducing pumping over time is also not expected to trigger CEQA or NEPA because it does not meet the definition of a CEQA or NEPA project.

Time-Table for Initiation and Completion: This demand reduction program would start with education and outreach to landowners on the necessary reduction in demand starting in 2020. Voluntary reduction may start in 2020, anticipating reducing demand in the MSGSA area annually by increments. The development of enforcement mechanisms is anticipated to start in 2020, in order to be in place for mandatory reductions starting in 2025. Mandatory reductions may include per-acre groundwater allocations that incrementally decrease as necessary to achieve the MSGSA area reduction target.

Expected Benefits and Evaluation: A demand reduction program is one component of how the MSGSA will achieve sustainable pumping in the GSA's area of the Merced Basin. Implementation and enforcement of a demand reduction program would directly reduce groundwater pumping and reduce consumptive use of the pumped groundwater. Benefits would be measured by the reduction in the total volume of groundwater used within the MSGSA area.

How Project Will Be Accomplished: Desired reductions in groundwater use may be accomplished through the development of a demand reduction program which may include a per-acre groundwater allocation or other tools, fees, reporting, monitoring, enforcement, and management to comply with the anticipated reduction of demand within the MSGSA area. The development of the demand reduction program may include outreach and feedback from stakeholders and MSGSA member agencies, creation of policies and procedures, and establishment of accounting and record-keeping tools.

Legal Authority: The Merced Subbasin GSA has the authority to develop a demand reduction program and may perform implementation and enforcement of potential allocations through metering or other methods to quantify groundwater use, implement annual water accounting, and implement pumping fees. Mechanisms for enforcement would be outlined in the demand reduction program and are expected to be enforced by the MSGSA and/or member agencies.

Estimated Costs and Plans to Meet Costs: Development and initiation of a demand reduction program is expected to cost about $500,000 to conduct the analysis, adopt policies and procedures, establish monitoring and reporting tools, and conduct outreach. This estimate does not include the potential cost to install and maintain meters or other plausible methods to collect necessary groundwater use data. Costs to implement the program would depend on the level of enforcement required to achieve demand reduction and the level of outreach required annually to remind users of their potential allocation for a given year. Annual management of the program is estimated to cost about $200,000 per year.

6.2.3 Domestic Well Mitigation Program

Description: The GSAs will lead the development of a domestic well mitigation program to respond to adverse impacts experienced by domestic well users where regional overdraft conditions occurring after 2015 are causing declining groundwater levels that interfere with groundwater production or quality. Note that the program is not intended to mitigate well issues not caused by regional groundwater conditions nor is it intended to resolve issues related to normal wear and tear.

Based upon the modeling analysis using the determined minimum thresholds, there currently is no indication that a domestic well mitigation program would be necessary in the Merced Subbasin. Regardless, the MSGSA is establishing a fund for this program and will begin coordinating with the other GSAs on its formulation. It is likely that well owners would be required to sign up for the program and a board, committee, or agency staff would review and approve domestic well mitigation claims. The mitigation plan will define the purpose, objectives, roles, responsibilities, requirements, and potential outcomes of the program and will be coordinated with the Merced County SB 552 Drought Plan that is also under development. Any preliminary studies or assessments will be conducted and documented to support development of the mitigation plan. Potential mitigation measures in the plan may include, but are not limited to:

- Short-term solutions in emergencies, such as delivery of bottled water and/or water tanks
- Establishing of threshold triggers to avoid future groundwater production or quality impacts
- Setting well pump at deeper depths, replacement of well pump, or well replacement
- Residence water treatment equipment
- Connection to or development of public water systems to serve impacted communities
- Municipal service connections

- Other relevant projects

Measurable Objective: This management action is expected to benefit the measurable objectives established for the chronic lowering of groundwater levels and degraded water quality sustainability indicators. Anticipated activities will result in avoiding undesirable results for domestic well users as beneficial users of groundwater.

Public Noticing: A domestic well mitigation program would be discussed at public meetings of the MSGSA, MIUGSA, and TIWD GSA-#1 governing boards; relevant GSA committees; and the Subbasin's Stakeholder Advisory Committee and Coordination Committee. It is anticipated that public outreach and education would be necessary for a successful program and to receive input from domestic well users. Outreach may include public notices, meetings, potential website presence, and email announcements.

Permitting and Regulatory Process: Development of a domestic well mitigation program is not a project as defined by the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) and would therefore not trigger either. Required permits and will be obtained and environmental documentation prepared as necessary for wells or other relevant projects related to bringing pressurized groundwater of suitable quality to residences.

Timetable for Initiation and Completion: The GSAs will coordinate on the basic roles and responsibilities of a potential program within the first 5 years of GSP implementation (by 2025), although initiation of a domestic well mitigation program will not occur until there is demonstrated need. Through a current Proposition 218 election that will occur on July 19, 2022, the MSGSA is establishing a fund with a maximum annual collection of $200,000 and a total maximum of $800,000. If approved, this will provide a portion of the near-term funding for the to-be-defined mitigation program. The number of domestic wells dewatered during implementation of the GSP (prior to 2040) is heavily dependent on precipitation and snowpack during that time period. Wet conditions may result in few dewatered wells. However, substantial numbers of domestic wells may be dewatered if prolonged drought occurs during early implementation of the GSP, while project and management actions are still being developed and implemented. The attributes of this management action will be evaluated as monitoring continues through GSP implementation to determine if undesirable results are present. It is not anticipated a domestic well mitigation program will be necessary beyond the GSP implementation period, as the Subbasin is expected to reach sustainability (absence of undesirable results) by 2040.

Expected Benefits and Evaluation: A domestic well mitigation program is expected to benefit domestic well users, including disadvantaged communities, who are experiencing adverse impacts (including financial and/or both water supply and/or quality) as a result of overdraft conditions. In the event this management action is necessary, expected benefits include improved groundwater supply conditions (including water quantity and quality). Benefits would be evaluated by the number of shallow wells impacted and successfully mitigated under this management action.

How Project Will Be Accomplished: Details of how this management action will be accomplished have yet to be determined, though the MSGSA is creating a fund and will be coordinating on this action with the other GSAs. The three GSAs will perform outreach and collect feedback from stakeholders (particularly domestic well users) to develop this program. Program details will be documented in a transparent manner so all interested parties have access to program objectives and requirements.

Legal Authority: The three GSAs have the legal authority per SGMA to perform any act necessary or proper to implement SGMA regulations, thereby allowing the adoption of rules, regulations, ordinances, and resolutions necessary for SGMA implementation (California Water Code § 10725.2).

Estimated Costs and Plans to Meet Costs: Costs to develop and implement a domestic well mitigation program are still being determined, and will depend on the design of the program. Potential funding sources include grants, technical support services, low interest loans, fees, or general funds of the GSAs. The MSGSA intends to approve a new landowner fee in July 2022 that will begin to fund a domestic well mitigation program. Although the roles and

responsibilities of MSGSA, MIUGSA, and TIWD GSA-#1 are still being discussed, the program will place the burden of sharing liability proportionately to the effects of the impact of yet-to-be-determined cumulative volumetric overdraft since January 1, 2015, or other more direct causes if they can be demonstrated to be independent from long term overall groundwater level depletion since January 1, 2015.

6.2.4 Above Corcoran Sustainable Management Criteria Adjustment Consideration

Description: This management action would consider an adjustment to the groundwater level sustainable management criteria for all or a portion of the Above Corcoran Clay Principal Aquifer. The Above Corcoran Clay Principal Aquifer has traditionally seen lower levels of use for water supply. As a result, minimum thresholds in this area are likely to be relatively high, as they are based on fall 2015 levels. A large component of the selection of fall 2015 as the minimum threshold was to limit impacts to domestic well users and to limit impacts of subsidence. Much of the Above Corcoran Clay Principal Aquifer has few domestic wells, and the Above Corcoran Clay Principal Aquifer is not thought to contribute to subsidence.

At the same time, a potential approach to mitigating subsidence impacts in the Below Corcoran Clay Principal Aquifer is to move pumping from below the clay to above the clay.

This management action would consider how the sustainable management criteria could be modified in all or a portion of the area, with consideration of GDEs and depletions of interconnected surface water, among others. Recharge projects may be considered for pairing with increased pumping from above the clay.

Measurable Objective: If undertaken, this management action is expected to benefit the measurable objectives established for the subsidence sustainability indicator. Revised sustainable management criteria could allow for more aggressive actions to address subsidence concerns more rapidly.

Public Noticing: Modifications to sustainable management criteria would be discussed at public meetings of the three GSA governing boards, relevant GSA committees, and the Subbasin's Stakeholder Advisory Committee and Coordination Committee.

Permitting and Regulatory Process: Modifications to sustainable management criteria is not a project as defined by the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) and would therefore not trigger either. No permits would be required.

Timetable for Initiation and Completion: If undertaken, it is likely that the effort would take place prior to 2025, to allow for the development of additional projects to address subsidence.

Expected Benefits and Evaluation: Modifications to sustainable management criteria could allow for more aggressive actions to address subsidence more rapidly, which could result in reduced damage to infrastructure. The value of this would depend on the level of additional action that would ultimately be taken.

How Project Will Be Accomplished: Modifications to sustainable management criteria would be accomplished through modifications to the GSP. This may include establishment of management areas or other approaches to accomplish the desired management within the SGMA framework.

As with the development of the GSP, these modifications would be made through a stakeholder process. The revised GSP would ultimately be adopted by the governing boards of the three GSAs following a public hearing. Ninety days prior to adoption, Merced County and the Cities of Atwater, Merced, and Livingston will be provided notice and the GSAs will review and consider comments received.

Legal Authority: The three Merced Subbasin GSAs have the legal authority per SGMA to amend a groundwater sustainability plan. (California Water Code § 10728.4).

Estimated Costs and Plans to Meet Costs: Costs are anticipated to be approximately $50,000 to $100,000, with the lower range of costs associated with analysis without GSP amendments and the higher range of costs associated with analysis with GSP amendments. Potential funding sources include grants or general funds of the GSAs.

6.3 PROJECTS

Projects were identified through a several month process involving Stakeholder and Coordinating Committees and the general public. This process included a public solicitation process. A template for project submission was created, posted online for the public, and sent to the Stakeholder and Coordinating Committees. This project submission template was also advertised during several committee meetings and remained online for public download on the Merced SGMA website. Project information was received from committee members and interested members of the public. The consulting team additionally reviewed local city plans and projects from the Merced Integrated Regional Water Management Plan Opti database for potentially relevant projects. Project information was compiled into a draft list. This list was discussed and presented during the January and February 2019 committee meetings. Input received from committee members and members of the public was integrated and used to refine the project list into a shortlist of projects for inclusion in the GSP. This shortlist was created on the basis of priorities identified by the public and committee members.

Priorities identified are listed as follows (in no particular order):

- Project addresses Disadvantaged Communities (DACs) and or Severely Disadvantaged Communities (SDACs)
- Project addresses areas with known data gaps (sometimes referred to by Basin stakeholders as the “white areas” as they appear “white” or blank on maps of data)
- Project provides basinwide benefit (i.e., benefits all GSAs)
- Project addresses a subsidence area
- Project focuses on recharge
- Project focuses on conveyance
- Project addresses and or prioritizes drinking water
- Project addresses and or prioritizes water for habitat
- Project focuses on monitoring, reporting, and data modeling activities for data collection to be gathered in first 5 years
- Project provides incentives to reduce pumping and to capture surface water (e.g., including flood flows)
- Project is beyond planning phase
- Project already has a dedicated funding mechanism
- Project identified as priority project by at least one GSA

An additional screening for whether the projects had a "Fatal Flaw" was conducted. A "Fatal Flaw" was defined as a case in which the implementing agency or agency upon whom the project may rely on for surface water identified an overriding issue with the project that would deem it infeasible (e.g., cost ineffectiveness, detrimental to existing surface water supply operations). Projects with Fatal Flaws were eliminated from further consideration and removed from GSP project lists.

These priorities were given equal weight and used as a filter for determining the shortlist. Projects addressing three or more of the above priorities were kept within the shortlist (see Section 6.4), while other projects were put in a current running list to be kept for reference upon request of Stakeholder Committee members and GSA staff (see Section 6.5).

6.4 PROJECTS SHORTLIST

The projects shortlist contains the priority projects as identified using the process described above. This subsection of the GSP satisfies the requirements of California Water Code §354.44, reiterated in the DWR Preparation Checklist for GSP Submittal Guidance. Consistent with SGMA requirements, the project descriptions for short-listed projects contain information regarding:

- the measurable objective that is expected to benefit,
- public noticing,
- permitting and regulatory processes,
- time-table for initiation and completion,
- expected benefits,
- how the project will be accomplished,
- legal authority,
- estimated costs and plans to meet costs
- circumstances for implementation, and
- management of groundwater extractions and recharge.

Table 6-3 provides a summary of the shortlisted projects. Full descriptions are included below.

Table 6-3: Projects Shortlist for Merced Subbasin Groundwater Sustainability Plan*

Project Name	Measurable Objective Expected to Benefit	Expected Benefits (as prioritized by stakeholders)	Current Status	Time-Table (initiation and completion)	Estimated Cost	Permitting and Regulatory Process
Project 1: Planada Groundwater Recharge Basin Pilot Project	Mitigation of chronic lowering of groundwater levels through monitoring & recharge	Basinwide Benefit, Benefit to DACs Recharge, First 5 Years, Beyond Planning Phase, Funded	Planning, to be implemented with DWR Grant Funding	01/01/2020-12/17/2023	$395,292	Requires permit from Merced County Environmental Health
Project 2: El Nido Groundwater Monitoring Wells	Mitigation of chronic lowering of groundwater levels and subsidence through monitoring, and potential water quality improvement	Basinwide Benefit, Benefit to DACs Subsidence, First 5 Years, Beyond Planning Phase, Funded	Planning, to be implemented with DWR Grant Funding	09/01/2018-12/31/2019	$400,000	Requires permit from Merced County Environmental Health
Project 3: Meadowbrook Water System Intertie Feasibility Study	Mitigation of chronic lowering of groundwater levels through surface water use, potential applicability to all sustainability indicators through alternatives evaluation	Basinwide Benefit, Benefit to DACs First 5 Years, Beyond Planning Phase, Funded	Planning	08/2019-06/2020	$100,588	No permitting or regulatory process required (feasibility study)
Project 4: Merquin County Water District Recharge Basin	Mitigation of chronic lowering of groundwater levels through monitoring & recharge	Benefit to DACs, GSA Priority, Recharge, First 5 Years, Beyond Planning Phase	Planning/Initial Study	08/07/2018-12/15/2021	$1,400,000	Initial study to determine CEQA compliance and
Project 5: Merced Irrigation District to Lone Tree Mutual Water Company Conveyance Canal	Mitigation of chronic lowering of groundwater levels and subsidence through in lieu recharge	White Areas, Subsidence, Conveyance, Water for Habitat	Conceptual	05/19-11/2020	$3-6,000,000	No permitting or regulatory process anticipated outside of County Encroachment and potential Streamed Alteration Permit
Project 6: Merced IRWM Region Climate Change Modeling	Supports all sustainability indicators through enhanced data availability	Basinwide Benefit, White Areas, First 5 Years	Design	06/01/2019-4/30/2021	$250,000	None required.
Project 7: Merced Region Water Use Efficiency Program	Supports all sustainability indicators through reduced water demand	Basinwide Benefit, Benefit to DACs, White Areas	Design	06/01/2019-12/31/2020	$500,000	None required.
Project 8: Merced Groundwater Subbasin LIDAR	Supports all sustainability indicators through enhanced data availability	Basinwide Benefit, White Areas, First 5 Years	Planning/Initial Study	08/2019-12/2020	$150,000	None required.
Project 9: Study for Potential Water System Intertie Facilities from MID to LGAWD and CWD	Mitigation of chronic lowering of groundwater levels through enhanced surface water supply	Benefit to DACs, Conveyance, GSA Priority, First 5 Years	Design Complete	06/01/2019-06/01/2020	$100,000	Environmental Impact Report will be required in addition to various permits from Merced County for construction phase
Project 10: Vander Woude Dairy Offstream Temporary Storage	Mitigation of chronic lowering of groundwater levels through enhanced surface water supply and potential recharge	Recharge, First 5 Years, Beyond Planning Phase	Planning/Initial Study & Conceptual Design	05/2018-05/2020	$750,000	None required. Private land with water right and outlet
Project 11: Mini-Big Conveyance Project	Mitigation of chronic lowering of groundwater levels through enhanced surface water supply	Conveyance, Recharge, GSA Priority	Planning	06/2022-06/2026	$ 6-8,000,000	Initial study for CEQA. County permitting for encroachment, construction, and other building permits
Project 12: Streamlining Permitting for Replacing Sub-Corcoran Wells	Mitigation of chronic lowering of groundwater levels through monitoring	Basinwide Benefit, First 5 Years, Subsidence	Planning	8/01/20190-01/31/2020	$75,000	None required.

*Information provided by project proponents.

Note from MID: Local project sponsors (e.g., LTMWC, LGAWD, etc.) anticipate that surface water sourced from the Merced Irrigation District may be available through temporary water purchase and sale agreements and may serve as a water supply for the project(s). It is understood that the Board of Directors for the Merced Irrigation District has and shall retain full and absolute discretion regarding whether and when it will enter into temporary water purchase and sale agreement(s), if any, and further, nothing contained in this document creates in any party or parties any right to water controlled by the Merced Irrigation District whether it be surface water or groundwater. Any transferred water made available by MID shall be limited by the terms and conditions contained in any respective temporary water purchase and sale agreement.

Project 1: Planada Groundwater Recharge Basin Pilot Project

Description: The Planada Groundwater Recharge Basin Pilot Project is a three-year pilot project to construct a groundwater recharge basin in the Planada area, an SDAC that is completely reliant on groundwater. The project addresses a demonstrated need for greater groundwater monitoring and data collection for potential recharge projects, particularly within this SDAC area.

A nested multiple depth monitoring well will be installed on the pilot site. The wells will be designed and installed to meet multiple purposes of monitoring groundwater benefits from recharge activities as well as serving as long-term monitoring locations for CASGEM and the GSP. A flow meter will also be installed on the MID delivery assembly to enable the amount of water reaching the recharge basin to be quantified. An evapotranspiration pan and precipitation gage will be installed to account for these components of the water budget when estimating recharge.

Measurable Objective: This project works toward the mitigation of chronic lowering of groundwater levels in the Merced Subbasin by enhancing monitoring efforts and investigating opportunities for recharge basin development.

Public Noticing: As part of disseminating information to the general public, MID will post project updates to its website. These updates will also be provided to the other Basin GSAs and ultimately the GSP webpage so that they may also publish updates on appropriate websites. Additional noticing for the public will take consistent with permitting requirements.

Permitting and Regulatory Process: The project is categorically exempt for purposes of compliance with CEQA. An application for the State General Permit for low threat discharges to land will also be submitted. It is also anticipated the project will need a Merced County well construction permit for the cone penetration test at both sites and the monitoring well at the site of the recharge basin. Permit applications for the cone tests will be prepared and submitted to the Merced County Department of Environmental Health along with the associated fees prior to conducting these tests. Once the preliminary site investigation is complete, a permit application for the monitoring well will be prepared and submitted to the Merced County Department of Environmental Health along with the associated fees. No well drilling or installation activities will begin prior to receipt of the permit for the monitoring well.

Time-Table for Initiation and Completion: The project is funded and currently in permitting. The 3-year study is expected to start by 2020.

Expected Benefits and Evaluation: Groundwater basin recharge will be an important component of the GSP; this pilot program will provide information critical to establishing long-term Basin sustainability, while directly benefitting an SDAC that needs a sustainable groundwater supply.

How Project Will Be Accomplished: The responsible agency for the project is MID with funding from DWR. The project examines two candidate sites for the pilot recharge basin and will conduct two to four cone penetration tests (CPTs) to examine subsurface materials suitable for recharge. The selected site will be excavated to reach a suitable layer of material for recharge. The site currently receives MID surface water deliveries.

Legal Authority: The three Merced Subbasin GSAs (Merced Irrigation-Urban Groundwater Sustainability [MIUGSA], MSGSA, and Turner Island Water District Groundwater Sustainability Agency #1 [TIWD GSA-1]) have the authority to develop recharge projects and will perform implementation and monitoring within this project through metering and water accounting.

Estimated Costs and Plans to Meet Costs: The estimated cost for this project is $395,000. Costs for this project are met through Proposition 1 Funding through DWR.

Project 2: El Nido Groundwater Monitoring Wells

Description: The El Nido Groundwater Monitoring Wells project is comprised of installing monitoring wells in and near the community of El Nido that will improve the understanding of stratigraphy and groundwater conditions in the area and improve ongoing monitoring of water elevation and water quality. Two sites will each have up to three monitoring wells installed in the same borehole, to allow monitoring at different depth intervals. Aquifer-specific information provided by the project is important for understanding the three-dimensional movement of water and understanding the causes of land subsidence, a key driver for the implementation of this project. Monitoring wells installed in this project will greatly assist data collection and developing an enhanced understanding of causes of subsidence and movement of groundwater. This information helps improve management and reevaluation of extraction and recharge activities.

Measurable Objective: The project addresses measurable objectives for water level and subsidence by enhancing monitoring efforts, especially for areas prone to subsidence. To the extent the project improves understanding of groundwater movement three-dimensionally in the Basin, it will also help address measurable objectives for water quality.

Public Noticing: As part of disseminating information to the general public, MID will post project updates to its website. These updates will also be provided to the other Basin GSAs and ultimately the GSP webpage so that they may also publish updates on appropriate websites. A draft technical memorandum (TM) will be prepared describing the location and design of the observation wells, well cluster installation, and groundwater monitoring activities including the data gathered during the monitoring event. The draft will be circulated to MID and the GSAs in the Subbasin for review and comment. Based on comments received, the final TM will be prepared. The final document will be made available to all stakeholders and the general public via MID's website and distributed to the Department of Water Resources (DWR) and GSAs within the Merced, Chowchilla, and Delta-Mendota Subbasins.

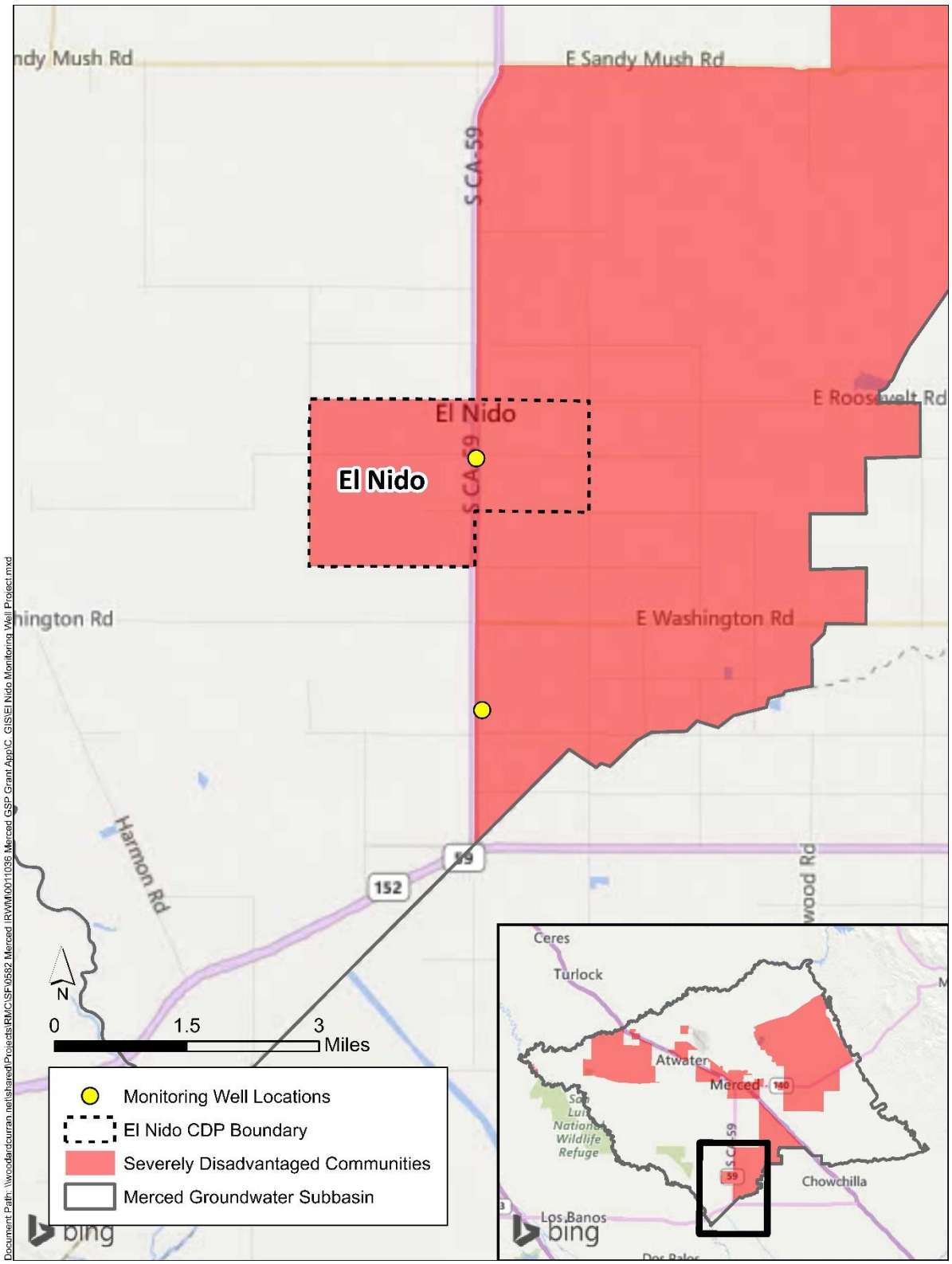
Permitting and Regulatory Process: Permit applications will be prepared and submitted to the Merced County Department of Environmental Health along with the associated fees. A CEQA Notice of Exemption may be prepared and filed with the County Clerk/Recorder's Office and the State Clearinghouse as a Class 6 Categorical Exemption pursuant to State CEQA Guidelines Section 15306 (Information Collection).

Time-Table for Initiation and Completion: The project is expected to start by 1 September 2019 and end December 2019.

Expected Benefits and Evaluation: The project will provide crucial information to better understand water movement and causes of land subsidence in this area. The project also directly benefits a SDAC.

How Project Will Be Accomplished: MID has identified two sites for the monitoring wells and has gained approval to use the sites. Two areas within the El Nido area have been identified for monitoring (Figure 6-1): Fire Station (located in the center of the El Nido community) and Vander Dussen (located in the southern portion of the community, between the community and the center of nearby subsidence). These sites are located approximately 2.3 miles apart, which is consistent with the monitoring well densities identified in DWR's *Monitoring Networks and Identification of Data Gaps BMP*, which indicated monitoring well densities between 0.2 and 10 wells per 100 square miles. Monitoring wells spaced on a grid 2.3 miles apart would result in a density of 19 wells per 100 square miles. This density is slightly above the DWR guidance but is appropriate for the El Nido area due to the groundwater subsidence and other issues in the area. This project does not rely on water provided from outside the jurisdiction of the agency.

Figure 6-1: Location of Proposed Monitoring Well Clusters



Legal Authority: The three Merced Subbasin GSAs (MIUGSA, MSGSA, and TIWD GSA-1) have the authority per SGMA to develop monitoring projects.

Estimated Costs and Plans to Meet Costs: The estimated cost for this project is $400,000. Costs for this project are met through Proposition 1 Funding through DWR.

Project 3: Meadowbrook Water System Intertie Feasibility Study

Description: The Meadowbrook Water System Intertie Feasibility Study includes activities necessary to complete a feasibility study for an intertie between the water systems of the Cities of Atwater and Merced, and the Meadowbrook Water System (Meadowbrook), an SDAC that relies entirely on groundwater. This Intertie Feasibility Study will consider potential connection between the water systems of Meadowbrook, the City of Atwater, and the City of Merced for use in emergencies or for future potential connections to serve or supplement demands for Meadowbrook customers. Data collection and review of alternatives will support use of surface water to replace groundwater use, reducing reliance on and overall extraction of groundwater resources.

Measurable Objective: This project addresses direct needs of SDAC areas, specifically ensuring emergency supplies for the Meadowbrook Water System. The feasibility study supports establishing and improving surface water connections to these areas, which would relieve pressure on groundwater resources that currently serve as the only supply source. Evaluation of alternatives that could reduce reliance on groundwater supplies benefits the sustainable groundwater management of the Basin and helps in meeting measurable objectives for all sustainability indicators (water level, water quality, subsidence, and depletion of interconnected surface waters.)

Public Noticing: Three stakeholder outreach meetings will be held during development of the Intertie Feasibility Study to inform stakeholders about project progress and solicit feedback. A draft TM will be circulated to MID, the City of Merced, the City of Atwater, Meadowbrook, and the other Basin GSAs for review and comment. Based on comments received, the consultant will prepare the final TM. The final document will be made available to all stakeholders and the general public via MID's website. The Draft Intertie Feasibility Study will be made available to stakeholders, including groundwater users and the general public, for review and comment through MIUGSA website and the anticipated GSP website. A 30-day public comment period will begin with the third public meeting. Comments on the Draft Intertie Feasibility Study received from stakeholders during the 30-day public review period will be incorporated to produce a Screencheck Final Intertie Feasibility Study. The Final Feasibility Study will be made available to all stakeholders and the general public via the MIUGSA and the anticipated GSP websites and will be distributed to DWR and GSAs within the Merced, Chowchilla, and Delta-Mendota Subbasins.

Permitting and Regulatory Process: This project does not require any permits or other regulatory approvals.

Time-Table for Initiation and Completion: This project is expected to start in August 2019 and end in June 2020.

Expected Benefits and Evaluation: Meadowbrook relies solely on groundwater to serve its customers, which are also categorized as an SDAC. This Intertie Feasibility Study will consider potential connection between the water systems of Meadowbrook, the City of Atwater, and the City of Merced for use in emergencies or for future potential connections to serve or supplement demands for Meadowbrook customers. MID is the applicant for this project.

How Project Will Be Accomplished: The needs and potential uses for the intertie, including emergency supply, system redundancy, fire suppression needs, and potential future connections will be evaluated. Based on this evaluation and in coordination with the City of Atwater, City of Merced, and Meadowbrook, MID will select the preferred purpose of the intertie. Up to five options including the identification of potential connection sites, pipeline alignments and sizes, and high-level preliminary cost estimates and a TM will be prepared. Once the preferred alternative is selected an Administrative Draft Intertie Feasibility Study that includes this alternatives analysis will be prepared.

The Feasibility Study will provide additional background information, develop a more detailed cost estimate, and conduct a preliminary environmental evaluation of potential impacts that may be used to determine the potential environmental compliance documentation that may be required for implementation of the intertie. A list of potential permits, as well as challenges to implementation will be included, along with a preliminary funding plan that identifies opportunities to fund implementation. The Intertie Feasibility Study will also include recommended next steps to move towards implementation.

Legal Authority: The three Merced Subbasin GSAs (MIUGSA, MSGSA, and TIWD GSA-1) have the authority per SGMA to develop feasibility projects.

Estimated Costs and Plans to Meet Costs: The estimated costs for this project are valued at $100,588. Costs for this project are met through Proposition 1 Funding through DWR.

Project 4: Merquin County Water District Recharge Basin

Description: The Merquin County Water District (MCWD) recharge basin would be constructed in the northeastern portion of the District to enhance the groundwater levels in the area. The MCWD relies on its existing irrigation wells during short water years and during the off season when surface flows are not available to meet demand from the customers of the District. Given these circumstances, a recharge basin is proposed for an area that is at the intersection of 1st Street and Van Cliff Road. There are open parcels at this location and the parcels can receive water for the Pump Ditch that is connected to the Eastside Canal. The parcels in this location are presently receiving irrigation water and have soil types of Delhi loamy sand (DdA) and Hilmar loamy sand (HhA), both soils have good infiltration rates. These suitable soils potentially provide opportunity for increasing recharge in the Subbasin.

Measurable Objective: This project helps address chronic lowering of groundwater levels in the Merced Subbasin by creating new recharge basins and installing monitoring wells.

Public Noticing: The MSGSA anticipates that public outreach would include multiple public workshops and meetings, potential website presence or email announcements, along with other public notices for the workshops.

Permitting and Regulatory Process: Project proponents anticipate that an initial study will be conducted for purposes of compliance with CEQA. The project may require a grading permit from Merced County for the excavation of the basin.

Time-Table for Initiation and Completion: The time-table below describes the dates for the different project phases.

Table 6-4: Time-table for Merquin County Water District Recharge Basin

Schedule Phase	Start Date	End Date
Planning	08/07/2018	01/16/2019
Design/Engineering	06/10/2019	08/30/2019
Environmental Documentation	07/16/2019	01/24/2020
Permitting	11/20/2019	03/31/2019
Acquisition of Rights-of-Way	03/31/2020	05/15/2020
Development of Financing	11/15/2019	04/15/2020
Construction/Implementation	05/15/5050	09/15/2020
Environmental Mitigation Efforts	05/15/2020	11/16/2020
Post Project Monitoring	11/16/2020	12/15/2021

Expected Benefits and Evaluation: The project will benefit direct recharge to the Subbasin and enhance monitoring networks through the installation of monitoring wells. The benefit to the Basin will be the injection of surface waters into the aquifer to help raise groundwater levels and improve or maintain the water quality of the Basin. The community of

Stevinson does not have a central water distribution system and both residential and agricultural needs use groundwater to meet their annual water demands. There is surface water that comes into the region that is used for part of the year by agriculture. The maintenance of the groundwater Basin to continue the accessible supply at a reasonable cost with the required water quality is important to the community to meet their needs within the available costs range for the DAC. The recharge basin will provide new water to the Basin through the capture and recharge of storm water, this will aid in the areas ability to maintain the groundwater Basin levels during dry years. The flows into the Basin will also reduce the volume of runoff flows.

How Project Will Be Accomplished: Prior to construction of the basin in MCWD will get permission for access to a parcel and conduct preliminary infiltration tests to determine if the parcel is suitable for a recharge basin. Pending testing, the parcel will be acquired by MCWD and then the construction of the recharge basin will begin. The parcels in the area are mostly 20 acre parcels, basin size approximately 18 acres in surface area. The basin would be filled when surface water is available in wet years or during storm flows in the winter from the drainage flow in the Eastside Canal. Monitoring wells would be installed to monitor the groundwater levels.

Note from MID: Local project sponsors (e.g., Lone Tree Mutual Water Company [LTMWC], Le Grand Athlone Water District [LGAWD], etc..) anticipate that surface water sourced from the MID may be available through temporary water purchase and sale agreements and may serve as a water supply for the project(s). It is understood that the Board of Directors for the MID has and shall retain full and absolute discretion regarding whether and when it will enter into temporary water purchase and sale agreement(s), if any, and further, nothing contained in this document creates in any party or parties any right to water controlled by the MID whether it be surface water or groundwater. Any transferred water made available by MID shall be limited by the terms and conditions contained in any respective temporary water purchase and sale agreement.

Legal Authority: The Merced Subbasin GSA has authority per SGMA to develop and support projects for groundwater recharge.

Estimated Costs and Plans to Meet Costs: The estimated costs for this project are valued at $1,400,000. Costs for this project are expected to be met through pursuit of further grant funding, private funding, and funding raised through MSGSA.

Project 5: Merced Irrigation District to Lone Tree Mutual Water Company Conveyance Canal

Description: LTMWC is seeking to establish a new 2.25 mile long canal connection from an existing MID canal to an existing canal within the LTMWC system. The capacity of the canal to be constructed would be 60 cubic feet per second (cfs) and the potential delivery would be 20-24,000 AFY. The project would benefit 1020 acres in the Sandy Mush Mutual Water Company service area that are entirely dependent on ground water by providing access to surface water from the canal which would cross the acreage in route to LTMWC. LTMWC has 11,574 acres which are significantly dependent on groundwater in all but above average rainfall years. In addition, LTMWC is situated on the northern border of acreage being annexed into the Clayton Water District and said acreage is entirely dependent upon groundwater. Given these circumstances, LTMWC could implement the project to wheel surface water into Clayton Water District for usage in lieu of groundwater use, or for groundwater recharge. The project addresses management of groundwater extraction and recharge through in lieu recharge by switching groundwater demand to surface water in a white area of the Subbasin.

Measurable Objective: The project supports mitigation of chronic lowering of groundwater levels through in lieu recharge, and also benefits reduction of subsidence through reduced groundwater pumping.

Public Noticing: The MSGSA and LTMWC anticipate that public outreach would include multiple public workshops and meetings, potential website presence or email announcements, along with other public notices for the workshops.

Permitting and Regulatory Process: The project proponents anticipated permitting requirements to be unlikely outside of a Merced County encroachment permit for crossing Sandy Mush Road. A potential additional permit is a Streamed Alteration Permit at Deadman Creek.

Time-Table for Initiation and Completion: The project is anticipated to run from May 2019 through November 2020. The project will be in planning and design phase from May through mid-summer 2019 with the preliminary engineering of two potential routes and subsequent selection of one route. This is followed by negotiation with landowners for easements, which is expected to be complete before end of 2019. Construction is anticipated to be complete by November 2020.

Expected Benefits and Evaluation: This project has several benefits including supporting reduction of groundwater pumping by providing in lieu recharge opportunities. Benefits also include support for flood control, specifically for the Lower San Joaquin Flood control project. Subsidence reduction is addressed due to reduced groundwater pumping in an area that has exhibited significant subsidence to date. This addresses public safety due to the Lower San Joaquin Flood control project running through the area to be serviced by the canal. The flood systems' capacity has been severely reduced by subsidence to date and projections by DWR forecast further losses in capacity. This system is also being utilized by the San Joaquin River Restoration Program for the return of salmon to the San Joaquin River. The subsidence affects the flow characteristics of the channel, slowing the flow and resulting in warmer water which is a negative impact on salmon survivability. In addition, the new conveyance frees up more capacity in MID's existing El Nido system which is capacity impacted at the present time for other white area users.

How Project Will Be Accomplished: LTMWC is the submitting agency working in cooperation with the Merced Subbasin GSA. Other participating agencies include MID (water source), Sandy Mush MWC (possible recipient) and Clayton W.D (possible recipient). LTMWC would create a 2.25 mile long canal connection from an existing MID canal to an existing canal within the LTMWC system. The project begins at the junction of the Benedict Canal and Deadman Creek on Gurr Road and proceeds south for slightly over 2 miles to the boundary of LTMWC (1.5 miles south of Sandy Mush Road and ¾ mile west of Combs Road).

Note from MID: Local project sponsors (e.g., LTMWC, LGAWD, etc..) anticipate that surface water sourced from the Merced Irrigation District may be available through temporary water purchase and sale agreements and may serve as a water supply for the project(s). It is understood that the Board of Directors for the MID has and shall retain full and absolute discretion regarding whether and when it will enter into temporary water purchase and sale agreement(s), if any, and further, nothing contained in this document creates in any party or parties any right to water controlled by the MID whether it be surface water or groundwater. Any transferred water made available by MID shall be limited by the terms and conditions contained in any respective temporary water purchase and sale agreement.

Legal Authority: The Merced Subbasin GSA has authority per SGMA to develop and support projects for conveyance and potential in lieu recharge, as well as projects which reduce subsidence in the Subbasin.

Estimated Costs and Plans to Meet Costs: The estimated costs for this project are between $3,000,000 - $6,000,000. Costs for this project are expected to be met through pursuit of further grant funding, private funding, and funding raised through MSGSA.

Project 6: Merced IRWM Region Climate Change Modeling

Description: This project will link the existing MIDH2O (Merced Irrigation District Hydrologic and Hydraulic Optimization) planning model, developed by the MID, with models developed by DWR's Flood-MAR (Flood-Managed Aquifer Recharge) program, to models developed by the NASA's ASO (Airborne Snow Observatory) for the Merced Basin, and to the Merced's IWFM groundwater model. The MIDH2O model will explore the potential range of climate change impacts to the Merced Region including impacts to water supply, groundwater yield, and the effectiveness of various

alternatives designed to help the region adapt to those anticipated changes. By linking the models, the Region can examine alternative water development and management options under a variety of climate change conditions to facilitate and efficiently evaluate multiple future scenarios. Several potential future scenarios will be assembled to the MIDH2O model and simulate a range of future climate changes. These scenarios will be simulated with different potential alternatives of water projects to evaluate the effectiveness in adapting to the climate changes. The results will help fill data gaps and inform the Region as to which projects can perform best in terms of adaptive management. Results will also identify areas where additional or different projects should be recommended to meet future needs. This project includes funding to complete a groundwater well survey for MID.

Measurable Objective: Supports all sustainability indicators through enhanced data availability for the entire Merced Subbasin area and beyond.

Public Noticing: There are no public noticing requirements for this project.

Permitting and Regulatory Process: Environmental documentation is not required for this project. No permits are required for this project.

Time-Table for Initiation and Completion: The project is expected to run from 1 June 2019 to 30 April 2021.

Expected Benefits and Evaluation: This project primarily addresses availability of water supply and climate conditions for projected future scenarios to assist project portfolio effectiveness. The project will inform the Region of the best methods and approaches for land use planning and management in response to climate change, promoting natural resource protection and improvement.

How Project Will Be Accomplished: This project links existing the MID developed Merced River MIDH2O model with the Flood-MAR system model. The purpose of this linkage is to explore the range of climate change impacts the Region may experience. This project does not rely on water provided from outside the jurisdiction of the agency.

Legal Authority: The three Merced Subbasin GSAs (MIUGSA, MSGSA, and TIWD) have the authority per SGMA to develop data collection projects to the benefit of the Subbasin and in working toward achieving the sustainability goal.

Estimated Costs and Plans to Meet Costs: Estimated costs for this project are $250,000. Cost are anticipated to be met through IRWM grant funding or through other grants.

Project 7: Merced Region Water Use Efficiency Program

Description: The Merced Subbasin, the Merced Region Water Use Efficiency Program will be implemented by multiple water purveyors in the Region to increase the level of water conservation & ensure long-term water use efficiency by the regions urban and agricultural users. The program promotes water management strategies that support the state's goal of a 20 percent reduction in urban per-capita water use by 2020 and will do so in a way that is beneficial to DACs in the region. This program will assist management of groundwater extractions through reducing overall water demand.

Measurable Objective: Reducing water demand should reduce the amount of groundwater pumped, thereby helping mitigate chronic overdraft of groundwater.

Public Noticing: The project will involve conducting water surveys throughout the Region, which will engage and enable maintaining effective communication among water resource stakeholders in the Region. Notification processes with the public will also be dependent upon the implementing water purveyors and agencies.

Permitting and Regulatory Process: No permitting or regulatory processes are anticipated for this project.

Time-Table for Initiation and Completion: The time-table below describes the dates for the different project phases.

Table 6-5: Time-table for Merced Regional Water Use Efficiency Program

Schedule Phase	Start Date	End Date
Design/Engineering	06/01/2019	12/31/2020
Development of Financing	06/01/2019	12/31/2020
Construction/Implementation	06/01/2019	12/31/2020
Post Project Monitoring	06/01/2019	12/31/2020

Expected Benefits and Evaluation: Implementing water conservation measures will help reduce water demands, offsetting potable water supplies and helping ensure water demands are met in the future. The project will help address climate change adaptation and mitigation by reducing water demands and offsetting existing potable water supplies and reducing energy use in treating and delivering water supplies to existing users. Reducing water consumption will effectively leave water in the Basin (rather than being diverted or pumped to meet water user demands), improving surface and groundwater quality. A portion of the project will target DACs.

How Project Will Be Accomplished: The Program consists of four components: (1) interior water efficiency fixture retrofits, primarily targeted at DACs; (2) exterior single family water use surveys & upgrades; (3) exterior water use surveys & upgrades for large landscapes, including CII & residential agriculture landscapes; and (4) the preparation of water use budgets for accounts with dedicated landscape meters. The retrofits for households located in DACs are subsidized because DACs are often unable to afford the upfront capital to participate in rebate-based conservation programs. This project does not rely on water provided from outside the jurisdiction of the agency.

Legal Authority: The submitting agency is Merced Integrated Regional Water Management Authority (MIRWMA) as well as the following project proponents: City of Merced, Merced Irrigation District, City of Atwater, City of Livingston, Meadowbrook Water Company, Le Grand CSD, Planada CSD, Stevinson Water District, Winton Water & Sanitary District, Turner Island Water District, Merquin County Water District, Chowchilla Water District. Legal authority is granted within the powers of the local agencies to implement the Water Use Efficiency Program at their local level (within their respective jurisdiction).

Estimated Costs and Plans to Meet Costs: Estimated costs for this project are $250,000. Cost are anticipated to be met through individual implementing purveyor or agency funds as well as seeking of grant funding.

Project 8: Merced Groundwater Subbasin LIDAR

Description: This project consists of Light Detection and Ranging (LIDAR) data of the Merced Groundwater Subbasin. This data will be used in conjunction with weather forecast data to predict local stormflows from rainfall events. The data will be tied to MID's proposed real time modeling of Bear, Black Rascal, and Burns Creeks. Accurate forecasting of local storm flows in the groundwater Basin is critical to prevent localized flooding, which has occurred with regularity throughout the Basin. Given this circumstance and the many potential benefits identified in the expected benefits section below, this project will prove useful in providing critically needed data for the Subbasin. It will also be used for implementation of future Flood-MAR projects, which work to improve overall management of groundwater recharge in the Subbasin.

Measurable Objective: Supports all sustainability indicators through enhanced data availability for the entire Merced Subbasin area and beyond.

Public Noticing: Outreach for this project will span flood emergency agencies such as the Merced County Office of Emergency Services and farmers or landowners in the Merced Subbasin. Interested communities and water users

interested in recharge will work through their respective service districts, and groundwater sustainability agencies in the process of communicating with MID.

Permitting and Regulatory Process: No permitting or regulatory processes are anticipated for this project.

Time-Table for Initiation and Completion: The anticipated timeline for this project is August 2019 to December 2020.

Expected Benefits and Evaluation: Improved forecasting of localized storms will allow maximization of Flood-MAR projects, promoting direct recharge and correcting groundwater overdraft conditions. Accurate prediction of local storm flow (which are predicted to intensify with climate change) can be used to protect public safety as dangerous flow forecast information can be shared with public safety officials. This project would help public safety officials and planners in determining what areas are threatened by forecasted storms and take the necessary precautions to prevent damage and flooding. Flooding of urban areas often results in trash, sewage, oil, and other pollutants being discharged into the creek system. Additionally, this will help manage storm flows for recharge. This project will assist in management of runoff from agricultural areas, urban areas, and undeveloped areas as well as provide recharge for the benefit of all groundwater users. Flood-MAR projects supported by this project can also create habitat for waterfowl and thereby promote associated recreation.

How Project Will Be Accomplished: LIDAR data would be collected through standard procedures including flyby using remote sensing technology. This information would be shared with submitting agencies. This project does not rely on water provided from outside the jurisdiction of the agency.

Legal Authority: The three Merced Subbasin GSAs (MIUGSA, MSGSA, and TIWD GSA-1) have the authority per SGMA to develop data collection projects to the benefit of the Subbasin and in working toward achieving the sustainability goal.

Estimated Costs and Plans to Meet Costs: Estimated costs for this project are $150,000. Costs are anticipated to be met through pursuit of regional level grant funding. Mariposa County Resource Conservation District is putting together a LIDAR grant for through Cal Fire, some of this area is in the Merced Subbasin. Project proponents are coordinating with Mariposa County Resource Conservation District in contributing to these efforts and to provide LIDAR coverage for the rest of the Subbasin. Cost are anticipated to be met through IRWM grant funding or through other grants.

Project 9: Study for Potential Water System Intertie Facilities from MID to LGAWD and CWD

Description: Under this project MID, LGAWD and Chowchilla Water District (CWD) would investigate the feasibility of improving and constructing water conveyance facilities to allow the temporary transfer of water from MID to LGAWD and CWD.

Measurable Objective: This project addresses mitigation of chronic lowering of groundwater levels through enhanced surface water supply.

Public Noticing: An Initial Study or other appropriate document may be prepared for purposes of compliance with CEQA at the appropriate time.

Permitting and Regulatory Process: Project proponents do not anticipate the need for permitting or other regulatory approvals at this time. Permits/approvals will be obtained, if needed.

Time-Table for Initiation and Completion: The project is anticipated to begin 1 June 2019 and be complete by 1 June 2020.

Expected Benefits and Evaluation: This project will allow CWD to deliver surface water to its water users and to recharge the groundwater by percolating it in planned CWD groundwater recharge basins. The project would provide

for diversion of flood waters to the canal, reducing flooding and providing surface water to reduce groundwater overdraft in the area. The project would help alleviate drought impacts. Specifically, because in-lieu and direct groundwater recharge would elevate groundwater levels within the Merced and Chowchilla Subbasins, it would address the risk of not meeting existing drinking and agricultural water demands once the project is constructed. The project will improve groundwater conditions impacting the SDAC communities of Le Grand and Planada.

How Project Will Be Accomplished: A study was performed by Tolladay, Fremming & Parson (TFP) for the Bureau of Reclamation (USBR) in 2001 in conjunction with Friant Water Users Authority/NRDC litigation settlement efforts to determine the feasibility, at a reconnaissance level, of increasing the capacity of some of MIDs distribution system and constructing a conveyance system from MIDs system to CWD, based on the ability to deliver alternative volumes of 7,500 AF and 15,000 AFY. The TFP study outlined six alternatives, as well as investigating a few combinations of alternatives. Chowchilla Water District is the submitting agency. A preliminary topographic survey would be performed to gather data on portions of two of the proposed alignments south of the Planada Canal and one south of the Fancher Lateral. A hydraulic analysis of the conveyance system utilizing HEC-RAS computer software would be utilized to bring alternative amounts of water to the districts. A cost analysis for the various options would be prepared.

Local project sponsors (e.g., LTMWC, LGAWD, etc.) anticipate that surface water sourced from the Merced Irrigation District may be available through temporary water purchase and sale agreements and may serve as a water supply for the project(s). It is understood that the Board of Directors for the Merced Irrigation District has and shall retain full and absolute discretion regarding whether and when it will enter into temporary water purchase and sale agreement(s), if any, and further, nothing contained in this document creates in any party or parties any right to water controlled by the Merced Irrigation District whether it be surface water or groundwater. Any transferred water made available by MID shall be limited by the terms and conditions contained in any respective temporary water purchase and sale agreement.

Note from MID: Local project sponsors (e.g., Lone Tree MWC, Le Grande-Athlone WD, etc..) anticipate that surface water sourced from the Merced Irrigation District may be available through temporary water purchase and sale agreements and may serve as a water supply for the project(s). It is understood that the Board of Directors for the Merced Irrigation District has and shall retain full and absolute discretion regarding whether and when it will enter into temporary water purchase and sale agreement(s), if any, and further, nothing contained in this document creates in any party or parties any right to water controlled by the Merced Irrigation District whether it be surface water or groundwater. Any transferred water made available by MID shall be limited by the terms and conditions contained in any respective temporary water purchase and sale agreement.

Legal Authority: The MIUGSA and Merced Subbasin GSA have authority per SGMA to develop and support projects for enhancing surface water supply to reduce groundwater extraction.

Estimated Costs and Plans to Meet Costs: Estimated costs for this project are $100,000. Costs are anticipated to be met through pursuit of grant funding opportunities, and potentially relevant GSA operating funds.

Project 10: Vander Woude Dairy Offstream Temporary Storage

Description: This project proposes to take a 50-acre field out of production and build a reservoir on that site. It will be approximately two feet below grade with 10-foot embankment built above grade. The reservoir would be used for temporary off-stream storage of irrigation water. and recharge.

Measurable Objective: This project addresses mitigation of chronic lowering of groundwater levels through enhanced surface water supply and potential recharge.

Public Noticing: No public noticing procedure is anticipated for this project.

Permitting and Regulatory Process: No permitting or regulatory process required. Project sits on private land (Merced County APN 065-110-032) with existing water right (A005386) and diversion outlet on Duck Slough.

Time-Table for Initiation and Completion: The project is anticipated to run for a duration of two years from May 2018 to May 2020 and has already started.

Expected Benefits and Evaluation: The project will improve storage capacity and to reduce reliance on groundwater resources for irrigation purposes. The project also provides opportunity for possible recharge.

How Project Will Be Accomplished: The project will be located North of Duck Slough (aka Mariposa Creek) approximately ¼ mile west of Highway 59. A soil investigation will be completed shortly to determine suitability. All water in and out of the reservoir will be metered. It is anticipated that the project will enable utilization of 500 to 1,000 AF of surface water to offset pumping.

Note from MID: Local project sponsors (e.g., Lone Tree MWC, Le Grande-Athlone WD, etc..) anticipate that surface water sourced from the MID may be available through temporary water purchase and sale agreements and may serve as a water supply for the project(s). It is understood that the Board of Directors for the MID has and shall retain full and absolute discretion regarding whether and when it will enter into temporary water purchase and sale agreement(s), if any, and further, nothing contained in this document creates in any party or parties any right to water controlled by the MID whether it be surface water or groundwater. Any transferred water made available by MID shall be limited by the terms and conditions contained in any respective temporary water purchase and sale agreement.

Legal Authority: SMMWC under the Merced Subbasin GSA has authority per SGMA to develop and support projects for enhancing storage of surface water to reduce groundwater use, and for projects that provide opportunities for groundwater recharge.

Estimated Costs and Plans to Meet Costs: Estimated costs for this project are $750,000. Costs have been met within the first year through private funding. Private funding will continue, although opportunities for grant funding are anticipated to be pursued.

Project 11: Mini-Big Conveyance Project

Description: LGAWD is currently working with Cal Poly's Irrigation Training & Research Center to assess the feasibility of constructing a conveyance facility from MID's Booster 3 Lateral to Deadman, Little Deadman, and Dutchman Creeks in the eastern portion of LGAWD. The initial feasibility and economic analysis indicate that the project is viable. The project could provide up to ~150 cfs of surface water to approximately 15,000-acres within LGAWD. Research with Cal Poly will provide an evaluation of MID's upstream system to identify flow constraints that LGAWD may be able to remedy through this project. This project would be a separate improvement district within LGAWD. It is expected that the water conveyed through this project would be delivered primarily during the early and late shoulder seasons (off-peak).

Measurable Objective: This project would address mitigation of chronic lowering of groundwater levels through enhanced surface water supply.

Public Noticing: Project proponents anticipate that public outreach may include potential public workshops and meetings, potential website presence or email announcements, along with other public notices for the workshops. Public noticing will also comply with requirements of the applicable permitting and regulatory processes.

Permitting and Regulatory Process: Project proponents anticipate that an initial study will be conducted for purposes of compliance with CEQA. The project will require the acquisition of land and easements. It is also anticipated that the project will be subject to potential County permits for encroachment, among other construction and building permits.

Time-Table for Initiation and Completion: It is anticipated that time will be needed for discussion and negotiations with MID. The project would likely begin in mid-2022 (June 2022), with the first year focused on acquiring permits. The project build out is anticipated to be completed within 3 years of acquiring proper permitting, bringing estimated end date to approximately June 2026.

Expected Benefits and Evaluation: Enhanced conveyance and surface water availability, which is anticipated to reduce reliance on groundwater resources.

How Project Will Be Accomplished: The canal or pipeline would start east of Le Grand and attach near the Mitchell Lateral by MID's Booster Lateral 3. The canal would require major capacity enhancements to the existing MID conveyance system. The conveyance system would serve the upper and middle portions of LGAWD, along with the eastern data gap areas of the Subbasin. The project would be comprised of three legs. The project would place in-lieu recharge at the head waters of the Subbasin. The system would intersect two areas conducive to recharge. This includes one recharge opportunity at Mariposa Creek and an additional portion of land about 200-500 ft. by approximately three miles long. The latter recharge option is comparable to a retention basin close by, which has proven successful. Constructing a single leg would feature a flow rate of 37 to 50 cfs per day (with maximum water at 27,000 to 35,000 AF). Practical consumption is 9,000 to 13,000 AF off-peak. Supply is estimated at 6,000 acres at 1.5 AF/acre. The project would supply surface water to LGAWD, Plainsburg Irrigation District, Sandy Mush Mutual Water Company and other lands currently without an adequate surface water supply.

Note from MID: Local project sponsors (e.g., Lone Tree MWC, Le Grande-Athlone WD, etc.) anticipate that surface water sourced from the Merced Irrigation District may be available through temporary water purchase and sale agreements and may serve as a water supply for the project(s). It is understood that the Board of Directors for the MID has and shall retain full and absolute discretion regarding whether and when it will enter into temporary water purchase and sale agreement(s), if any, and further, nothing contained in this document creates in any party or parties any right to water controlled by the MID whether it be surface water or groundwater. Any transferred water made available by MID shall be limited by the terms and conditions contained in any respective temporary water purchase and sale agreement.

Legal Authority: LGAWD under the Merced Subbasin GSA has authority per SGMA to develop and support projects for enhancing surface water supplies to reduce groundwater use.

Estimated Costs and Plans to Meet Costs: Estimated costs for this project range between $6,000,000 to $8,000,000. Costs are anticipated to be met through grant funding and an improvement district with LGAWD.

Project 12: Streamlining Permitting for Replacing Sub-Corcoran Wells

Description: Subsidence is a major issue of concern in the southern parts of the Merced Subbasin. In order to combat subsidence, local stakeholders are considering shifting groundwater production from deeper wells below the Corcoran Clay, to the shallower, unconfined aquifer. Current understanding of subsidence suggests that such relocation of groundwater pumping to the shallower aquifer would contribute to reducing the amount of subsidence in the area. However, it is not currently known if such a relocation would result in other impacts to groundwater or beneficial users of groundwater.

Under the Groundwater Mining and Export Ordinance of Merced County, Ordinance No. 1930, drilling a new well and moving production between aquifer systems requires a new well permit from the county. The permitting process and associated environmental process requires an understanding of impacts from the well, including the possibility that the well may have a significant effect on the environment. Cumulative effects of past, present, and reasonably foreseeable probable future wells must also be understood. The purpose of this project is to provide technical information on

cumulative impacts of the shifting of groundwater production from below the Corcoran Clay to above the Corcoran Clay to support Merced County's permitting and environmental processes.

Measurable Objective: This project works toward meeting the measurable objective for the chronic lowering of groundwater levels sustainability indicator by moving pumping from the stressed deeper aquifer into the shallower, unconfined aquifer, which can be more readily managed through recharge projects. The project also works towards reducing subsidence, helping the subbasin achieve the measurable objective for the land subsidence sustainability indicator.

Public Noticing: The MSGSA anticipates that this project would result in a technical memorandum available to the public upon request.

Permitting and Regulatory Process: This project streamlines the required permitting of groundwater wells under the Merced County Ordinance No. 1930, Groundwater Mining and Export Ordinance.

Time-Table for Initiation and Completion: The technical analysis is expected to take approximately three to five months and may be completed and available for use in evaluating groundwater well permits as soon as early 2020.

Expected Benefits and Evaluation: The project will benefit impacts to subsidence by shifting groundwater production from the lower aquifer to the shallow aquifer in the Subsidence Area. The project will also benefit groundwater levels by moving production from the deeper aquifer to the shallower aquifer, in that the deeper aquifer is more stressed and more difficult to recharge because of the Corcoran Clay and the shallower aquifer is less stressed and easier to recharge.

How Project Will Be Accomplished: Merced County will work with an engineering firm to conduct an analyses to evaluate the potential impacts of moving groundwater production wells from below the Corcoran Clay to above the Corcoran Clay. The analysis will include the delineation of the portion of the county to be identified as the Subsidence Area for use in the analysis, data review including the evaluation of existing information, reports, and other materials to support the analysis, review of the available groundwater models to determine the suitability for scenario development and impact analysis, groundwater extraction impact analysis, including groundwater modeling with a multi-layer model simulation of both confined (below the Corcoran Clay) and unconfined (above the Corcoran Clay) aquifers, along with groundwater-surface water interaction, and the development of a technical memorandum to describe the work performed and results.

Legal Authority: The County of Merced holds the permitting authority for groundwater wells in the unincorporated portion of Merced County under the Groundwater Mining and Export Ordinance of Merced County, Ordinance No. 1930.

Estimated Costs and Plans to Meet Costs: The estimated costs for this project are valued at $70,000 to complete a technical analysis of the cumulative impacts. The estimated duration of the project is three to five months. The County of Merced may assume the costs of this project.

6.5 PROJECTS RUNNING LIST

At the request of GSA board members and stakeholders, the Merced Subbasin GSP also contains a running list of potential projects to be revisited on an as-needed basis. These are not intended to be taken directly as projects submitted to DWR as part of the official list of GSP projects. This list only provides a reference for potential future projects, should GSP priorities and available funding mechanisms align. The running list of projects is provided in Table 6-6 below.

Table 6-6: Projects Running List for Reference

Project Name	Submitting Agency	GSA	Brief Description	Current Status	Estimated Cost
Project 13: Planada Northwest 2019 Water System Improvement Project	Planada Community Services District (2018 IRWMP)	MIUGSA	The proposed project focuses on upgrades to the Planada Community Service District's (District) water distribution system to ensure consistent water delivery to residents of the community. Improvements include: replacement of undersized water lines in the northwestern part of town, with current thin-wall plastic 2", 3" and 4" diameter water lines upsized to 8" diameter Class 900 PVC pipe; upgrading old-style water meters to radio-read meters that have better leak-detection capabilities and can better track water usage and water wasting in the community; replacement of water main valves that are beyond their useful life and no longer operate or do not open and close all the way.	Design	$ 2,184,198
Project 14: Water Efficiencies Rebate Program	City of Merced (2018 IRWMP)	MIUGSA	This proposal's goals are to save water and energy by awarding rebates to customers for upgrading to water efficient appliances. Water efficient new appliances will be rebated as follows: $100 per dish washer, $100 per clothes washer, $50 for converting toilets to ultra-low flow models of 1.6 gpf or less and new pool covers will also be rebated at $50 or 50% of the purchase price, whichever is less. Water conservation is needed to meet state mandates for 20% reduction by 2020. Many older homes have large water consuming appliances and this benefit will help our community to upgrade. By upgrading old appliances to water conserving devices, the customer can reduce water consumption and save energy without changing habits. This project will aid water users in the disadvantaged community of the City of Merced.	Conceptual	$ 100,000
Project 15: Merced Irrigation Flood-MAR Canal Automation	Merced Irrigation District (2018 IRWMP)	MIUGSA	Merced Irrigation District is proposing automation of certain facilities to enhance Flood-MAR capabilities and expand areas which can be recharged with stormwater events. The project consists of automating certain facilities including but not limited to the Washington Lateral, Northside Canal, Livingston Canal, Le Grand Canal, Caton Lateral, Escaladian Canal, Hammett Lateral, Atwater Canal, Cressey Lateral, and Arena Canal. Currently these canals have manual structures which require frequent human adjustment and inputs to safely manage flows. By automatizing these facilities, the district will be able to safely accommodate volatile and unpredictable storm flows while keeping canal levels high enough for Flood-MAR purposes. Additionally, this project will better manage surface water diversions and increase distribution efficiency by reducing spills.	Conceptual	$ 6,500,000
Project 16: Livingston Canal Lining Project	Merced Irrigation District (2018 IRWMP)	MIUGSA	The project will line a portion of the canal section of the Livingston Canal through the City of Atwater. The Livingston Canal is both a stormwater facility and irrigation facility.	Construction	$ 3,100,000
Project 17: Well 20 TCP Treatment	City of Atwater (2018 IRWMP)	MIUGSA	Redesign and install treatment for 1,2,3-TCP at Well 20 in the City of Atwater. Currently Well 20 has been drilled but nothing else has been done since there was found to be high levels of 1,2,3-TCP during pump testing. Well 20 used to be the second highest producing well in the city until high levels of manganese and iron were found due to the well being drilled too deep. A new hole was drilled on the same lot but needs additional money to cover cost of installing water treatment. City suffers from poor water pressure during summer at peak usage hours due to well not being online.	Conceptual	$ 3,000,000
Project 18: Cash for Grass Pilot Program to Eliminate Wasteful Pollution Containing Water Run-off	City of Merced (2018 IRWMP)	MIUGSA	Purpose of project is to educate about storm drains carrying pollution to creeks and begin a pilot program in the City of Merced to rebate water customers for converting their grass landscape into water efficient xeriscape with water efficient changes to their irrigation systems to eliminate pollution containing run-off. Xeriscape refers to landscaping in ways that reduce or eliminate the need for supplemental water from irrigation. Polluted run-off from urban landscapes goes into storm gutters and drains which flow to creeks; primarily Bear Creek and Black Rascal Creek. Excess irrigation of turf leads to increased water consumption, increased costs, it depletes our water supply and its run-off pollutes creeks. The program will serve to educate the public about storm water pollution and rebate them for converting grass and old irrigation systems into qualifying xeriscape with water efficient drip irrigation systems that will pollute less and save more water. Pollution in our creeks is a threat to public health, enjoyment, and the natural beauty of our urban waterways. In 1993, the City of Merced passed a water conservation ordinance and allows only limited irrigation along with prohibitions on wasting water and causing harmful pollution containing run-off. This pilot program will help eliminate pollution containing run-off from entering into local creeks and serve to beautify the community and promote water conserving irrigation practices. The City of Merced is an economically disadvantaged community and with the stimulus these rebates provide the water customers can add value to their property with landscape/xeriscape upgrades and via the conversion to water saving drip irrigation systems. The project will ultimately lead to decreased polluted storm water and trash flowing into our urban waterways. Additionally, the water customers will benefit by the rebate and the long-term benefits will be decreased water consumption. (addresses DACs and water quality)	Design	$ 65,680
Project 19: Black Rascal Creek Flood Control Project	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District) (2018 IRWMP)	MIUGSA, MSGSA	Construction of a regulating reservoir on the Black Rascal Creek Watershed. Project location is immediately north of Yosemite Avenue and Arboleda Drive in northeast Merced. Project will provide protection against a 200-year storm event and will provide much needed flood control on the currently unprotected Black Rascal Creek Watershed. Project will be beneficial to the project area and also to all downstream areas. The reservoir will maintain a deadpool for wildlife purposes. During the flood season, the reservoir will act primarily as a flood control retarding basin. During the irrigation season, the reservoir will regulate irrigation flows thereby increasing Merced Irrigation District system water efficiency without impacting power generation scheduling at New Exchequer Dam with the Independent System Operator (ISO).	Design	$ 35,761,703
Project 20: Black Rascal Creek Flood Control Bypass/ Supplemental Groundwater Supply Improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District) (2018 IRWMP)	MIUGSA, MSGSA	This project proposes a set of gates in MID's Le Grand Canal to replace the breach, which is installed annually, allowing MID to redirect and control flood flows. The Le Grand Canal contributes up to 600 CFS of floodwater to Black Rascal creek. This proposed control structure can also be utilized to send flood flows on alternate, longer routes creating an artificial offset to the timing of peak storm flows as well as permit storm flows to be directed to alternate creeks and artificial groundwater recharge areas.	Planning	$ 1,000,000

Project Name	Submitting Agency	GSA	Brief Description	Current Status	Estimated Cost
Project 21: Study or a pilot recharge basin project on Canal Creek	Amsterdam Water District	MSGSA	Amsterdam Water District, a new district in the MSGSA, has a project for either a study or a pilot recharge basin project on Canal Creek. This project is still in an early phase.	Planning	NA
Project 22: Permitting and Characterization of Merced River Water for Potable Water Supply	City of Livingston (2018 IRWMP)	MIUGSA	This project is for the City of Livingston. This project consists of obtaining sufficient year-round water quality information to determine the feasibility of using Merced River Water to augment the City's groundwater domestic water supply. The project will also include preparing the required environmental documentation to obtain the necessary permits to obtain water from the Merced River. The City prepared a feasibility study to construct a horizontal collector well. The report concluded that a horizontal collector well would produce adequate water quantity.	Conceptual	$ 325,000
Project 23: Weather Based Irrigation Controllers	City of Merced (2018 IRWMP)	MIUGSA	This project is for the purchase and installation of Toro Sentinel Controllers for parks irrigation systems in the City of Merced. The Toro Sentinel Controllers are weather based irrigation controllers. The City began to use the Toro Sentinel Controllers in 2011 and currently has 68 units in the parks and maintenance districts. This powerful, yet simple-to-use controller software is ideal for large sites such as cities as it allows a user to control up to 999 field satellites from a remote location with a desktop or laptop computer. The City has a need for approximately 100 more units. The controllers can remotely shut off water, change irrigation times, days, and set alarms for stations if malfunctions occur such as power outages or extreme flows. Having the Toro Sentinel Controllers reduces manual labor and travel time from controller to controller and most importantly aids in water efficiency as the controller automatically adjusts for changes in weather.	Ongoing Program	$ 540,000
Project 24: Brasil Recharge Project	Bob Kelley, Merced Subbasin GSA/Stevinson Water District	MSGSA	Project would consist of pumping station and conveyance piping 8500' from existing canal to upgradient lands on property owned by Mike Brasil, 18246 1st Ave. Stevinson, CA 95374. Existing lands are leveled to accept recharge water in a 35-acre dedicated basin and networked into existing irrigation pipelines to allow flood irrigation on 360 acres of adjacent contiguous land both east and west of Van Clief Rd. and north of 1st Ave. and west of Griffith Rd. Water would be received in wet years (not dry years) Project Owner is Mike Brasil. Other Participating Agencies (if applicable) include Stevinson Water District. Project Location is 18246 1st Ave. Stevinson, CA 95374 and includes 35-acre Recharge Basin and 360 acres of adjacent land owned by Mike Brasil east and west of Van Clief Rd. north of 1st Ave. and west of Griffith Rd. Phase details: Planning and Initial Study complete. Conceptual Design and Design in process. Existing canal facilities and pumping stations are in place. Upgrading to size of pumps and motor upon completion of design. Determination of size of conveyance piping upon completion of design. NOE for environmental review as project is and will continue existing use as dairy farming land. Funding: Should grant funding be available fine, otherwise private funding. Timing: Likely to be implemented in 2023.	Conceptual Design	$ 300,000
Project 25: Mariposa Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District) (2018 IRWMP)	MIUGSA	The enlargement of Mariposa Reservoir and downstream levee and channel improvements would increase the level of flood protection to Planada and Le Grand, both of which are DAC's in Merced County. Mariposa Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This project would meet the requirements of the new flood control legislation.	Planning	$ 15,000,000
Project 26: Owens Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District) (2018 IRWMP)	MIUGSA	Owens Reservoir was constructed in the early 1950's as an element of the Merced Streams Group Project authorized by Congress's 1944 Flood Control Act. The Flood Control Act of 1970 called for three additional flood control reservoirs, enlargement of existing reservoirs, and 52 miles of levee and channel modifications. To date only one additional reservoir has been built (Castle Dam). The enlargement of Owens Reservoir and downstream levee and channel improvements would increase the level of flood protection to Planada and Le Grand, both DAC's. Owens Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This project would meet the requirements of the new flood control legislation.	Planning	$ 15,000,000
Project 27: Atwater-McSwain Regulating/Recharge Basin	Merced Irrigation District (2018 IRWMP)	MIUGSA	The project entails construction of a regulating/recharge basin. The basin will be excavated, and automated inlet and outlet gates will be constructed along with the necessary flow measurement and control. The overall footprint of the project site is estimated at 20 acres, and the basin will occupy approximately 15 acres. The project will provide groundwater recharge in the area to increase supply and also serve as a regulating reservoir to be use by MID operations personnel.	Planning	$ 3,300,000
Project 28: Rice Field Pilot Study Monitoring Wells	Merced Irrigation District (2018 IRWMP)	MIUGSA	This Project entails construction of at least 3 groundwater monitoring wells to evaluate the efficacy of MID's rice field recharge pilot project.	Planning	$ 250,000
Project 29: Water Meter Conservation Project	City of Atwater (2018 IRWMP)	MIUGSA	Install water meters at connections that feed the biggest lots in the City of Atwater. Currently the City of Atwater has 1/3 of their connections on water meters. Most of these our homes built after 1992 and have smaller lot sizes. The homes with bigger lot sizes are currently not charged based on their water consumption, just on a flat rate. The City would like to install meters on these lots to assist with better billing and better water conservation. It would also help the City with their annual report for water loss.	Design	$ 800,000
Project 30: Real Time Simulation Flood Control Modeling - Bear Creek	Merced Irrigation District (2018 IRWMP)	MIUGSA	This project consists of modeling Bear, Black Rascal, and Burns Creeks. These three creeks (or the confluence of them) run through the City of Merced and have historically caused flooding to the area. The real time simulation model (RTS) would utilize HEC-RAS and HEC-HMS modeling software. The ability to run real time simulations will improve the ability to forecast flood flows and flood events. This forecasting will be critical in utilizing flood flows for FLOOD-MAR projects in the area. Additionally, it will enable MID to be better prepared for flood flows which happen during the irrigation season. Excess surface water is often conservatively spilled in anticipation of a rain event that occurs during the irrigation season due to lack of forecasting information.	Conceptual	$ 100,000

Project Name	Submitting Agency	GSA	Brief Description	Current Status	Estimated Cost
Project 31: Crocker Dam Modification	Merced Irrigation District (2018 IRWMP)	MIUGSA, MSGSA	This project encompasses installation of automatic gates at MID's Crocker Dam, located just west of Merced at the bifurcation of Black Rascal Creek and Bear Creek. The automatic gates would allow for MID to remotely operate the dam and adaptively manage the flows in Bear Creek/Black Rascal Creek. This would provide improved flood control downstream, water storage, and be a supply for groundwater recharge from stormwater (Flood-MAR).	Conceptual	$ 1,240,000
Project 32: East Pike Recharge Basin	GBRK LLC & Stevinson Water District	MSGSA	Submitting Entity is GBRK LLC, PO Box 818 Newman, CA 95360. Other Participating Agencies include Stevinson Water District. Project includes a 35-acre dedicated basin and networked into existing irrigation facilities to allow flood irrigation on 360 acres of adjacent contiguous land. Water conservation measures including drip irrigation are planned as a part of irrigation efficiencies programs. District incentive programs available. 600 AF/Y of captured storm event run off in above average rainfall year from SWD distribution facilities, East Side Canal. Project will require a low lift pump station of 10 cfs design capacity. Project location is on SWD lateral, Highline. Only requirement is pump station and construction of recharge basin. Landowner currently experiences significant seepage loss of surface water and would like to increase water efficiencies and use groundwater in dry season or during periods of insufficient surface water. Project location: 781 Lander Ave. Stevinson, CA 95374 within the Stevinson Water District. The 35-acre dedicated recharge basin is located 1500' west of Hwy 165 and 2000' north of San Joaquin River in Stevinson. APN No 055-250-006. Financing: project will secure private financing.	Planning/Initial Study & Conceptual Design	$ 50,000
Project 33: East Purdy Recharge Basin	Flying H Partners LLC & Stevinson Water District	MSGSA	Submitting Entity is Flying H Partners LLC. Other Participating Agencies include Stevinson Water District. Project includes 35-acre dedicated basin and networked into existing irrigation facilities to allow flood irrigation on 360 acres of adjacent contiguous land. Water conservation measures including drip irrigation are planned as a part of irrigation efficiencies programs. District incentive programs available. 600 AF/Y of captured storm event run off in above average rainfall year from SWD distribution facilities, East Side Canal. Project will require a low lift pump station of 10 cfs design capacity. Project location is on SWD lateral, Highline. Only requirement is pump station and construction of recharge basin. Landowner currently experiences significant seepage loss of surface water and would like to increase water efficiencies and use groundwater in dry season or during periods of insufficient surface water. Project location 1232 S. Van Clief Rd. Stevinson CA 95374. 20 acre dedicated recharge basin located 2600' east of Sixth Ave. and Van Clief Rd. in Stevinson, CA 95374. APN 055-238-049. Financing: project will secure private financing	Planning/Initial Study & Conceptual Design	$ 50,000
Project 34: TIWD GSA-1 Merced GSP Projects Reservoir	Larry Harris, TIWD GSA-1	TIWD GSA-1	Evaluate the construction of a reservoir to hold excess waters that arrive in our area during the rainy season for later use during the irrigation season. TIWD GSA-1 is working with MID on this. Estimation of footprint 600 acres. Banks less than 12ft. (7 or 8ft bank). Flood flows and flows from MID would be captured. (catch winter, off season flows to use during the summer). Estimated Project Life (Years): 40. Funding: Grants and internal funding	Planning/Initial Study	$ 1,500,000
Project 35: University of California Merced Surface Water Augmentation	Merced Irrigation District and the University of California Merced (2018 IRWMP)	MIUGSA	The University of California Merced is in the process of developing sustainable water strategies that include the optimization of water resources. Currently, the only source of UCM Campus water is the city well (aquifer), which provides 100% of water used by the campus. Irrigation accounts for 50% percent of the total potable water used by UCM. The Merced Irrigation District and the University of California Merced are partnering to support the interconnection of the University's irrigation water supply to the Fairfield Canal. Lake Yosemite which the Fairfield Canal originates from will charge the University's Little Lake through a delivery gate located adjacent to Scholars Lane Bridge. This non-potable water source will be used in lieu of ground water for irrigation, leaving groundwater in the Basin for potable uses while optimizing the use of surface water.	Planning	$ 800,000
Project 36: Surface Water for City Park Irrigation	City of Livingston (2018 IRWMP)	MIUGSA	This project would provide surface water for the irrigation of the City's two largest Parks: Gallo Park and Arakelian Park. Water would be obtained from the nearby canals, filtered, and pressurized to irrigate the parks. The combined area of the two proposed parks is almost 15 acres. Most of the park's surface area is turf. The project is estimated to reduce groundwater pumping by almost 100 ac-ft per year. (City of Livingston) The City of Livingston's water supply is solely groundwater. Groundwater levels decline sharply during the spring and summer months and rise during the fall and winter months. In the last five years, the overall year to year groundwater levels have been declining. The groundwater contains arsenic, manganese and TCP which require the City to utilize costly treatment processes to remove them. The cost of producing potable water in the City has been increasing due to the presence of these constituents. Non-potable uses such as irrigation don't require treated groundwater and surface water could reduce the cost of irrigation at the City parks.	Planning	$ 350,000
Project 37: Exchange Recycled Water for Surface Water in Parks	City of Merced (2018 IRWMP)	MIUGSA	This project would take parks off municipal groundwater and replace the irrigation with surface water. The City would provide recycled water to the irrigation district in exchange for the surface water that would be used to water the parks. Initially it would be a demonstration project at a single project and could be expanded to other city parks as a water exchange program.	Conceptual	$ 80,000
Project 38: Marguerite Water Retention Facility	Brad Robson	MSGSA	This project includes up to 13,000 AF off-site storage for possible early season MID water, flood control, migratory waterfowl/wildlife habitat and irrigation water. The project would capture seasonal creek water. Project Owner: Le Grand Athlone District. Location: Between Deadman and Dutchman Creek. Based on report Merced county streams flood control by Army Corp Engineers March 1980.	Planning/Initial Study	NA
Project 39: Le Grand-Athlone Water District Surface Water Extension	2018 IRWMP	MSGSA	This project includes building a conveyance infrastructure from MID's booster 3 or another facility southeast, eventually connecting to Chowchilla Water District facilities near the intersection of the Madera Canal and the Chowchilla River. The connection would allow flexibility in distributing flood and other types of water in the Exchequer and Friant systems. Surface water would be available to Merced SOI growers, Plainsburg Irrigation District, LeGrand-Athlone Water District, Sandy Mush Mutual Water Company and others that predominantly use groundwater only.	Conceptual	$ 20,000,000
Project 40: Bear Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District) (2018 IRWMP)	MIUGSA	Bear Reservoir was constructed in the early 1950's as an element of the Merced Streams Group Project authorized by Congress's 1944 Flood Control Act. The Flood Control Act of 1970 called for three additional flood control reservoirs, enlargement of existing reservoirs, and 52 miles of levee and channel modifications. To date only one additional reservoir has been built (Castle Dam). The enlargement of Bear Reservoir and downstream levee and channel improvements would increase the level of flood protection to the most populated areas of Merced County. Bear Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This project would meet the requirements of the new flood control legislation.	Planning	$ 20,000,000

Project Name	Submitting Agency	GSA	Brief Description	Current Status	Estimated Cost
Project 42: Lake Yosemite Booster Pump Station	Merced Irrigation District (2018 IRWMP)	MIUGSA	Lake Yosemite receives inflows from MID's Main Canal. It has four primary outlets; the Tower Lateral, the Sells Lateral, the Fairfield Canal, and the Le Grand Canal. During winter operations, the lake level is so low that only the Tower Lateral can be used for outflow (unless a major storm event occurs) due to the other 3 canal headgates having a higher invert. This project entails installation of booster pump station to allow for full utilization of Lake Yosemite's storage capacity and diversion facilities. The Booster pump would permit MID to move Lake Yosemite water to other portions of the district and be a key tool in implementing Flood-MAR projects.	Conceptual	$ 100,000
Project 43: Various Storm Basin Improvements	City of Livingston (2018 IRWMP)	MIUGSA	This project would include improving the City of Livingston's storm water basin pump stations. The City relies on storm water pumping stations to control storm water runoff. Several storm water pumping stations need repair. Without these pump stations the City's ability to handle large storm water flows is reduced.	NA	$ 650,000
Project 44: Burns Reservoir Enlargement and Downstream Levee and Channel Improvements	Merced Streams Group (County of Merced, City of Merced, Merced Irrigation District) (2018 IRWMP)	MIUGSA, MSGSA	Burns Reservoir was constructed in the early 1950's as an element of the Merced Streams Group Project authorized by Congress's 1944 Flood Control Act. The Flood Control Act of 1970 called for three additional flood control reservoirs, enlargement of existing reservoirs, and 52 miles of levee and channel modifications. To date only one additional reservoir has been built (Castle Dam). The enlargement of Burns Reservoir and downstream levee and channel improvements would increase the level of flood protection to the most populated areas of Merced County. Burns Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This project would meet the requirements of the new flood control legislation.	Planning	$ 15,000,000
Project 45: Fairfield Canal/ El Nido Superhighway	2018 IRWMP	MIUGSA, MSGSA	This project will consist of flood flow capacity improvements and canal automation, which is essential for implementing Flood-MAR projects and conveying water to MID's existing El Nido Groundwater Recharge Basin. The Fairfield and El Nido Canal system conveys water to over 52,000 acres. This project would open that acreage up to potential groundwater recharge and flood control projects. Additionally, it will assist in better management of flood flows which are anticipated to be higher intensity due to climate change. During the irrigation season, canal automation will also help to reduce operational spill and conserve water. This project will be a key component in implementing Flood-MAR to the Merced area providing critical groundwater recharge.	Conceptual	$3,000,000
Project 46: Mariposa Dam Gate Modification	Brad Robson	MSGSA	The Mariposa Dam provides flood control during rain events. It has an open pipe at the bottom of the dam and meters out the storm water. The proposed project is comprised of installing a gate to slow the release of the water when possible. This would provide opportunity for ground water recharge. Mariposa creek traverses an area that has great recharge potential due to its natural soil properties. The project would also benefit stream habitat and the DAC of Le Grand. LGAWD is the submitting agency under the Merced Subbasin GSA and would need to work with the Army Corps of Engineers who currently manages the Mariposa Dam site. The project would benefit DACs and provide opportunities for recharge. Additional benefits include water for habitat. This project supports mitigation of chronic lowering of groundwater levels through recharge.	Planning	NA
Project 47: Infiltration Basin, Clayton Water District	Clayton Water District	MSGSA	The infiltration basin size is proposed to be 100 acres and able to recharge 0.35 acre-feet per day yielding 3,500 AF of annual average storage. Recovery of the stored water will be above the E-Clay, in what is called a shallow zone. There are 3 Recovery wells proposed for this project as well as the utilization of 4 existing wells in and around the area to recover the stored water. Location of the infiltration basin will be defined once funding becomes available. Project is in Planning/Initial Study phase. Project is expected to take 3 years to complete. This includes environmental permitting and compliance. Capital costs are approx. $3.25M. Annual O&M costs are $25K annually. The wells are expected to be replaced every 20 years. Estimated Project Life in years is 60 years. Costs are based on 2019 dollars. Cost estimate was developed using previous projects and water developed at the planning level of the project. First order of funding will be Grant Assistance, second order of funding will be a Prop 218 Election.	Planning/Initial Study	$3,250,000
Project 48: Storage Basin, Clayton Water District	Clayton Water District	MSGSA	The storage basins are proposed to total 1,000 acres at 10 feet deep will yield 10,000 AF plus the demand reduction of 350 AF for a total of 10,350 AF average annual supply. The basins will be designated as storage basins and will not be cropped. Location of the infiltration basin will be defined once funding becomes available. Project is in Planning/Initial Study phase. Project is expected to take 3 years to complete. This includes environmental permitting and compliance. Capital costs are approx. $10M. Annual O&M costs are $50K annually. The recovery pumps are expected to be replaced every 20 years. Costs are based on 2019 dollars. Estimated Project Life in years is 60 years. Cost estimate was developed using previous projects and water developed at the planning level of the project. First order of funding will be Grant Assistance, second order of funding will be a Prop 218 Election.	Planning/Initial Study	$10,000,000
Project 49: Lateral Recharge, Clayton Water District	Clayton Water District	MSGSA	Lateral Recharge project include the placement of lateral leach lines within a permanent crop field (in between the rows) at a depth of at least 4 feet, assuming a 150 acre block there are 58 rows (almonds) 10 AF/day can be recharged and over the course of 100 days, 1,000 AF can be recharge in an average annual basis. Project proposed to find four 150 blocks of participating landowners, yielding 4,000 AF. Location of the infiltration basin will be defined once funding becomes available. Project is in Planning/Initial Study phase. Project is expected to take 2 years to complete, environmental process is assumed to be minimal. Capital cost is $2M per 600-acre block. Annual O&M costs are $25K annually. Leach lines are expected to be replaced every 20 years. Estimated Project Life in years is 20 years. Costs are based on 2019 dollars. Cost estimate was developed using best engineering judgement at the planning level of the project. First order of funding will be Grant Assistance, second order of funding will be a Prop 218 Election.	Planning/Initial Study	$2,000,000 (per acre block)
Project 50: Eastside By-Pass Diversions, Clayton Water District	Clayton Water District	MSGSA	The Clayton Water District is proposing 8 additional diversion in the Eastside By-Pass north of State Route 152, with a capacity of 20 cfs each for a total of 320 AF/day. The project will be to submit a Temporary Appropriative Water Right Application for the use of flood flows in the Eastside bypass, utilizing temporary diversion facilities (to be placed by landowner at their cost). Where water will be diverted for direct use as well as for temporary underground storage, which can be extracted later. Yield in 50 days is 16,000 AF averaged over 4 years totals 4,000 AF of annual average surface water. Location of the diversion points vary along the Eastside Bypass. This project is in Conceptual Design phase. Capital costs are approx. $200K. No annual O&M costs. There are no replacement costs associated with this project. Application for this project is to be renewed yearly. Costs are based on 2019 dollars. Cost estimate was developed using previous projects and was developed at the conceptual level of the project. First order of funding will be Grant Assistance, second order of funding will be a Prop 218 Election.	Conceptual Design phase	$200,000
Project 51: Merced Groundwater Basin Subsidence Area and	Clayton Water District	MSGSA	This project consists of an irrigation conveyance facility that connects the Central California Irrigation District's Riverside/Poso Canal to Clayton Water District (including lands to be annexed). The facility would provide supplemental water to an area which is severely impacted by subsidence. The project would be split into two phases; Phase 1 consisting of a feasibility study which would include alternative conceptual designs with Phase 2 consisting of Construction. Conceptually this facility would be approximately 2-3 miles in length and	Planning	$100,000

Project Name	Submitting Agency	GSA	Brief Description	Current Status	Estimated Cost
Supplemental Supply - Phase 1			cross the San Joaquin River and East Side Canal to send water from West to East. Total cost for project is $100K. Latitude 37.112065 and Longitude -120.590162. Areas along portion of the San Joaquin River in Merced and Madera Counties have been identified by DWR and the USGS as areas subject to subsidence. In 2013, the project area subsided between 0.5 and 0.75 feet in just 12 months. The subsidence may be attributed, along with other potential factors, to groundwater extraction. Below the surface, subsidence may result in greater depths to groundwater and decreased storage volume within the aquifer. Above the surface, it may lead to infrastructure challenges necessitating canal modifications and road improvements as well as increasing areas that are susceptible to flooding which could include an elementary school, the City of Dos Palos, Highway 152, and many acres of farmland. This project would assist in correcting and/or slowing the rate of subsidence by providing supplemental water to the area and thereby providing both direct and in-lieu recharge to the underlying aquifer and benefits the overall Merced GW Basin sustainability. The California Central Valley is crisscrossed by similar water conveyance projects consisting of canals, pipelines, and pumps. This type of project is typical in water conveyance. MIUGSA is listed as a project partner in the Merced IRWMP Opti database. Objectives of project include: - Correct groundwater overdraft conditions, promote direct and in-lieu recharge, and identify supplemental water. Suppress potential subsidence through reduced groundwater pumping. This project promotes in-lieu recharge by providing a supplemental surface water supply to the area. Additionally, the proposed facility could be utilized for direct recharge. - Manage flood flows and stormwater runoff (including those caused by climate change) for public safety, water supply, recharge, and natural resource management. This project would increase the acreage which could benefit from Flood Management Aquifer Recharge (Flood-MAR) projects. Flood-MAR projects in the area would help reduce flood flows in the San Joaquin River system, which has historically caused flood events downstream and threatened public safety and the environment. - Meet demands for all uses, including agriculture, urban, and environmental resource needs. The supplemental supply would directly serve agriculture but the benefits of the in-lieu recharge would be reaped by all groundwater users including urban, agriculture, and the environment. - Improve coordination of land use and water resources planning. This project facilitates augmentation of local water supplies to enhance the sustainability of the groundwater basin as directed by SGMA. - Effectively address climate change adaptation and/or mitigation in water resource management and infrastructure. This project would help mitigate climate change in the following ways;1. Provide surface water to Clayton Water District offsetting the need to pump groundwater thereby reducing energy consumption (Diesel or Electricity) 2. Subsidence is forcing multiple infrastructure projects to be redesigned, including canals which have historically been gravity conveyance systems. If subsidence continues, large energy guzzling pump stations will be necessary to continue to provide historical water deliveries - Maximize water use efficiency, including expanding in-lieu recycled water projects where feasible. This project expands the footprint that Flood-MAR projects could reach thereby allowing otherwise "Lost" water to benefit the groundwater basin, improving basin water efficiency. - Protect and improve water quality for all beneficial uses, consistent with the Basin Plan. The lower San Joaquin river has historically flooded (recently 1997, 2006, 2011, 2017). Each time this flooding occurs, it introduces pollutants, debris, oil, and potentially sewage into the environment. These San Joaquin River Flood-MAR projects would reduce these events (or lessen the extent) thereby improving water quality. - Protect, restore, and improve natural resources. The lower San Joaquin river has historically flooded (recently 1997, 2006, 2011, 2017). Each time this flooding occurs, it introduces pollutants, debris, oil, and potentially sewage into the environment. These San Joaquin River Flood-MAR projects would reduce these events (or lessen the extent) thereby protecting natural resources. - Address water-related needs of disadvantaged communities (DACs). The DAC of El Nido is severely disadvantaged and faces substantial subsidence issues. This project would benefit the area of El Nido. Additionally, it would benefit the entire Merced Groundwater Subbasin including all the DACs within it, by providing in-lieu and direct recharge to the basin, benefiting every user. - Establish and maintain effective communication among water resource stakeholders in the Region. This project would bring multiple water users together as it interconnects multiple irrigation conveyance systems. Effective communication would be established and maintained for proper project operations. This communication includes farmers, water districts, state and federal agencies, irrigation districts, and other interested parties. - Enhance public understanding of water management issues and needs. This project could be utilized as an example of reducing subsidence and mitigating declining groundwater levels to the public. Furthermore, the concept could be reproduced elsewhere. Project benefits all DAC's in the subbasin by the in-lieu and direct recharge provided. Cost estimates are provided in 2018 dollars.		

Note from MID: Local project sponsors (e.g., Lone Tree MWC, Le Grande-Athlone WD, etc.) anticipate that surface water sourced from the Merced Irrigation District may be available through temporary water purchase and sale agreements and may serve as a water supply for the project(s). It is understood that the Board of Directors for the Merced Irrigation District has and shall retain full and absolute discretion regarding whether and when it will enter into temporary water purchase and sale agreement(s), if any, and further, nothing contained in this document creates in any party or parties any right to water controlled by the Merced Irrigation District whether it be surface water or groundwater. Any transferred water made available by MID shall be limited by the terms and conditions contained in any respective temporary water purchase and sale agreement.

6.6 POTENTIAL AVAILABLE FUNDING MECHANISMS

The State Water Resources Control Board (SWRCB) identified some potential funding mechanisms that can be used toward the planning, construction, and implementation of GSP projects. Several funding types may be applicable to the current short list and potential future projects for the Merced GSP including: projects included in an Integrated Water Resource Management Plan (IRWM) Plan, projects addressing drinking water, stormwater recharge, water recycling projects, wastewater and system improvement projects, and projects that focus on DAC or SDAC areas.

The range of applicable projects, per SWRCB Funding Opportunities fact sheet and per Water Code §10727.4(h), include recharge projects, groundwater contamination remediation, water recycling projects, in-lieu use, diversions to storage, conservation, conveyance, and extraction projects. Additional Projects or Management Actions outside of this list that a GSA determines will help achieve the sustainability goal for the Basin may also be applicable (see GSP Regulations §354.44). Many of the available funding mechanisms accept applications on a continuing basis. Table 6-7 provides a brief overview of the project types and available funding and programs as well as important dates to consider for implementation.

Table 6-7: Overview of Project Types and Available Funding Mechanisms

Project Type and Purpose	Funding Type	Program	Important Dates
Water recycling projects	Planning and construction grants and financing	Water Recycling Funding Program (Prop 1 and 13)	Planning applications accepted on continuous basis. Construction applications received by December 31st each year will be used to develop a priority score. Projects which receive a priority score equal to or greater than the yearly fundable list cutoff score will be placed on the fundable list for the upcoming fiscal year
Wastewater treatment for DAC & SDAC projects	Planning and construction grants and financing	Small Community Grant Fund (Prop 1 and CWSRF)	Applications accepted on continuous basis
Drinking Water	Planning and implementation grants	Sustainable Groundwater Management Grant Program (Round 3 - Prop 68)	Round 3 Solicitation November 2019, Awards March 2020
Public water system improvements	Planning and construction grants and financing	Drinking Water Grants (Prop 1 and 68, and DWSRF)	Applications accepted on continuous basis
Stormwater recharge projects	Implementation grants	Storm Water Grant Program (Prop 1)	Solicitation Period Spring 2020
IRWM projects (included and implemented in an adopted IRWM Plan)	Implementation Grant	IRWM Implementation Grant Program (Prop 1)	Solicitation planned for release spring 2019. Round 1 applications due fall 2019. Round 2 solicitation in 2020.

Many of the projects listed within the Merced GSP are pulled from the most recent Merced IRWMP, making them applicable to the IRWM Implementation Grant Program (Prop 1) funding. Funding options are explained in greater detail in Chapter 7 (Plan Implementation) of this GSP.

7 PLAN IMPLEMENTATION

The Merced Irrigation-Urban GSA (MIUGSA), Merced Subbasin GSA (MSGSA), and Turner Island Water District GSA #1 (TIWD GSA-1) will work together cooperatively to implement the Merced Groundwater Sustainability Plan (GSP) in compliance with the Sustainable Groundwater Management Act (SGMA). Implementation of the GSP will be a substantial undertaking that will include implementation of the projects and management actions included in Chapter 6, as well as the following:

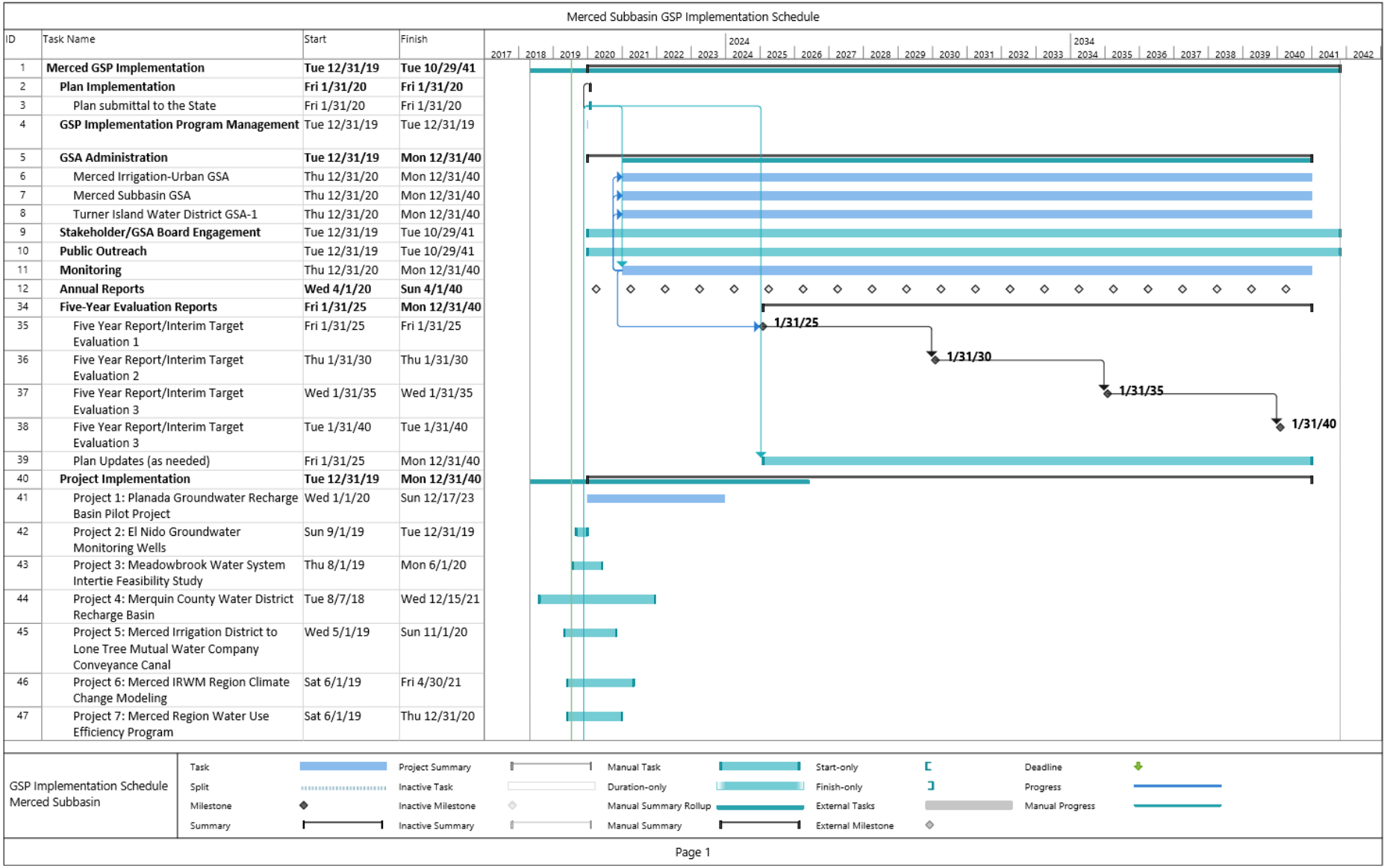
- Merced GSP implementation program management
- Merced GSAs administration
- Public outreach
- Implementation of the monitoring programs
- Development of annual reports
- Development of 5-year update and report

Chapter 7 (Plan Implementation) provides a description of the above, including contents of the annual and five-year reports that will be provided to the Department of Water Resources (DWR) as required under SGMA regulations.

7.1 IMPLEMENTATION SCHEDULE

A detailed implementation schedule through 2041 is provided in Figure 7-1 which contains information on the GSP Implementation Program management, GSA administration, public outreach, GSP implementation program management, monitoring, Annual and Five-Year Evaluation Reports, monitoring, and implementing GSP-related projects and management actions.

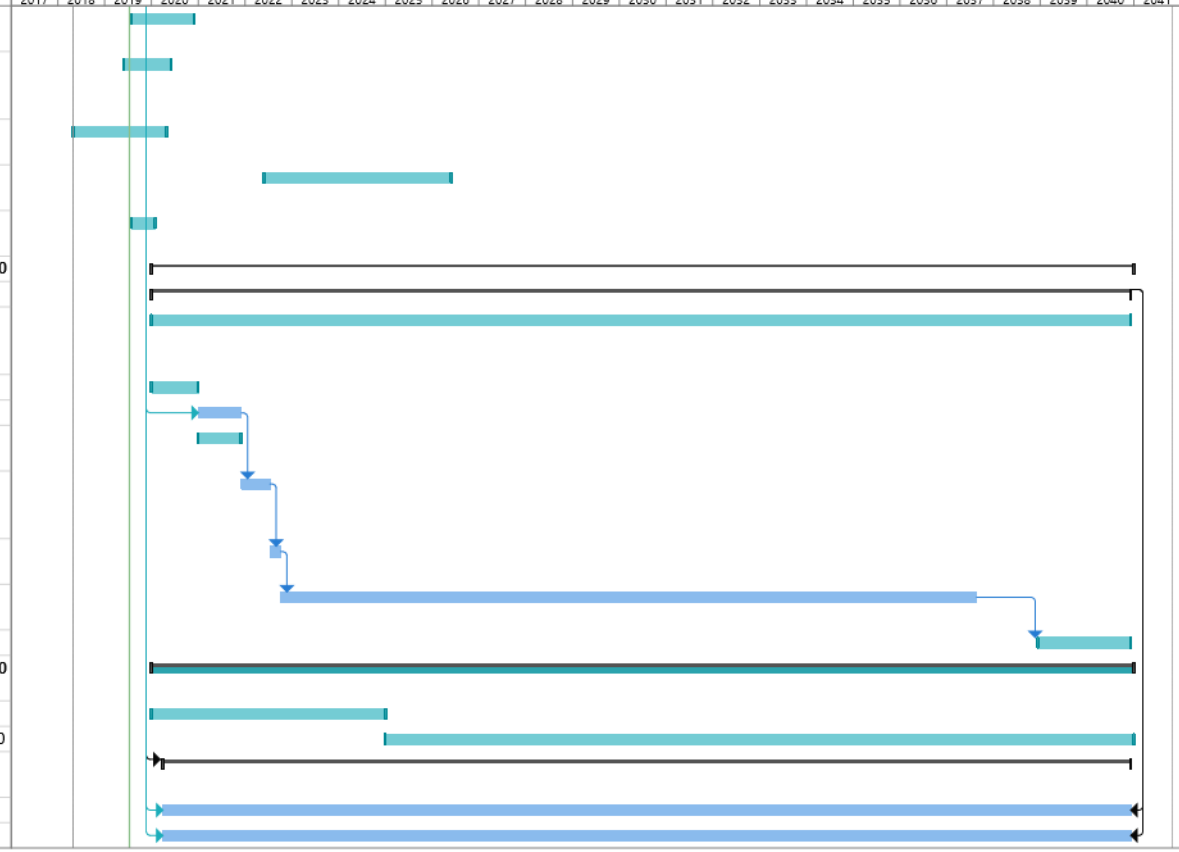
Figure 7-1: GSP Implementation Schedule



ID	Task Name	Start	Finish
1	**Merced GSP Implementation**	**Tue 12/31/19**	**Tue 10/29/41**
2	**Plan Implementation**	**Fri 1/31/20**	**Fri 1/31/20**
3	Plan submittal to the State	Fri 1/31/20	Fri 1/31/20
4	**GSP Implementation Program Management**	Tue 12/31/19	Tue 12/31/19
5	**GSA Administration**	**Tue 12/31/19**	**Mon 12/31/40**
6	Merced Irrigation-Urban GSA	Thu 12/31/20	Mon 12/31/40
7	Merced Subbasin GSA	Thu 12/31/20	Mon 12/31/40
8	Turner Island Water District GSA-1	Thu 12/31/20	Mon 12/31/40
9	**Stakeholder/GSA Board Engagement**	Tue 12/31/19	Tue 10/29/41
10	**Public Outreach**	Tue 12/31/19	Tue 10/29/41
11	**Monitoring**	Thu 12/31/20	Mon 12/31/40
12	**Annual Reports**	**Wed 4/1/20**	**Sun 4/1/40**
34	**Five-Year Evaluation Reports**	**Fri 1/31/25**	**Mon 12/31/40**
35	Five Year Report/Interim Target Evaluation 1	Fri 1/31/25	Fri 1/31/25
36	Five Year Report/Interim Target Evaluation 2	Thu 1/31/30	Thu 1/31/30
37	Five Year Report/Interim Target Evaluation 3	Wed 1/31/35	Wed 1/31/35
38	Five Year Report/Interim Target Evaluation 3	Tue 1/31/40	Tue 1/31/40
39	Plan Updates (as needed)	Fri 1/31/25	Mon 12/31/40
40	**Project Implementation**	**Tue 12/31/19**	**Mon 12/31/40**
41	Project 1: Planada Groundwater Recharge Basin Pilot Project	Wed 1/1/20	Sun 12/17/23
42	Project 2: El Nido Groundwater Monitoring Wells	Sun 9/1/19	Tue 12/31/19
43	Project 3: Meadowbrook Water System Intertie Feasibility Study	Thu 8/1/19	Mon 6/1/20
44	Project 4: Merquin County Water District Recharge Basin	Tue 8/7/18	Wed 12/15/21
45	Project 5: Merced Irrigation District to Lone Tree Mutual Water Company Conveyance Canal	Wed 5/1/19	Sun 11/1/20
46	Project 6: Merced IRWM Region Climate Change Modeling	Sat 6/1/19	Fri 4/30/21
47	Project 7: Merced Region Water Use Efficiency Program	Sat 6/1/19	Thu 12/31/20

Merced Subbasin GSP Implementation Schedule

ID	Task Name	Start	Finish
48	Project 8: Merced Groundwater Subbasin LIDAR	Thu 8/1/19	Tue 12/1/20
49	Project 9: Study for Potential Water System Intertie Facilities from MID to LGAWD and CWD	Sat 6/1/19	Mon 6/1/20
50	Project 10: Vander Woude Dairy Offstream Temporary Storage	Tue 5/1/18	Fri 5/1/20
51	Project 11: Mini-Big Conveyance Project	Wed 6/1/22	Mon 6/1/26
52	Project 12: Streamlining Permitting for Replacing Sub-Corcoran Wells	Thu 8/1/19	Fri 1/31/20
53	**Management Action Implementation**	**Wed 1/1/20**	**Mon 12/31/40**
54	**1. Pumping Allocations for GSAs**	**Wed 1/1/20**	**Fri 12/7/40**
55	Public outreach/education about allocation framework implementation	**Wed 1/1/20**	**Fri 12/7/40**
56	Fill Data Gaps	Wed 1/1/20	Thu 12/31/20
57	Finalize Allocation Method	Fri 1/1/21	Thu 12/2/21
58	Document Developed Supply Estimates	Fri 1/1/21	Thu 12/2/21
59	Determine Allocation of New Water Supplies & Review Water Rights	Fri 12/3/21	Thu 7/14/22
60	Develop Timeline for Pumping Reduction	Fri 7/15/22	Thu 10/6/22
61	Implement Annual Pumping Reductions	Fri 10/7/22	Thu 8/20/37
62	Maintain Pumping Allocations	Mon 12/13/38	Fri 12/7/40
63	**2. MSGSA Demand Reduction Program**	**Wed 1/1/20**	**Mon 12/31/40**
64	Voluntary Reductions	Wed 1/1/20	Wed 1/1/25
65	Mandatory Reductions	Wed 1/1/25	Mon 12/31/40
66	**Adaptive Management Action Implementation (as-needed)**	**Mon 3/30/20**	**Fri 12/7/40**
67	Evaluate Unimplemented Projects	Mon 3/30/20	Fri 12/7/40
68	Revisit Projects not included in GSP	Mon 3/30/20	Fri 12/7/40



GSP Implementation Schedule
Merced Subbasin

Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Progress
Manual Progress

Page 2

7.2 GSP IMPLEMENTATION PROGRAM MANAGEMENT

The GSP Implementation Program Management will primarily consist of oversight of the implementation of the projects and management actions described in Chapter 6 of this GSP and general GSP administration. This includes coordination of technical activities associated with GSP implementation and project management of activities implemented through the GSP across GSAs. The GSP Implementation Program Management would also include grant administration for funding awarded for regional projects or programs or potential Plan updates.

GSP administration includes the joint coordination activities of the three GSAs necessary to implement the GSP. GSP development was guided by a Coordinating Committee and the GSAs intend to continue to use the Coordinating Committee to guide implementation of the GSP. Administrative activities include managing quarterly in-person Coordinating Committee meetings and on-going email updates from MIUGSA, MSGSA, and TIWD GSA-1 to the Coordinating Committee related to the statewide SGMA program and Merced GSP activities. It also includes oversight of consultants or contractors that may be retained by the GSAs in support of joint GSP activities (including but not limited to, GSP updates, annual reporting, and monitoring), and administration of the Merced GSAs Coordination MOU.

Activities under GSP Implementation Program Management also include stakeholder engagement through the Stakeholder Advisory Committee (SC). The SC will be maintained as a non-voting body, with the intent to provide input and an exchange amongst a broad range of stakeholder perspectives This body will meet quarterly to discuss GSP and GSA activities, provide input to the Coordinating Committee, and present on items of interest related to the basin. These meetings are to be staggered in a way that allows two weeks to one month's time before the Coordinating Committee. This will enable a formal summary of input to be generated and provided to the Coordinating Committee. The focus and frequency of these meetings may be revised depending upon what topics need to be discussed. It is expected that Stakeholder Committee input and discussion will be especially important in the first several years of GSP Implementation, as these initial years will involve key decision-making and project implementation. For the purpose of providing input and encouraging exchange with the Coordinating Committee, a liaison position may be created among the members of the SC. The liaison will report at the Coordinating Committee meetings and serve as a direct representative for the SC body. The Stakeholder Committee meetings are held in-person and are generally two hours long. A facilitator may be selected and funded by the GSAs for these meetings. There are currently 23 SC members, each of whom serve an indefinite term. Opportunities for new members to join the Stakeholder Committee will occur prior to each GSP update.[25]

Coordinating Committee meetings will be held quarterly, generally staggered with respect to the SC meeting. The Coordinating Committee is responsible for steering the Merced GSP Implementation Program, including review of internal drafts of the GSP and subsequent updates along with the annual reports. As described in Chapter 1 (Introduction and Plan Area), the Coordinating Committee is responsible for developing recommendations for basin management and considering input from the SC and the public before presenting recommendations to the GSA Boards. The Coordinating Committee will work closely with GSP and GSA staff to manage the Merced GSP Implementation Program. In addition to quarterly meetings, the Coordinating Committee will participate in calls and emails as necessary and may meet more frequently during development of annual reports, GSP updates or as needed.

7.3 GSA ADMINISTRATION

Each of the three GSAs are administered independently and involve coordination and oversight of individual GSA projects and programs. Chapter 1 (Introduction and Plan Area) describes the governance and member agencies of each of the GSAs. GSA administration would include: regular coordination meetings within each GSA; regular email communications to update GSA members on on-going basin activities; coordination activities with the other GSAs; and

[25] For further information on Stakeholder Committee structure and involvement, please see Chapter 1 (Introduction and Plan Area)

other activities necessary for GSA operations. GSA staff meetings are assumed to occur more frequently during Five-Year Update years than during non-Five-Year Update years, with other oversight and administration activities occurring as needed and on an on-going basis. GSA administration is also expected to require additional effort during GSP updates, and during Annual Report and Five-Year Evaluation Report development.

Although staff from the GSAs and GSA member agencies will be meeting regularly as part of GSA administration, their individual GSA's Board of Directors will meet in accordance with each GSA's Board Calendar or bylaws. Joint calls with the Boards of each GSA for basin-wide updates and coordination activities will be held in alternating months from individual GSA Board of Director meetings. The Coordinating Committee will be responsible for developing agendas and recommendations for joint Board meetings, while the Coordinating Committee members from each GSA will be responsible for providing updates and presenting recommendations to their respective GSA's Board.

7.4 PUBLIC OUTREACH

During GSP development, the Merced GSP Program used multiple forms of outreach to communicate SGMA-related information and solicit input. The GSAs intend to continue public outreach and provide opportunities for engagement during GSP implementation. This will include providing opportunities for public participation, especially from beneficial users, at public meetings, providing access to GSP information online, and continued coordination with entities conducting outreach to DAC communities in the Basin. Announcements will continue to be distributed via email prior to public meetings (e.g., Stakeholder Committee meetings, Coordinating Committee meetings, public workshops, and GSA Board meetings). Emails will also be distributed as specific deliverables are finalized, when opportunities are available for stakeholder input and when this input is requested, or when items of interest to the stakeholder group arise, such as relevant funding opportunities. The Merced SGMA website, managed as part of GSP Administration, will be updated a minimum of monthly, and will house meeting agendas and materials, reports, and other program information. The website may be updated to add new pages as the program continues and additional activities are implemented. Additionally, public workshops will be held semi-annually, or more frequently if necessary, to provide an opportunity for stakeholders and members of the public to learn about, discuss, and provide input on GSP activities, progress towards meeting the Sustainability Goal of this GSP, and the SGMA program.

7.5 MONITORING PROGRAMS

The GSP identifies the need for ongoing monitoring and filling of data gaps. The monitoring programs are a critical element of GSP implementation. The GSAs intend to implement the monitoring programs described in Chapter 4 (Monitoring Networks) to track conditions for the applicable sustainability indicators discussed in Chapter 3 (Sustainable Management Criteria). The GSP has identified monitoring networks for groundwater levels, water quality, and subsidence; representative monitoring sites have been selected and minimum thresholds have been established. Monitoring Network data will be collected and used to determine whether Undesirable Results are occurring, to better characterize basin conditions, to identify trends, and to determine if adaptive management is necessary. Monitoring data will be managed using the Merced Data Management System (DMS) developed during GSP preparation specifically for this purpose. The GSP Monitoring Networks make use of existing monitoring programs and develop further monitoring to continue characterization of the Subbasin. As described in Chapter 4 (Monitoring Networks), key components involved in the implementation of the Monitoring Network activities for the Merced GSP by relevant Sustainability Indicator include:

Groundwater Levels

The monitoring program for groundwater levels will utilize existing CASGEM wells in the Subbasin. Additional efforts to fill data gaps will include:

- Evaluation of other existing wells for additional construction information (where missing) and/or permission for access to wells to collect data.

- Seeking funding to construct additional monitoring wells, which are preferred to active wells due to shorter screened intervals and lack of groundwater production to interfere with measurements. New monitoring well sites should include a very shallow well at the same location for areas near GDEs, to the extent funding and logistics allow.

- Installation of pressure transducers at representative wells that exhibit groundwater levels that are highly variable or difficult to explain to better understand the variability, to the extent feasible. Installations may be temporary or permanent.

The GSAs will introduce a comprehensive plan for filling data gaps within two years of acceptance of the GSP by DWR. The plan will include the qualitative data gaps discussed above along with DWR recommendations for the CASGEM plan. The plan will identify most sensitive areas for priority of implementation of the plan, and a timeline for filling all identified gaps.

Water Quality

The water quality monitoring program for the GSP will utilize monitoring wells and data from existing programs such as the East San Joaquin Water Quality Coalition Groundwater Quality Trend Monitoring and Public Water System wells, and includes the following key activities:

- Active coordination with existing monitoring programs:
    - Monthly review of data submitted to the Department of Pesticide Regulation (DPR), Division of Drinking Water (DDW), Department of Toxic Substances Control (EnviroStor), and SWRCB (GeoTracker as part of the Groundwater Ambient Monitoring and Assessment [GAMA] database).
    - Quarterly check-ins with existing monitoring programs, such as CV-SALTS and ESJWQC GQTM.
    - Annual review of annual monitoring reports prepared by other programs (such as CV-SALTS and ILRP).
    - GSAs will invite representative(s) from the Regional Water Quality Control Board, Merced County Division of Environmental Health, and ESJWQC to attend an annual meeting of the GSAs to discuss constituent trends and concerns in the Subbasin in relation to groundwater pumping.
- Exploratory efforts in obtaining construction information for at least 20 DDW PWS wells in the Corcoran Clay region

Subsidence

The subsidence monitoring program for the GSP will utilize monitoring data from the SJRRP's subsidence control points. Installation of extensometers has been recommended to help understand the depth at which subsidence is occurring. This will involve coordination with the SJRRP, the USGS, and other entities associated with subsidence studies, as well as interbasin coordination efforts with Chowchilla and Delta-Mendota Subbasin on the funding and installation of additional subsidence monitoring that may include extensometers or other measurement methods to better understand trends and any potential correlation to groundwater levels in the different principal aquifers across all subbasins.

Depletion of Interconnected Surface Waters

The GSP will rely on groundwater level monitoring and streamflow monitoring to support characterization of the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions. Efforts for coordination and monitoring methods development include:

- Contacting state, federal, and environmental organizations to determine interest in developing a method of tracking the date and location where ephemeral or intermittent flowing streams and rivers cease to flow.
- Seeking funding for development of multi-level monitoring wells to better characterize very shallow groundwater conditions near rivers and streams as well as near other deeper monitoring wells.

7.6 DEVELOPING ANNUAL REPORTS

As required under California Code of Regulations §356.2 (SGMA regulations), annual reports must include three key sections: 1) General Information, 2) Basin Conditions, and 3) Plan Implementation Progress. Report information requirements are detailed below and would be completed in a manner and format consistent with the SGMA regulations. As annual reporting continues, it is possible that this outline will change to reflect basin conditions, the priorities of Merced GSAs, and applicable requirements from DWR.

7.6.1 General Information

General information will include an executive summary that highlights the key content of the annual report. As part of the executive summary, this section will include a description of the sustainability goals, provide a description of GSP projects and their progress as well as an annually updated implementation schedule and map of the Subbasin. Key components as required by SGMA regulations include an Executive Summary and a Map of the Basin.

7.6.2 Basin Conditions

Basin conditions will describe the current groundwater conditions and monitoring results. This section will include an evaluation of how conditions have changed in the Subbasin over the previous year and compare groundwater data for the year to historical groundwater data. Pumping data, effects of project implementation (e.g., recharge data, conservation, if applicable), surface water flows, total water use, and groundwater storage will be included. The GSAs will also evaluate the use of the GDE Pulse tool to help assess GDEs. This tool was developed by The Nature Conservancy and ties together satellite (Landsat), rainfall, and groundwater data. Key components to the Annual Report as required by SGMA regulations include:

- Groundwater elevation data from the monitoring network
- Hydrographs of elevation data
- Groundwater extraction data
- Surface water supply data
- Total water use data
- Change in groundwater storage, including maps

7.6.3 Plan Implementation Progress

Progress towards successful plan implementation would be included in the annual report. This section of the annual report would describe the progress made towards achieving interim milestones as well as implementation of projects and management actions. Key components as required by SGMA regulations include Plan Implementation Progress and Sustainability Progress.

7.7 DEVELOPING FIVE-YEAR EVALUATION REPORTS

SGMA requires that GSPs be evaluated regarding their progress towards meeting the approved sustainability goals at least every five years, and to provide a written assessment to DWR. An evaluation must also be made whenever the

GSP is amended. A description of the information that will be included in the five-year report is provided below and would be prepared in a manner consistent with §356.4 of the SGMA regulations.

7.7.1 Sustainability Evaluation

This section will contain a description of current groundwater conditions for each applicable sustainability indicator and will include a discussion of overall Subbasin sustainability. Progress towards achieving interim milestones and measurable objectives will be included, along with an evaluation of groundwater elevations (being used as direct measure for water level and proxy measure surface water depletions), groundwater quality, and subsidence in relation to minimum thresholds.

7.7.2 Plan Implementation Progress

This section of the five-year report will describe the current status of project and management actions since the previous five-year report. An updated project implementation schedule will be included, along with any new projects that were developed to support the goals of the GSP and identification of any projects that are no longer included in the GSP. The benefits of projects that have been implemented will be included, and updates on projects and management actions that are underway at the time of the five-year report will be reported.

7.7.3 Reconsideration of GSP Elements

Part of the five-year report will include a reconsideration of GSP Elements. As additional monitoring data is collected during GSP implementation, land uses and community characteristics change over time, and GSP projects and management actions are implemented, it may become necessary to revise the GSP. This section of the five-year report will reconsider the basin setting, management areas, undesirable results, minimum thresholds, and measurable objectives. If appropriate, the five-year report will recommend revisions to the GSP. Revisions would be informed by the outcomes of the monitoring network, and changes in the basin, including but not limited to, changes to groundwater uses or supplies and outcomes of project implementation.

7.7.4 Monitoring Network Description

A description of the monitoring network will be provided in the five-year report. Data gaps, or areas of the basin that are not monitored in a manner consider with the requirements of §352.4 and §354.34(c) of the regulations will be identified. An assessment of the monitoring network's function will be provided, along with an analysis of data collected to-date. If data gaps are identified, the GSP will be revised to include a program for addressing these data gaps, along with an implemented schedule for addressing gaps and how the GSAs will incorporate updated data into the GSP.

7.7.5 New Information

New information that has become available since the last five-year evaluation or GSP amendment will be described and the GSP evaluated in light of this new information. If the new information would warrant a change to the GSP, this would also be included.

7.7.6 Regulations or Ordinances

The five-year report will include a summary of the regulations or ordinances related to the GSP that have been implemented by DWR or others since the previous report and address how these may require updates to the GSP.

7.7.7 Legal or Enforcement Actions

Enforcement or legal actions taken by the GSAs or their member agencies in relation to the GSP will be summarized in this section of the five-year report, along with how such actions support sustainability in the basin.

7.7.8 Plan Amendments

A description of amendments to the GSP will be provided in the five-year report, including adopted amendments, recommended amendments for future updates, and amendments that are underway during development of the five-year report.

7.7.9 Coordination

The Merced GSP will be implemented by the MIUGSA, MSGSA, and TIWD GSA-1. These GSAs will coordinate as appropriate with GSAs in adjacent basins, specifically: The Delta-Mendota Subbasin, the Chowchilla Subbasin, and the Turlock Subbasin. The GSAs have executed or are in the process of executing interbasin agreements or memorandum of intent to coordinate with each neighboring basin.

7.7.10 Schedule for 5-Year Periods

Development and adoption of a GSP by January 31, 2020 was a large task, and during GSP development, the GSAs identified key areas that would need to be further developed as part of five-year updates. Table 7-1 illustrates the Merced GSP's schedule for implementation from 2020 to 2040, highlighting the high-level activities anticipated for each five-year period. A more detailed schedule is included in Figure 7-1. These activities are necessary for ongoing Plan monitoring and updates, as well as tentative schedules for projects and management actions. Additional details on the activities included in the timeline are provided in these activities' respective chapters of this Plan.

Table 7-1: GSP Schedule for Implementation 2020 to 2040

2020	2025	2030	2035	2040
Monitoring and Reporting	**Preparation for Allocations and Low Capital Outlay Projects**	**Prepare for Sustainability**	**Implement Sustainable Operations**	
• Establish Monitoring Network • Install New Groundwater Wells • Reduce/Fill Data Gaps	• GSAs conduct 5-year evaluation/update • Monitoring and reporting continue	• GSAs conduct 5-year evaluation/update • Monitoring and reporting continue	• GSAs conduct 5-year evaluation/update • Monitoring and reporting continue	
• GSAs allocated initial allocations • GSAs establish their allocation procedures and demand reduction efforts • Develop Metering Program	• As-needed demand reduction to reach Sustainable Yield allocation • Metering program continues	• As-needed demand reduction to reach Sustainable Yield allocation	• Full implementation demand reduction as needed to reach Sustainable Yield allocation by 2040	
• Funded and smaller projects implemented	• Planning/ Design/ Construction for small to medium sized projects	• Planning/ Design/ Construction for larger projects begins	• Project implementation completed	
• Extensive public outreach regarding GSP and allocations	• Outreach regarding GSP and allocations continues	• Outreach continues	• Outreach continues	

7.8 FIRST FIVE YEAR UPDATE – 2020-2025

The first five years of GSP implementation will be critical in setting the basin on a path toward sustainability. Several key tasks were identified during development of the first GSP that need to be further developed or resolved in the five-year GSP update. These are special studies or issues that need resolution but could not be resolved during initial GSP development. These include:

Establishing Metering Program

In order to implement allocations as part of the GSP and to confirm basin water use and water budgets, it is necessary to measure how much groundwater is being extracted from the basin. The Coordinating Committee has agreed on the need to develop a program to measure this extraction in the first five years of the GSP. In discussing a potential metering program, the SC and CC highlighted the need to take a flexible approach. There are many considerations that would need to be taken into account in establishing a metering and telemetry program, including:

- Costs and challenges associated with different extraction/metering programs—broader approaches through methods using remote sensing, focused monitoring through metering, or a combination.
- There are different types of architecture (set ups) for metering and different types of meters that vary in terms of: cost, pressure loss, flow range, and accuracy
- Challenges for installation such as remote locations, limited available straight segments of pipe, different pipe diameters between sites, and availability of power
- There can be inconsistency between well sites where sites might not be able to have the same meter type
- Well site data transmitters will also need to be installed at the well sites (this can include frequency radios, cellular data radios, or a landline connection)

High-level cost estimates generated based on a Metering and Telemetry Technical Memo are summarized as below. A memo with further detail is provided in Appendix M.

- High-level estimate per well site: $6,000 - $10,000 for installation and first year operating costs (per well)
- Network Communication Factors: High-level network communications estimate (not a hosted service): $3,000 -- $15,000 for first year (for entire system)
- Data Collection, Storage, and Access Factors: High-level central collection host estimate (not a hosted service): one-time cost of $20,000 -- $27,000 (for entire subbasin system). Overall per well cost depends on how much data we want to store.
- Maintaining cost of hosting data each year: roughly estimated as $8,000 per year.

Finalizing Allocation Framework

Beginning the implementation of the Management Action Water Allocation Framework will require completion of several steps listed below. The allocation framework was the subject of much discussion by the Stakeholder and Coordinating Committees during GSP development. The GSAs intend to allocate water to each GSA and have not yet reached agreement on allocations or how they will be implemented. Additional description of the Water Allocation Framework is provided in Chapter 6 (Projects and Management Actions to Achieve Sustainability Goal).

Some of the next steps needed in first five years of GSP to begin implementation of allocations include:

- Agreeing upon details of how allocations to each GSA will be established
- Developing, refining, and documenting estimates of developed supply and determining rights to confirmed estimates of developed supply

- Determining how pumping will be measured through metering program or equivalent
- Establishing sustainable allocation trading and crediting rules
- Implementation schedule and timing
- Conducting outreach and communications

Implementation of the Water Allocation Framework is expected to be developed in the first five years of the GSP with full implementation and enforcement by GSAs by 2040.

Developing Methodology for establishing Minimum Thresholds at New Wells

The Sustainable Management Criteria chapter of this GSP describes a methodology for establishing minimum thresholds for groundwater levels at representative wells. That methodology requires having some historical data at a well in order to establish the threshold. The GSAs anticipate installing new wells, particularly in the MSGSA portions of the Subbasin to fill data gaps. The GSAs will need to develop a methodology for establishing minimum thresholds at future representative wells that may be added to the monitoring network and do not have sufficient historical data. This could include using MercedWRM projections to establish projected water levels for those wells as the basis for MTs or using historical well data from nearby wells.

Refining and Improving MercedWRM Model Calibration

Efforts are anticipated to refine and improve calibration of the MercedWRM especially for the eastern portion of basin where the tanked water program occurred (see Section 3.3.2). This is due in part to the specific geological formations in this area. It is anticipated that the model will need to be refined to more accurately reflect groundwater elevations for this area.

Refinements to Climate Change Analysis to Better Reflect Local Surface Water Operations

The approach developed for this GSP was based on the methodology in DWR's guidance document (DWR, 2018a) and uses best available information related to climate change in the Merced Subbasin. There are limitations and uncertainties associated with the analysis. One important limitation is that CalSim II does not fully simulate local surface water operations. Thus, the analysis conducted for this GSP may not fully reflect how surface and groundwater basin operations would respond to the changes in water demand and availability caused by climate change. For this first GSP iteration, use of a regional model and the perturbation factor approach (see Section 2.4 [Climate Change Analysis] within Chapter 2 [Basin Setting]) were deemed appropriate given the uncertainties in the climate change analysis.

It is anticipated that future refinements of the analysis would utilize the local surface water operations model, the Merced Irrigation District Hydrologic and Hydraulic Operations Model (MIDH2O). Use of this model will allow for greater resolution in the simulation of Merced River flows and surface water supply based on local management.

Mitigation for Possible Future Domestic Well Dewatering

The GSAs recognize that water levels may continue to decline during GSP implementation and do not consider a single domestic shallow well being dewatered to be significant and unreasonable. Nonetheless, the GSAs recognize the importance of access to safe drinking water for all users in the basin and will evaluate during the first five years of the GSP establishing mitigation for shallow domestic wells that might be dewatered by declining water levels during the GSP implementation period.

Creating a Data Gaps Plan

It is anticipated that within two years of the acceptance of the GSP by DWR, the GSAs will develop a plan to address identified data gaps with a timeline for implementation based on priority.

Pursuing Funding Opportunities

Funding will be pursued in the form of grant applications, loans, GSA operational funds, and private funds in order to fulfil and implement the different components of the GSP. This includes funding to install extensometers or other measurement methods for subsidence monitoring, create and implement metering programs, and fund projects and management actions. Further detail is provided in Sections 7.9 - 7.11 of this Chapter.

7.9 IMPLEMENTATION COSTS

In implementing the Merced GSP, the GSAs will incur costs which will require funding. The primary activities that will incur costs are listed and summarized in Table 7-2.

Table 7-2: Costs to GSAs and GSP Implementation Costs

Activity	Estimated Cost[1]	Assumptions
GSP Implementation and Management for GSAs		
GSP Implementation Program Management	$120,000 annually	Assumes annual costs of grant administration for regional projects or programs, or potential Plan updates. Also includes professional services to support the joint activities of the three GSAs such as costs for coordination & facilitation of SC & CC meetings.
GSA Administration	Approx. $1M annually for all GSAs combined[3]	Costs for MIUGSA and MSGSA estimated at $400K per year each, TIWD estimated at $140K per year. These include general GSA operating costs, professional services, and costs for coordination of GSA Board meetings.
Public Outreach	$75,000 annually	Assumes costs for creating communication materials, website updates (incl. maintenance and hosting), and conducting 2 public workshops per year.
Monitoring Program	$85,000 annually for all but the first year $175,000 for first year due to one-time cost items for initial set up.	Assumes costs for GW levels, evaluation of existing water level wells for additional construction information and/or permission for access to wells to collection data, coordination with existing programs[4], obtaining additional construction information for PWS wells, and data management. Does not include costs for new well installation.
Developing Annual Reports	$50,000 annually (FY23-FY40) Additional costs during initial years ($50,000-$75,000 for FY20 – FY22)	Includes data compiling and reporting on 1) General Information, 2) Basin Conditions, and 3) Plan Implementation Progress.
Developing Five-Year Evaluation Reports	$800,000 every 5 years (across 2 fiscal years)	Includes data compiling and reporting on progress for each relevant sustainability indicator, plan implementation progress and updates, monitoring network updates and progress in addressing data gaps, description of new information, amendments, and coordination.
Implementing GSP-Projects and Management Actions		
Project 1: Planada Groundwater Recharge Basin Pilot Project	$395,292	Costs spread over 5 years.
Project 2: El Nido Groundwater Monitoring Wells	$400,000	Costs occurred in first year.
Project 3: Meadowbrook Water System Intertie Feasibility Study	$100,588	Costs spread over 1-2 years.
Project 4: Merquin County Water District Recharge Basin	$1,400,000	Costs spread over 3 years.
Project 5: Merced Irrigation District to Lone Tree Mutual Water Company Conveyance Canal	$3-6,000,000	Costs spread over 1-2 years.
Project 6: Merced IRWM Region Climate Change Modeling	$250,000	Costs spread over 3 years.

Activity	Estimated Cost[1]	Assumptions
Project 7: Merced Region Water Use Efficiency Program	$500,000	Costs spread over 1-2 years.
Project 8: Merced Groundwater Subbasin LIDAR	$150,000	Costs spread over 1-2 years.
Project 9: Study for Potential Water System Intertie Facilities from MID to LGAWD and CWD	$100,000	Costs spread over 1-2 years.
Project 10: Vander Woude Dairy Offstream Temporary Storage	$750,000	Costs spread over 1-2 years.
Project 11: Mini-Big Conveyance Project	$ 6-8,000,000	Costs spread over 5 years.
Project 12: Streamlining Permitting for Replacing Sub-Corcoran Wells	$75,000	Costs spread over 1-2 years.
Management Action 1 – Water Allocation Framework	TBD[2]	TBD
Management Action 2 – MSGSA Demand Reduction Program	$500,000 initial year cost $200,000 annual cost	First year costs to include development and initiation of demand reduction program. Does not include well installation costs. Does include analysis, policies and procedures adoption, establishing monitoring and reporting tools, conducting outreach. Costs to implement the program depend on level of enforcement required to meet allocation each year. Annual cost estimate includes program management.

[1] Estimates are rounded and based on full implementation years (FY2021 through FY2040). Different costs may be incurred in FY 2020 as GSP implementation begins. Costs are presented in year 2019 dollars.

[2] Costs of implementing the Water Allocation Framework will depend on how the framework is implemented and are too speculative to estimate until management action is further developed.

[3] This estimate will be updated once input from GSA staff received for anticipated GSA administrative and operating costs. (Merced cost estimate based on Prop 218 staff report estimate of GSA Operating costs.

[4] Existing programs include those identified in Chapter 4 Monitoring Networks, particularly monitoring programs for additional water quality, depletion of interconnected surface water, and subsidence.

7.10 IMPLEMENTING GSP-RELATED PROJECTS AND MANAGEMENT ACTIONS

Costs for the Projects and Management Actions are described in Chapter 6 of this GSP. Financing of the projects and management actions would vary depending on the activity. Potential financing for projects and management actions are provided in Table 7-3. though other financing may be pursued as opportunities arise or as appropriate. In future plan updates, the GSAs may develop additional management actions and revisit projects not included on the shortlist for this GSP. This includes projects on the running list described in Chapter 6.

Projects considered for implementation will also be evaluated for potential water quality impacts during the selection and implementation process.

Table 7-3: Funding Mechanisms for Proposed Projects and Management Actions

Project/Management Action Title and Type		Responsible Agency	Potential Funding Mechanism
Project 1: Planada Groundwater Recharge Basin Pilot Project	Recharge	All GSAs	DWR Grant Funding (grant awarded)
Project 2: El Nido Groundwater Monitoring Wells	Monitoring Water Quality	All GSAs	DWR Grant Funding (grant awarded)
Project 3: Meadowbrook Water System Intertie Feasibility Study	Conveyance	All GSAs	DWR Grant Funding (grant awarded)
Project 4: Merquin County Water District Recharge Basin	Recharge	MSGSA	IRWM Implementation Grant Program (Prop 1) Storm Water Grant Program (Prop 1)
Project 5: Merced Irrigation District to Lone Tree Mutual Water Company Conveyance Canal	Conveyance	MSGSA	MSGSA Operating Funds & Lone Tree Mutual Water Company Operating Funds Loans
Project 6: Merced IRWM Region Climate Change Modeling	Data Modelling	All GSAs	IRWM Implementation Grant Program (Prop 1) Storm Water Grant Program (Prop 1)
Project 7: Merced Region Water Use Efficiency Program	Conservation	All GSAs	IRWM Implementation Grant Program (Prop 1)
Project 8: Merced Groundwater Subbasin LIDAR	Data Modelling	All GSAs	IRWM Implementation Grant Program (Prop 1) Storm Water Grant Program (Prop 1)
Project 9: Study for Potential Water System Intertie Facilities from MID to LGAWD and CWD	Conveyance	MIUGSA, MSGSA	IRWM Implementation Grant Program (Prop 1)
Project 10: Vander Woude Dairy Offstream Temporary Storage	Recharge Storage	MSGSA	Private Funding Grants
Project 11: Mini-Big Conveyance Project	Conveyance	MSGSA	Grants
Project 12: Streamlining Permitting for Replacing Sub-Corcoran Wells	Regulatory	MSGSA	MSGSA Operating Funds
Management Action 1: Water Allocation Framework	Regulatory	All GSAs	Operating Funds per GSA
Management Action 2: MSGSA Demand Reduction Program	Reduced Groundwater Use	MSGSA	Operating Funds per GSA

7.11 GSP IMPLEMENTATION FUNDING

Implementation of the GSP is projected to range between $1.2M and $1.6M per year. Costs for projects and management actions are estimated to be an additional $22.9M in total, with costs for individual projects or management actions ranging between $75K to $8M in total. It is anticipated that most of these projects will be implemented within the first five years of GSP implementation. Development of this GSP was substantially funded through a Proposition 1 Sustainable Groundwater Planning Grant. The implementation of the GSP and future SGMA compliance will be a substantial and costly undertaking that will likely require GSAs to collect fees as well as seek additional outside funding. The Merced GSAs will develop a financing plan for the overall implementation of the GSP. Costs for GSP project implementation will be shared based on project beneficiaries. Costs of overall GSP administration are expected to be shared by the three GSAs consistent with the cost share in the MOU (Appendix A). Financing options under consideration include pumping fees, assessments, loans, and grants.

Prior to implementing any fee or assessment program, the GSAs would complete a rate assessment study or other analysis consistent with the regulatory requirements. On July 23, 2019, the Merced Subbasin GSA Governing Board adopted a Prop 218 landowner fee for all lands within the management area of the Merced Subbasin GSA in order to fund its administrative activities necessary for SGMA compliance.

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APPENDIX A: MERCED SUBBASIN GSAS MEMORANDUM OF UNDERSTANDING

MEMORANDUM OF UNDERSTANDING BETWEEN THE MERCED SUBBASIN GROUNDWATER SUSTAINABILITY AGENCY, THE MERCED IRRIGATION URBAN GROUNDWATER SUSTAINABILITY AGENCY AND THE TURNER ISLAND WATER DISTRICT GROUNDWATER SUSTAINABILITY AGENCY

THIS Agreement is entered into to be effective October 13, 2017 by and among the Merced Subbasin Groundwater Sustainability Agency (GSA), the Merced Irrigation Urban GSA, and the Turner Island Water District GSA.

RECITALS

WHEREAS, on September 16, 2014 Governor Jerry Brown signed into law Senate Bills 1168 and 1319 and Assembly Bill 1739, known collectively as the Sustainable Groundwater Management Act; and

WHEREAS, the Act went into effect on January 1, 2015; and

WHEREAS, the Act seeks to provide sustainable management of groundwater basins, enhance local management of groundwater, establish minimum standards for sustainable groundwater management, and provide local groundwater agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater; and

WHEREAS, each of the Parties overlie the Merced Subbasin (Basin Number 5-22.04, Department of Water Resources Bulletin 118) within the San Joaquin Valley Groundwater Basin, which has been designated as a high-priority basin by DWR; and

WHEREAS, the Merced Subbasin GSA elected to manage the groundwater over the boundaries of its members and act as the GSA pursuant to SGMA and notified DWR on or about March 28, 2017; and

WHEREAS, the Merced Irrigation Urban GSA elected to manage the groundwater over the boundaries of its members and act as the GSA pursuant to SGMA and notified DWR on or about May 31, 2017; and

WHEREAS, the Turner Island Water District GSA elected to manage the groundwater over the boundaries of the water district and act as the GSA pursuant to SGMA and notified DWR on or about March 22, 2017; and

WHEREAS, the Parties have previously collaborated on groundwater management through membership in the Merced Area Groundwater Pool Interests (MAGPI); and

WHEREAS, collectively, the boundaries of the Parties include all lands overlying the Basin;

WHEREAS, the Parties desire, through this Agreement, to coordinate the work of the GSAs and the management of the Basin, in accordance with SGMA; and

WHEREAS, the Parties shall designate a point of contact for the Merced Subbasin Groundwater Sustainability Plan development, who shall communicate with all other Parties.

NOW, THEREFORE, in consideration of the mutual promises, covenants and conditions herein set forth, the Parties agree as follows:

ARTICLE 1: DEFINITIONS

As used in this Agreement, unless the context requires otherwise, the meaning of the terms hereinafter set forth shall be as follows:

1.1 "Agreement" shall mean this Memorandum of Understanding among the Merced Subbasin GSA, Merced Irrigation Urban GSA and Turner Island Water District GSA.

1.2 "Basin" shall mean Merced Groundwater Subbasin, California Department of Water Resources Basin No. 5-22.04 as its boundaries may be modified from time to time in accordance with Cal. Water Code Section 10722.2.

1.3 "Coordination Agreement" shall mean a legal agreement adopted between two or more GSAs that provides the basis for intra-basin coordination of multiple GSPs within that basin pursuant to SGMA.

1.4 "**Coordination Committee**" is defined in Article 4 of this Agreement.

1.5 "DWR" shall mean the California Department of Water Resources.

1.6 "Effective Date" shall mean the date on which the last Party executes this Agreement.

1.7 "Groundwater Sustainability Agency" or **"GSA"** shall mean an agency enabled by SGMA to regulate a portion of the Basin cooperatively with all other Groundwater Sustainability Agencies in the Basin, in compliance with the terms and provisions of SGMA.

1.8 "GSAs" - shall mean the three (3) GSAs in the Merced Subbasin, namely the Merced Subbasin GSA, the Merced Irrigation GSA, and the Turner Island Water District GSA.

1.9 Groundwater Sustainability Plan" or **"GSP"** shall have the definition set forth in SGMA.

1.10 "**MID**" shall mean the Merced Irrigation District.

1.11 "**Notice**" is defined in Section 4.2 of this Agreement.

1.12 "Party" shall mean any of the signatories to this Agreement and "**Parties**" shall mean all of the signatories to this Agreement.

1.13 "SGMA" or "**Act**" shall mean the Sustainable Groundwater Management Act of 2014 and all regulations adopted under the legislation (SB 1168, SB 1319 and AB 1739) that collectively comprise the Act, as that legislation and those regulations may be amended from time to time.

ARTICLE 2: KEY PRINCIPLES

2.1. The Parties intend to work together in mutual cooperation to develop one GSP in compliance with SGMA, for the sustainable management of groundwater for that portion of the Basin collectively underlying the boundaries of all of the Parties.

2.2. The Parties intend to mutually cooperate to the extent possible to jointly implement the GSP within the Basin.

2.3. To the extent the Parties are not successful at jointly implementing the GSP within the Basin, or to the extent that any Parties wishes to independently implement the GSP within its boundaries, a Party may implement the GSP within its boundaries, and agrees to work together with all Parties to coordinate such implementation in accordance with the requirements of SGMA.

2.4. The Parties expressly intend that this Agreement shall not limit or interfere with the right and authority of any Party over its own internal matters, including, but not limited to, a Party's legal rights to surface water supplies and assets, groundwater supplies and assets, facilities, operations, water management and water supply matters. The Parties make no commitments by entering into this Agreement to share or otherwise contribute their water supply assets as part of the development or implementation of a GSP.

2.5. Nothing in this Agreement is intended to modify or limit the Parties' police powers, land use authorities, or any other authority.

2.6. The Parties further intend through this Agreement to cooperate to obtain consulting, administrative and management services needed to efficiently develop a GSP, to conduct

outreach to other basin agencies and private parties, and to identify mechanisms for the management reasonably anticipated to be necessary for the purposes of this Agreement.

2.7. Each of the Parties acknowledges that SGMA requires that the entire Basin must be managed under one or more GSPs for the basin to be deemed in compliance with SGMA, and that if multiple GSPs are adopted within the Basin the GSAs must coordinate, and are required to use the same data and consistent methodologies for certain required technical assumptions when developing a GSP.

ARTICLE 3: PURPOSE AND POWERS

3.1. Purpose of the Agreement. The purposes of this Agreement is to:

a. Cooperatively carry out the purposes of SGMA;

b. Provide for coordination among the Parties to develop and implement a GSP and/or facilitate a Coordination Agreement, to the extent necessary;

c. Develop, adopt and implement a legally sufficient GSP covering those portions of the Basin that are within the jurisdictional boundaries of the Parties, subject to the limitations set forth in this Agreement;

d. Satisfy the requirements of SGMA for coordination among GSAs.

3.2. Authority Under the Agreement. To the extent authorized by the Parties and subject to the limitations set forth in this Agreement and the limitations of all applicable laws, the Parties acting collectively shall have the following authority including, but not limited to, the power:

a. To coordinate the implementation of SGMA among the Parties in accordance with this Agreement;

b. To recommend the adoption of actions, rules, regulations, policies, and procedures related to the coordination of the Parties for purposes of implementation of SGMA;

c. To perform all acts necessary or proper to carry out fully the purposes of this Agreement; and to exercise all other powers necessary and incidental to the implementation of the powers set forth herein.

3.3. Powers Reserved to Parties. Each Party will retain the sole and absolute right, in its sole discretion, to:

a. Be a GSA individually or collectively within the Party's boundaries;

b. Approve any portion, section or chapter of the GSP adopted by the Parties as applicable within the Party's boundaries;

c. Exercise the authorities granted to each Party as a GSA under SGMA;

d. Implement SGMA and any GSP adopted pursuant to this Agreement within its boundaries;

Notwithstanding anything to the contrary in this Agreement, this Agreement does not provide any Party the authority to undertake any activities within the geographic or service area boundaries of any of other Party pursuant to the GSP developed or adopted hereunder, unless the Parties have formally and expressly consented and agreed in writing to the activity proposed.

3.4. Term. This Agreement shall be effective as of the Effective Date and shall remain in effect until terminated in accordance with Article 7.3 of this Agreement.

3.5. Role of Party Agencies. Each of the Parties agrees to undertake such additional proceedings or actions as may be necessary in order to carry out the terms and intent of this Agreement. The support of all Parties is required for the success of this Agreement. This support will involve the following types of actions:

a. The Parties will provide support to a Coordination Committee and any third party facilitating the development of the GSP by making available staff time, information and facilities within available resources;

b. Policy support shall be provided by the Parties to either approve, or respond quickly to, any recommendations made as to funding shares, operational decisions, and other policy areas;

c. Contributions of public funds and of personnel, services, equipment or property may be made by any Parties for any of the purposes of this Agreement provided that no repayment will be made for such contributions.

3.6. Other Officers and Employees. To the extent the Parties, or any third party facilitating the development of the GSP, need support from employees, officers, consultants or otherwise need to hire employees, the Parties may do the following:

a. Provide that any employee of any Party with the express approval of that Party, may work on behalf of the Parties under this Agreement, and shall perform, the same various duties under the direction of the Coordination Committee as for his or her other employer in order to carry out this Agreement. This work may be completed and funded under the existing employment with one of the Parties. In the alternative, the Coordination Committee may recommend that the Parties to

this Agreement enter into agreements to compensate, off-set costs, or otherwise fund the cost of the employment for work performed under this Agreement;

b. The Parties shall collectively contract or hire consultants and/or employees to perform work under this Agreement. The Parties may designate one Party to administer the contract. For each contract that will require cost sharing amongst the parties, the proposed contract will be presented to the Coordination Committee for review, and each Party must approve the contract pursuant to that Party's approval requirements. Such contracts shall be drafted in a manner to reflect that consultants hired to perform work under this Agreement are working on behalf of all the Parties and will be expected to work with the Parties on a collective basis and with each Party on an individual basis. Such contracts shall be made to be enforceable by all applicable Parties. Additionally, the contracts must include appropriate indemnity, insurance, and non-disclosures to protect all Parties. Once approved, no expansion, addition, or change to an approved scope of work in a signed contract involving and increase or decrease in compensation under the contract can be made by the contract administrator until approved by each Party pursuant to that Party's approval requirements.

ARTICLE 4: GOVERNANCE

4.1 Coordination Committee. The activities under this Agreement will be guided by a Coordination Committee made up of up to four (4) representatives from each of the Parties. The Coordination Committee shall work collaboratively under the terms of this Agreement to develop recommendations for the technical and substantive Basin-wide issues. These recommendations shall be reached by unanimous vote of the Coordination Committee and submitted to each Party's governing board for final approval. The governing body of each Party must approve the recommendations of the Coordination Committee prior to them becoming effective.

The Coordination Committee shall develop, but not be limited to, the following actions:

a. budget(s) and appropriate cost sharing for any project or program that requires funding from the Parties;

b. Propose guidance and options for obtaining grant funding;

c. Recommend the adoption of rules, regulations, policies, and procedures related to the Agreement;

d. Recommend the approval of any contracts with consultants or subcontractors that would undertake work on behalf of the Parties and/or relate to Basin-wide issues

and, if applicable, recommend the funding that each Party should contribute towards the costs of such contracts;

e. Report to the Parties respective governing boards when dispute resolution is needed to resolve an impasse or inability to make a consensus recommendation;

f. Recommend action and/or approval of a GSP.

4.2. Dispute Resolution. Should any controversy arise among or between the Parties concerning this Agreement, or the rights and duties of any Party under this Agreement, such a controversy shall be addressed as follows:

a. Any Party may trigger the dispute resolution process by delivering, in writing to all Parties, a notification of a dispute or controversy that contains a specific description of the actions alleged to be contrary to this Agreement, and a proposed solution ("**Notice**"). Within thirty (30) days after receipt of Notice, the Parties shall attempt in good faith to resolve the controversy through informal means. If the Parties cannot agree upon a resolution of the controversy within sixty (60) days from receipt of Notice, the dispute shall be submitted to mediation prior to the commencement of legal action.

b. Mediation shall be no less than a full day (unless otherwise agreed upon by the Parties) and the cost of mediation shall be paid in equal proportion among the Parties.

c. The mediator shall be either voluntarily agreed to, or, if the Parties cannot agree upon a mediator, selected by the method set forth in (i) or (ii) below:

    i. Each Party shall appoint one mediator in writing. At the next meeting of the Coordination Committee, one member shall select the name of one mediator from the three randomly from a container.

    ii. If the three Parties do not voluntarily agree to in writing to the randomly selected mediator, then the mediator shall be appointed by the Superior Court upon motion for appointment of a neutral mediator.

d. Should the mediation process described above not provide a final resolution to the controversy raised, any Party may pursue any judicial or administrative remedies otherwise available. However, notwithstanding this Section 4.2, a Party may seek a preliminary injunction or other interlocutory judicial relief prior to completion of the mediation if necessary to avoid irreparable damage or to preserve the status quo.

ARTICLE 5: EXCHANGE OF DATA AND INFORMATION

5.1. Exchange of Information. The Parties acknowledge and recognize pursuant to this Agreement and SGMA, the Parties will need to exchange information amongst and between the Parties and the Parties' consultants.

5.2. Procedure for Exchange of Information. The Parties may exchange information through collaboration and/or informal requests made at the Coordination Committee level or through working/stakeholder subcommittees designated by the Coordination Committee. To the extent it is necessary to make a written request for information to other Parties, the following protocols shall be followed: Each of the Parties shall designate a representative to respond to information requests and provide the name and contact information of the designee to the Coordination Committee. Requests may be communicated in writing and transmitted in person or by mail, facsimile machine or other electronic means to the appropriate representative as named in this agreement.

5.3. Non-Disclosure of Confidential Information.

a. The Parties acknowledge that, in connection with their mutual activities under this Agreement, each of them may share sensitive and/or confidential information with the other Parties. To the fullest extent permitted by law, including but not limited to the Public Records Act, California Government Code Section 6250 et seq., each of the Parties shall maintain any information, documents or materials shared by the other Parties or mutually developed pursuant this Agreement, in confidence, and shall not voluntarily provide or reveal such information, documents or materials to any third party. If any Party receives a request or order from a third party that the receiving Party believes requires it to disclose any such information, documents or materials, the receiving party shall (i) immediately notify the other Parties in writing and provide them with a copy of such request or order, (ii) defer any disclosure of such information, documents or material for as long as legally permitted and (iii) cooperate with any other Party that wishes to pursue an order preventing the disclosure of such information, documents or materials.

b. The Parties further acknowledge and agree that, unless otherwise required by law, any documents, data or material designed as "DRAFT" that is shared with other Parties to this Agreement (1) shall remain confidential (2) will not be made final or shared with third parties (other than employees or consultants of that Party with a need to know), and (3) shall be used only for the purposes set forth in this Agreement.

c. If there is a breach or threatened breach of any provision of this Section 5.3, it is agreed and understood that the non-breaching Party shall have no adequate remedy in money or other damages and accordingly shall be entitled to injunctive relief; provided however, no specification in this Agreement of any particular remedy shall be construed as a waiver or prohibition of any other remedies in the event of a breach or threatened breach of this Agreement.

5.4. Model(s). The Parties will collectively adopt a single water resources model for purposes of preparing the GSP. Any Party may utilize the model for investigative runs, however, only runs made with assumptions and changes approved by the Parties will be accepted as official for inclusion within the GSP. The approved model will be located at Merced Irrigation District ("**MID**") until a future location is agreed upon by the Parties. All Parties shall receive copies of the model and shall have access to the model at MID during normal business hours.

ARTICLE 6: FINANCIAL PROVISIONS

6.1. Contributions and Expenses. Each of the Parties shall be responsible to fund its participation in this Agreement. Funding outside costs, such as consultants, projects, or other Basin-wide activities shall be determined separately for each project. For any such Basin-wide project, the Coordination Committee shall develop a scope of work and recommended a cost allocation for each of the Parties that would need to be approved by a Party's governing board before it is binding on that Party. With respect to sharing costs for GSP development, the Parties agree to the cost share allocation in **EXHIBIT A**, GSP Cost Share Allocation dated October 13. 2017.

6.2. Funding Responsibilities. Each Party will be solely responsible for raising funds for payment of that Party's share of operating and administrative costs. The obligation of each of the Parties to make payments under the terms and provision of this Agreement is an individual and several obligation and not a joint obligation with those of the other Parties. Each of the Parties shall be individually responsible for its own covenants, obligations, and liabilities under this Agreement. No Party shall be precluded from independently pursuing any of the activities contemplated in this Agreement. No Party shall be the agent or have the right or power to bind any other Parties without such Party's express written consent, except as expressly provided in this Agreement.

6.3. Alternate Funding Sources. The Parties may secure contributions of grant funding, state, federal, or other funding as funding or a portion of funding for projects between the Parties.

ARTICLE 7: CHANGES IN PURPOSE, PARTICIPATION, WITHDRAWAL AND TERMINATION

7.1. Changes in Purpose. This Agreement shall remain in place and all applicable provisions shall remain in effect, in the event the Parties determine it is not possible to develop a single GSP pursuant to this Agreement. In that instance, the Parties may develop separate, multiple GSPs, but agree that they will work together to amend this Agreement and utilize this Agreement and the Coordination Committee to meet the requirements of SGMA to utilize the same data and consistent methodologies as required by SGMA, coordinate implementation of the GPSs, and work together as necessary to comply with SGMA. Under those circumstances, this Agreement, as amended, shall constitute the Coordination Agreement required by SGMA.

7.2. Noncompliance. In the event any Party (1) fails to comply with the terms of this Agreement, or (2) undertakes actions that conflict with or undermine the compliance with SGMA and/or achieving sustainable groundwater management, as determined through mediation or by the Coordination Committee, the Party or Parties alleging non-compliance shall provide written notice summarizing the nature of lacking compliance. Further, the non-compliant Party agree to make best efforts to resolve or remedy any such non-compliance. Such actions may include, for example, failure to pay its agreed upon contributions when due; refusal to participate in GSA activities or to provide required monitoring of sustainability indicators; refusal to enforce controls as required by the GSP; refusal to implement any necessary actions as outlined by the approved GSP minimum thresholds that are likely to lead to "undesirable results" under SGMA.

7.3. Withdrawal and Termination.

a. A Party may, in its sole discretion, unilaterally withdraw from this Agreement, effective upon ninety (90) days' prior written notice to the governing boards of the other Parties, provided that (1) the withdrawing Party will remain responsible for its proportionate share of any obligation or liability duly incurred while a Party to the Agreement and (2) the withdrawing Party agrees to take all actions after termination to remain in full compliance with SGMA. The withdrawing Parties will not be responsible for its proportional share of any future obligation or liability after the written notice of termination has been given to the governing boards of the other Parties. Thereafter, the withdrawing Party shall not be responsible for any obligations or liabilities incurred by the remaining Parties. In the event the withdrawing Parties have any rights in any property or have incurred obligations, the Parties may not sell, lease or transfer such rights or be relieved of its obligations, except in accordance with a written agreement executed by it and the Parties. This Agreement shall remain in effect for the non-withdrawing parties after the withdrawal of a party.

b. This Agreement may be terminated by unanimous written consent of all the Parties. Nothing in this Agreement shall prevent the Parties from entering into another coordination agreement. However, in the event of termination each of the Parties will remain responsible for its proportionate share of all debts, liabilities and obligations incurred prior to the effective date of termination.

7.4. Disposition of Property Upon Termination. Upon termination of this Agreement, the Coordination Committee shall recommend the Parties distribute the assets between the successor entity and the Parties in proportion to how the assets were provided.

7.5. Use of Data. Upon withdrawal, any Party shall be entitled to use any data or other information developed during its time as a Party to the Agreement. Further, should a Party withdraw after completion of the GSP, the withdrawing Party shall be entitled to rely on and utilize the GSP for future implementation of SGMA within its boundaries.

ARTICLE 8: MISCELLANEOUS PROVISIONS

8.1. Indemnification.

a. Each of the Parties shall hold harmless, defend and indemnify the other Parties, and their agents, officers and employees, from and against any liability, claims, actions, costs, damages or losses of any kind, including death or injury to any person and/or damage to property arising out of the activities of the Agreement to the extent of their respective cost share allocation (as set forth in Exhibit "A").

b. The indemnification obligation set forth in Section 8.1.a shall exclude actions or claims alleged to have occurred in full, or in part, as a result of active negligence by any indemnified Party, its officers, agents or employees and except for actions or claims alleging dangerous conditions of public property that arise out of the acts or failure to act by the indemnified Party, its officers, agents or employees which are not created by an indemnifying Party.

c. The indemnification provisions contain in this Section include, but are not limited to, violation of applicable law, ordinance, regulation or rule, including, where the claim, loss, damage, charge or expense was caused by deliberate, willful, or criminal acts of any Party, or any of their agents, officers, or employees or their performance under the terms of this Agreement.

d. It is the intent of the Parties that where negligence or responsibility for injury or damages is determined to have been shared, principles of comparative negligence will be followed and each Party shall bear the proportionate cost of any loss, damage, expense and liability attributable to that Party's negligence.

e. Each Party shall establish procedures to notify the other Parties, where appropriate, of any claims, administrative actions or legal actions with respect to any of the matters described in this Section. The Parties shall cooperate in the

defense of such actions brought by others with respect to the matters covered in this Agreement.

f. These indemnification obligations of this Section shall continue beyond the Term of this Agreement as to any acts or omissions occurring during this Agreement. The duty to indemnify set forth herein shall extend only to that period of time prior to a Party's withdrawal.

8.2. Liability Coordination Committee. Each Party must defend, indemnify and hold harmless the other Parties from the actions of their employees or agents taken within the scope of the authority of this Agreement.

8.3. Amendments. This Agreement may be amended from time to time by a unanimous vote of the Parties' respective governing boards.

8.4. Binding on Successors. Except as otherwise provided in this Agreement, the rights and duties of the Parties may not be assigned or delegated without a unanimous vote by the Parties. Any approved assignment or delegation shall be consistent with the terms of any contracts, resolutions, indemnities and other obligations then in effect. This Agreement shall inure to the benefit of, and be binding upon, the successors and Assigns of the Parties hereto.

8.5. Notice. Any notice or instrument required to be given or delivered under this Agreement may be made by: (a) depositing the same in any United States Post Office, postage prepaid, and shall be deemed to have been received at the expiration of 72 hours after its deposit in the United States Post Office; (b) transmission by facsimile copy to the addressee; (c) transmission by electronic mail; or (d) personal delivery, as follows:

If to Merced Subbasin Groundwater Sustainability Agency:

Ms. Lacey Kiriakou
Merced County
2222 M Street
Merced, CA 95340
Phone: 209.385.7654
Email: LKiriakou@co.merced.ca.us

If to Merced Irrigation Urban GSA:

Mr. Hicham Eltal
Merced Irrigation District
744 W. 20th Street
Post Office Box 2288
Merced, CA 95344-0288
Phone: 209.722.5761

Email: heltal@mercedid.org

If to Turner Island Water District GSA:

Mr. Lawrence Scott Skinner
Turner Island Water District
1269 W. I Street
Los Banos, CA 93535
Phone: 209.827.7700
Email: sskinner@wolfseninc.com

8.6. Counterparts. This Agreement may be executed by the Parties in separate counterparts, each of which when so executed and delivered shall be an original. All such counterparts shall together constitute but one and the same instrument.

8.7. Choice of Law. This Agreement shall be governed by the laws of the State of California.

8.8. Severability. If one or more clauses, sentences, paragraphs or provisions of this Agreement are held to be unlawful, invalid or unenforceable, it is hereby agreed by the Parties that the remainder of the Agreement shall not be affected thereby. Such clauses, sentences, paragraphs or provisions shall be deemed reformed so as to be lawful, valid and enforced to the maximum extent possible.

8.9. Headings. The paragraph headings used in this Agreement are intended for convenience only and shall not be used in interpreting this Agreement or in determining any of the rights or obligations of the Parties to this Agreement.

8.10. Construction and Interpretation. This Agreement has been arrived at through negotiation and each of the Parties has had a full and fair opportunity to revise the terms of this Agreement. As a result, the normal rule of construction that any ambiguities are to be resolved against the drafting Parties shall not apply in the construction or interpretation of this Agreement.

8.11. Entire Agreement. This Agreement constitutes the entire agreement among the Parties and supersedes all prior agreements and understandings, written or oral. This Agreement may only be amended by written instrument executed by all Parties.

IN WITNESS WHEREOF, the Parties hereto execute this Agreement on the last date written beside each Party representative's signature.

Merced Subbasin Groundwater Sustainability Agency

By: Robert D Kelley Date: 10/12/2017

Name: Robert D KELLEY

Merced Irrigation Urban Groundwater Sustainability Agency

By:_____ Date:_____

Name: _____

Turner Island Water District Groundwater Sustainability Agency

By:_____ Date:_____

Name: _____

EXHIBIT A
GSP DEVELOPMENT COST SHARE ALLOCATION
October 13, 2017

GSA	COST ALLOCATION
Merced Irrigation Urban GSA	40%
Merced Subbasin GSA	58%
Turner Island Water District GSA	2%
	100%

The percentage are derived from a ratio between irrigated and urban areas and groundwater production for the last 10 years, as derived from the latest available sources.

APPENDIX B: COMBINED MEETING MINUTES FROM COORDINATING COMMITTEE, STAKEHOLDER ADVISORY COMMITTEE, AND PUBLIC MEETINGS

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: March 26, 2018 at 9:30 AM

LOCATION: Merced County Admin Building – 2222 M St, 3rd Floor Conference Room 310, Merced, CA

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☐	Daniel Chaves	Merced Irrigation-Urban GSA
☐	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☒	Rodrigo Espinoza	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Overview of Sustainable Groundwater Management Act (SGMA) Groundwater Sustainability Plan (GSP) requirements
    - Woodard & Curran (consultant) provided a review of SGMA GSP requirements and discussed coordination with adjacent basins.
2. Overview of work completed to date and the scope of work for the Merced GSP development
    - Woodard & Curran provided an update on work completed to date, including modeling work that was completed as part of SGMA Readiness and Stressed Basins efforts. The basin groundwater model has been validated and calibrated.
    - DWR recommended full funding for Merced's GSP preparation and 3 Severely Disadvantaged Communities (SDAC) projects. Recommendations are currently out for public comment.
        i. Next Step: DWR expected to finalize recommendation soon and begin contracting.
3. GSP development process / timeline / roadmap
    - Woodard & Curran provided an overview of the GSP roadmap and timeline. The GSP needs to be finished in 18 months because the 3 GSAs need to adopt by Jan 31, 2020.

The meeting handout (Roadmap) and slides provide details on 13 scope tasks and anticipated process for plan development.

4. Discuss the stakeholder outreach approach
    - About 45 applications were received for the Stakeholder Committee. Draft committee list was formed by working with staff from each of GSAs.
    - ACTION: CC unanimous recommendation to approve the Stakeholder Committee; each GSA will take this list back to their board to approve.
5. Discuss DWR's SGMA Technical Support Services (TSS) opportunity
    - Woodard & Curran provided a summary of the TSS opportunity. The types and locations of monitoring will need to be identified to request services from DWR. The group discussed multiple options and criteria for potential well locations. The goal is to develop 2-3 ideas to discuss with DWR and move forward with the most appealing option.
    - ACTION: CC unanimous approval to pursue TSS funds with caveat team will come back to CC with specifics, time permitting.
6. Confirm Coordinating Committee schedule for in-person meetings and calls
    - The Committee agreed to set a standing meeting time for the fourth Monday of the month from 1:30pm to 3:30pm. The next meeting would be April 23, 1:30pm to 3:30pm (Note: the May meeting would be moved to May 29 from 1:30pm to 3:30pm due to the Memorial Day holiday).
7. Opportunity for public comment on items not on agenda
    - There was a request for information on the grant application for the 3 SDAC projects. Grant information is available through the DWR website and a link will be added to the Merced SGMA website (www.MercedSGMA.org)
8. Next steps and adjourn

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: April 23, 2018 at 1:30 PM

LOCATION: Sam Pipes Room, Civic Center/City Hall, 678 W 18th Street, 1st Floor, Merced, CA

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☐	Daniel Chaves	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Approval of minutes for March 26, 2018 meeting
    - Minutes were unanimously approved
2. Stakeholder Committee Progress and Update
    - First Stakeholder Committee Meeting will be 5/29/2018
3. Overview of work completed to date related to basin conditions
    - Woodard & Curran provided additional information on work completed to date as part of SGMA Readiness and Stressed Basins efforts:
        i. Merced Water Resources Model
        ii. Monitoring Plan – Merced County
4. Introduction to Terminology:
    - Woodard & Curran provided an overview of the key terminology for SGMA, including the relationships between Sustainability Indicators, Undesirable Results, Minimum Thresholds, Measurable Objectives, Interim Milestones, Margin of Operational Flexibility, and Monitoring Network
5. Preliminary Discussion on Undesirable Results

The group brought up the following potential undesirable effects to consider for each of the Sustainability Indicators:

- Chronic Lowering of Groundwater Levels
    i. Groundwater levels were noted to be an important indicator for several other Sustainability Indicators due to interconnectedness and easier visibility
    ii. Reduced specific pumping capacities at deeper wells
    iii. Question for technical team: how much emphasis will there be on recording or differentiating between static levels vs pumping levels?
- Reduction in Groundwater Storage
    i. Groundwater storage was noted to be less important due to a relatively large storage capacity – undesirable effects from reduced storage will be measured primarily in chronic lowering of groundwater levels
    ii. Might need to consider storage changes above vs below the Corcoran Clay separately
- Seawater Intrusion
    i. Does not apply to the Subbasin; salinity will be considered in degraded water quality
- Degraded Water Quality
    i. Crop impacts
    ii. Nonpoint sources, e.g. contaminant plumes in the cities
    iii. Water quality above vs below the Corcoran Clay
    iv. Groundwater pumping may be a positive action if trying to contain a specific localized groundwater quality concern
- Land Subsidence
    i. Increased conveyance costs of irrigation water
    ii. Possible changes in direction of flow in unconfined aquifer
    iii. Cost of injecting water as a tool to slow subsidence
    iv. Look into research on lagging effect of subsidence after groundwater pumping
- Depletion of Interconnected Surface Water
    i. CC members had no additions to list presented in slide

Other discussion points included:

- Substitute Environmental Document (SED) for Bay-Delta Plan unlikely to be finalized during GSP development; GSP will be developed according to current requirements but changes can be incorporated later if needed
- Shallow domestic wells are unlikely to be useful for groundwater level measurements
- The LeGrand area was identified as a key indicator region that has historically been more sensitive to groundwater level changes, but may have limited monitoring data available (additional investigation needed)

6. Discuss DWR's SGMA Technical Support Services (TSS) opportunity

    - Woodard & Curran provided an update on the TSS opportunity based on the 4/20/18 conference call with DWR

- Likely that Delta-Mendota Subbasin will site a monitoring well on their side of the Subbasin boundary which will be beneficial for Merced Subbasin as well, leaving Merced Subbasin with an opportunity to request a monitoring well in a different location in the Subbasin (potentially in the LeGrand region)

7. Discuss Leadership Counsel for Justice and Accountability Request for Letter of Support
    - Leadership Council for Justice & Accountability has applied for SGMA funding for DAC outreach in the San Joaquin Valley, and DWR has requested Leadership Counsel obtain letter of support from the GSPs in those areas (including Merced)
    - CC chose to take no action until additional information is provided by the group on their workplan and how it will be coordinated with the work Self Help Enterprises will conduct in the subbasin
8. Opportunity for public comment on items not on agenda
    - No questions
9. Next steps and adjourn
    - CC members were provided with maps of monitoring wells in 1992, 2015, and present for their respective GSA and given an assignment to indicate wells or regions of wells known to experience undesirable effects for each of the six Sustainability Indicators
    - Hicham ElTal provided an update on the first interbasin meeting between Turlock and Merced, with a next meeting tentatively June 18, 2018

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: May 29, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☒	Rodrigo Espinoza	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Approval of minutes for April 23, 2018 meeting
    - Minutes were unanimously approved
2. Stakeholder Committee (SC) Update
    - Unanimous approval to add City of Livingston representative Alex McCabe to the SC (was left off initial list due to administrative error)
    - Samantha Salvia provided an update on the first SC meeting, held earlier in the day.
        i. First SC Meeting was held morning of 5/29/2018, attended by 20 members.
        ii. SC members expressed interest in regular updates on interbasin coordination as well as meeting time allocated for educational topics including water quality related to SGMA and Bay Delta Plan. These items will be worked into future meetings on an ongoing basis.
        iii. SC members requested ability to designate alternates when they are unable to attend a meeting. CC members were open to alternates provided they represent the same interests as the SC member. Consultant team was directed to put together a

proposal for Stakeholder Committee procedures for attendance and designation of alternates.

- Hicham ElTal reported that UC Merced has offered to present on effective communication of water topics.
    i. CC group agreed to direct consultant team to schedule an optional "brown bag" lunchtime presentation for both SC and CC members in June or July.

3. Presentation by Woodard & Curran on GSP Development
    - Charles Gardiner (Catalyst Group) provided an update on the Stakeholder Outreach Plan
        i. This is envisioned as a living document and will be updated roughly quarterly.
        ii. Any additional comments are requested from CC members by June 8.
    - Dominick Amador (Woodard & Curran) gave a presentation on the Merced Water Resources Model (MercedWRM).
        i. The MercedWRM historical and existing conditions baseline was developed through the MAGPI group and is available to support GSP implementation.
        ii. W&C is currently incorporating additional data from Turner Island WD.
        iii. Additional discussion by the CC is needed to refine the assumptions required for development a projected conditions baseline.
        iv. Bob Kelley (Stevinson Water District) requested the committee consider extending the hydrologic period though the 2017 water year to capture the effects of drought recovery.
    - Samantha Salvia (Woodard & Curran) provided a summary of feedback on the Undesirable Results Exercise from the CC members of all 3 GSAs
4. Update on DWR's SGMA Technical Support Services (TSS) opportunity
    - Hicham ElTal (Merced Irrigation District) reported that discussions with Chris White (Central California Irrigation District) have continued re: installing a monitoring well in the southwest corner of the Subbasin. A landowner has volunteered a site but is requesting well characteristics information which Hicham is working on providing.
    - Next steps include locating a site for the desired monitoring well in the Le Grand area.
    - Amanda Peisch from DWR attended the 5/29/2018 SC meeting and indicated that limited funds are available in this first TSS round. More funds may be available in the future and will be dependent on state budget because source is the General Fund.
5. Discuss Leadership Counsel for Justice and Accountability Request for Letter of Support

- Amanda Monaco (Water Policy Coordinator at Leadership Counsel for Justice and Accountability) provided a description of her organization's work with Disadvantaged Communities and how it fits into GSP development in the Merced Subbasin.
- CC directed staff to write a letter of support for Leadership Counsel.

6. Opportunity for public comment on items not on agenda
    - No questions
7. Next steps and adjourn

MEETING MINUTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: June 25, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Approval of minutes for May 29, 2018 meeting.
    - Minutes were unanimously approved
2. Stakeholder Committee (SC) Update
    - Alyson Watson (Woodard & Curran) provided an update on the second SC meeting held earlier in the day. SC members were provided a background on sustainability terms and had open discussion about the definition of sustainability and how it applies to the Subbasin.
3. Plan Area and Authority
    - Alyson Watson provided an overview of what the Plan Area and Authority chapter includes, which will be provided for review by Coordinating Committee (CC) members at the end of June to return with comments by July 23 meeting.
4. Minimum Thresholds
    - MID likely has 1 well in area in eastern portion of the Subbasin that could be added to analysis., with 1 additional possibly near Fahrens Creek. Identified need to work with Planada CSD and others to get additional data in this eastern area.

- Some dry wells in 2015 were only 25 feet deep, but it may not be reasonable to say the threshold is 25 ft in these spots.
- Ron Meyers was identified as a pump tester who may have more detailed well completion information than some of the agencies for areas with private wells. Nic Marchini will provide Ron's contact info.
- Nic Marchini will look at static water level records back to 2012 and try to put together a summary spreadsheet to fill some data gaps.
- Hicham ElTal noted that in the McSwain area, some water is being produced from below a hardpan (not related to Corcoran Clay). In 2008, some wells dropped 40-50 feet. This one example out of several other special situations where shallow groundwater wells may not be useful for regional measurement and analysis.
- Hicham ElTal indicated that agencies in neighboring Subbasin may have more information about trucked water program and should be contacted.
- CC members discussed the definition of Groundwater Dependent Ecosystems (GDEs) and the need for ground-truthing the dataset provided by The Nature Conservancy (TNC)/DWR.

5. Current Conditions Baseline

- Ali Taghavi (Woodard & Curran) gave a presentation on current conditions baseline assumptions and results so far.
- Hicham ElTal and Ken Elwin indicated the possibility of using the latest 2012 MID dataset in the Water Resources Management Plan, prepared by CH2, for Merced and McSwain area to inform assumptions for parks, cemeteries, backyards, etc. within City of Merced boundary.
- Bob Kelley requested to rename "Change in Storage" to "Deficit" or "Overdraft" in Groundwater Budget graphics.
- A table summarizing average rainfall and example hydrologic years will be provided to CC members as a data request for suggested changes/updates.

	Average rainfall	Sample Years
Wet year		
Above normal		
Below normal		
Dry		
Critical		

6. Future Conditions

- Woodard & Curran shared that there is a need for additional information about future baseline assumptions from CC members.
- Bob Kelley shared that there is some information available about dairies, but it is not very detailed.

- Ken Elwin and Justin Vison will provide assumptions about other future conditions.
- Three assumption areas were identified for additional input:
    i. Urban: 2013 level of water usage (Will conservation measures last long-term? What can each municipality tolerate?)
    ii. Agriculture Surplus Water (Same cropping pattern with less water? What future cropping mix changes will increase or decrease water usage?)
    iii. Interbasin Coordination (How much water is escaping from Merced Subbasin to other subbasins?)
- CC members were requested to review and provide comments on projected water supply and demand information, agricultural land use, and industrial users on private wells.
- Woodard & Curran will summarize for Bob Kelley the historical information that has already been provided.

7. Coordination with Neighboring Basins Update
    - Staff have provided edits on Interbasin agreement back to Chowchilla Subbasin.
    - 2 meetings have been held so far with representatives from Turlock Subbasin to coordinate on GSP development status, data, etc.
    - Staff are trying to schedule a meeting with Delta-Mendota Subbasin, with preference to coordinate with GSAs preparing GSPs adjacent to Merced Subbasin.
    - CC members directed staff to represent them at the Interbasin Coordination meetings.
8. Update DWR's SGMA Technical Support Services (TSS) opportunity
    - Hicham ElTal (Merced Irrigation District) is still coordinating with CCID on federal and state funding for monitoring wells for subsidence. He is also still coordinating with a potential landowner to site an additional monitoring well south of LeGrand.
    - Amanda Peisch (Department of Water Resources) provided a brief update that four other TSS applications have been submitted so far. The $2-3M drilling contract is open, but DWR is hoping some other application requests outside of drilling would be handled through services provided by existing DWR staff. While funding is not exactly first-come first-serve, it is still limited and will be decreasing soon.
9. Opportunity for public comment on items not on agenda
    - A question was raised about whether GDEs will be included in future water budget projections:
        i. Not explicitly, but they are included in evapotranspiration (ET) from future land use.

- Water demand for for maintenance of natural spaces will be included through UWMPs (for city-supplied spaces) with some already in model. Refuge water release requirements from MID are already built into the model.

10. Next steps and adjourn

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: July 23, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Approval of minutes for June 25, 2018 meeting.
    - Minutes were unanimously approved
2. Stakeholder Committee (SC) Update
    - Alyson Watson (Woodard & Curran) provided an update on the third SC meeting held earlier in the day. SC members had questions, discussion, and clarifications on assumptions for the groundwater model
    - The Coordinating Committee (CC) gave feedback on the Stakeholder Communication Workshop with UC Merced
        - Framing of the content was interesting, but how questions were posed could be improved
        - Good points were made by participants on key basin issues
3. Presentation by Woodard & Curran on GSP development
    - Plan area and authority
        - Some comments were received via email. CC members were asked to please let the Woodard & Curran team know if they plan to provide comments
    - Minimum thresholds

- Alyson Watson (Woodard & Curran) provided an overview. Technical work feeds into the policy decisions and informs what the basin will try to accomplish: identifying Undesirable Results (URs), Minimum Thresholds, and Measurable Objectives
- Groundwater Elevations
    - A list of the 6 sustainability indicators was provided. As previously discussed, seawater intrusion and storage are not considered relevant for the Merced Subbasin. Minimum thresholds are to be set where URs occur (e.g. lowest groundwater levels without UR)
    - Establishing what is undesirable/unreasonable is a policy decision. If a decision is made that an issue is significant and unreasonable that is occurring now, we can use as a 2015 data point
- Alyson Watson described the Minimum thresholds approach analysis for Corcoran clay. The approach is based on the information available for above, below, and outside the Corcoran clay. The consultant team's proposed approach looked at the CASGEM monitoring wells that are also located above the Corcoran clay and took into account the Tanked Water Program area. During the drought there were domestic wells that went dry in this area, which could be indicative of an undesirable result unless those wells have been deepened and the issues that occurred at those groundwater elevations have been addressed
- Alyson Watson also explained the minimum thresholds approach for outside the Tanked Water Program impacted area
    - An initial 20% buffer was established for the model to give an example of what this would look like in terms of thresholds. It is not suggested to have a threshold for every well, but to consider where the Tanked Water Program is and if there are some negative, undesirable results there
- Discussion and comments on the minimum thresholds approach were as follows:
    - Comment from Woodard & Curran (W&C): the question that must be asked is what undesirable results are occurring? For example, if all of the Tanked Water Program wells have been replaced, does this represent an undesirable result?
    - Comment from CC: there is not much data, nor many wells in the foothills of the Subbasin
    - Comment from CC: in selecting monitoring wells, it will be important to consider the age of the well and its anticipated additional life in terms of compliance
        - Comment from W&C: the CASGEM wells were selected because they have recorded dates that can be checked
    - Clarification given for question on adaptive management: a buffer is applied for operational flexibility. This process first considers well water for the lowest domestic wells and then looks at what happens when applying a 20% buffer
    - Comment from CC: there should be more substantiation behind the 20% buffer selection
    - Comment from W&C: the next step is to look at a 10% or 20% buffer, compare this to the data that the GSAs have, and figure out what is reasonable
- Water Quality

- Question was asked whether there are levels that could trigger issues with water quality. Response from W&C: this is very site-specific, and requires further work with staff from local agencies to understand this
- Alyson Watson (W&C) gave a brief introduction to the CV-SALTS (the Central Valley Salinity Alternatives for Long-Term Sustainability) initiative and the ILRP (Irrigated Lands Regulatory Program).
- Comment from CC: a data point on the TDS (Total Dissolved Solids) map "Average TDS Concentration BELOW Corcoran Clay (2000 – 2016)" was identified as surprising
- There was a brief discussion on salinity issues. Input from Alyson Watson (W&C): the challenge is that relatively few actions can be taken to address migration of salinity. The priority for the GSP is to identify undesirable results and how these are happening and prevent further impacts
- Input from Jim Blanke (W&C): there are some water quality issues that cannot be control (e.g. naturally occurring constituents). There are also existing programs that address some of these constituents

- Land subsidence
  - GW levels can be used as a proxy, or the GSP can use a rate of subsidence. However, even if all groundwater users in basin stopped pumping it is not known whether subsidence will continue. It is recommended by the consultant team to use this proxy and to ensure the GSP uses the same measurement approach as neighboring subbasins
  - Comment from CC: in the 1960s there was subsidence, but fewer wells and a high water table. The reasons for this are not well understood. Therefore, the GW level proxy might be a safer option
- Interconnected Surface Water
  - Alyson Watson and Dominick Amador (W&C) provided a brief overview of the interconnected surface water modelling
  - The model shows a segment north west of San Joaquin River and Merced River as an area of interest. The model will need to be adjusted to consider additional parameters for dry conditions
  - It is possible to look at how shallow wells have changed over time relative to stream losses. However, there are not many wells and there is fluctuation
  - The next step is to consider what are the undesirable results. Further work with be needed to determine GW conditions that are influencing low flows

a. Hydrogeologic conceptual model overview
   - This item was tabled to the next meeting due to lack of time

b. Current conditions baseline, projected water budget, and sustainable yield
   - Alyson Watson (Woodard & Curran) described how continued water use over 50 years will affect the water budget. The underlying assumptions are being refined
   - The sustainable yield is also being developed for discussion at the next meeting

4. Public Outreach update

- Plans for upcoming August 2 Public Meeting were discussed. Meeting materials are on the website

5. Coordination with Neighboring Basins
    - Hicham ElTal (Merced Irrigation District) reported there are upcoming meetings to sign agreements with Chowchilla and he is still working to set up a meeting with Delta-Mendota
6. Update DWR's SGMA Technical Support Services (TSS) opportunity
    - Hicham ElTal (Merced Irrigation District) provided an update. For Delta-Mendota, it might be possible to have two monitoring wells. He might be able to reach out to Chowchilla as well. Hicham also contacted DWR regarding Grant Agreement funding. DWR are not as concerned about whether the GSAs will receive funds, but that it might take longer for funds to be received
7. Public comment
8. Next steps and adjourn
    - Reminder given that Aug. 2nd is next Public meeting

Next Regular Meeting
August 27, 2018 at **1:30 p.m.**
Merced, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item
Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: August 27, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☐	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
2. Approval of minutes for July 23, 2018 meeting.
    a) Minutes were unanimously approved
2. Stakeholder Committee (SC) update
    a) Alyson Watson (Woodard & Curran) provided an update on the fourth SC meeting held earlier in the day. SC members had questions, discussion, and clarifications on methodology for setting minimum thresholds, particularly for groundwater elevations.
3. Presentation by Woodard & Curran on GSP development
    a) Minimum Thresholds for Groundwater Elevations
        i. Alyson Watson (Woodard & Curran) presented the updated proposed methodology for calculating minimum thresholds for groundwater elevations at existing CASGEM wells.
        ii. Coordinating Committee members thought the updated methodology made sense. DWR data on domestic wells is likely to be poor, so using a 25th percentile shallow value sounds appropriate.
        iii. Public Comment: Timing of spring/fall measurement of CASGEM wells may not align with seasonal peak domestic well pumping (e.g. domestic wells may be temporarily dewatered in August, which wouldn't be caught by March/October monitoring).

iv. The "buffer"/"total range" for the elevation threshold analysis is including the impacts of seasonality and may want to consider fall to fall or spring to spring comparison.

v. Question: Should we use threshold setting results to directly identify additional monitoring locations? Answer: Our approach will be to determine storage changes through the sustainable yield process and then use the results to evaluate minimum thresholds and monitoring needs.

vi. In the gap area(s), Woodard & Curran will be evaluating other non-CASGEM wells in the database to identify any with (1) enough historical data and also that (2) meet requirements to be used (have completion depth, etc.). A separate challenge is that thresholds for newly constructed monitoring wells may take several years to determine a threshold (e.g. time needed to develop historical data).

1. Marco Bell (Merced Irrigation District [MID]) indicated that an update will be available in approximately 1-2 months about additional monitoring wells MID is working on adding or selecting from existing wells to fill CASGEM gap areas as identified in the Merced Subbasin CASGEM monitoring plan.

2. Request: Hicham ElTal (MID) requested standing agenda time to be added to future meetings to provide an update on CASGEM program status.

vii. Shallow school district wells were identified as a potential additional indicator for the groundwater threshold analysis. Woodard & Curran will start by contacting the Office of Education to obtain information about these wells for incorporation into the analysis.

b) Hydrogeologic Conceptual Model (HCM)

i. Alyson Watson (Woodard & Curran) provided an overview of the HCM section of the GSP and some example maps that will be included in the section writeup that will be provided for CC member review in the next few months.

ii. CC Comment: 3D renderings or cross sections need to include both a vertical and horizontal scale to distinguish vertical exaggeration or include a non-exaggerated version.

c) Projected Water Budget and Sustainable Yield

i. Alyson Watson (Woodard & Curran) provided an update to assumptions and results of the projected conditions baseline groundwater budget and sustainable yield groundwater budget.

ii. Question: On the projected conditions baseline budget, why does net deep percolation not change significantly? Answer: Right now, it doesn't take into account efficiency changes since it is a baseline under projected conditions, but we would expect some decrease under other scenarios.

iii. Question: What are main assumptions in first 25 years (2015-2040) of the sustainable yield groundwater budget? Answer: No specific decisions on assumptions were made on how we will get to sustainable conditions in 2040, but for the purposes of modeling the end-result or goal, reducing agricultural land was used as a model input.

iv. Question: Under the 25-year projected sustainable yield, were assumed model condition changes modeled as front- or back-loaded in the timeline? Answer: This discussion and decision for implementation of projects and management actions will come later in the GSP process. Likely we will design it to be a smooth or back-loaded process to account for expected changes from SED or other factors.

d) Data Management Approach and DMS Demo

i. Jeanna Long (Woodard & Curran) provided a description of the data management system (Opti), including a short demo of the existing tool.

ii. Question: Will data be available to the public? Answer: The GSAs will decide, but the flexibility is there to make certain or all parts publicly available.

4. Public Outreach Update

    a. Alyson Watson (Woodard & Curran) provided a summary of discussion and comments recorded during the August 2 public workshop presentation.

5. Coordination with neighboring basins

    a) No update on Turlock right now, but meetings continue to coordinate on milestones. (Reminder: Turlock is on a different SGMA schedule that has a completion deadline 2 years after Merced).

    b) Debbie Liebersbach (Turlock Irrigation District) has met with Delta-Mendota representatives to start coordination efforts. Currently Turlock and Delta-Mendota Subbasin are discussing development of a resolution or similar document which will be shared with Merced when ready.

        i. Woodard & Curran will be setting up a meeting with Delta-Mendota soon to start coordination with the two GSPs adjoining the Merced Subbasin.

    c) A preliminary meeting was held with Chowchilla staff to begin coordination on modeling.

6. Update DWR's SGMA Technical Support Services (TSS) opportunity

    a) Hicham ElTal (MID) is waiting for a meeting to be set up by DWR to discuss timing of expected funding for Merced Subbasin project(s). Woodard & Curran continues to move the contract agreement forward with DWR and is currently waiting to hear back from DWR on the latest round of comments.

7. Public comment

    a) No comments.

8. Next steps and adjourn

Next Regular Meeting
September 24, 2018 at **1:30 p.m.**
Merced, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: September 24, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☒	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
2. Approval of minutes for August 27, 2018 meeting.
    a) Minutes were unanimously approved
3. Stakeholder Committee (SC) update
    b) Alyson Watson (Woodard & Curran) provided an update on the fifth SC meeting held earlier in the day. SC members had questions, discussion, and clarifications on updated methodology for groundwater elevation minimum elevations, plus projected water budget and sustainable yield.
4. Presentation by Woodard & Curran on GSP development
    a) Minimum Thresholds Update
        i. Groundwater Elevations
            1. Alyson Watson (Woodard & Curran) provided an update to the methodology of setting minimum thresholds for groundwater elevations (primarily the addition of CASGEM voluntary monitoring well locations and use of Merced County domestic well database related to undesirable results).
            2. Public question: What are the ranges of domestic well depths beyond the shallowest? Are there outliers for other domestic wells if the minimum threshold is the same as the shallowest domestic well? Answer: This is something we'll be

looking at more closely when we get farther into the process of selecting a smaller number of monitoring locations.

3. Question: How did you choose a 3-mile radius for domestic wells? Answer: This is a balance between being locally representative and capturing enough domestic wells per monitoring location to be statistically representative.

ii. Water Quality

1. Alyson Watson (Woodard & Curran) provided an overview of data analysis in progress for TDS and contaminated sites, demonstrating that there are large data gaps for TDS with depth.

2. Public comment: Try interviewing drillers in the area – they tend to have a good sense of at what depth high salinity is found.

b) Projected Water Budget and Sustainable Yield

i. Alyson Watson (Woodard & Curran) provided a reminder on the assumptions and results of the projected conditions baseline groundwater budget and update to the results of sustainable yield groundwater budget.

ii. Public question: Why was a 25 year implementation period used? Answer: The model's historical period is from 1995-2015 and SGMA compliance is required in 2040, so the implementation period ends up being 2015-2040 (25 years).

iii. Public question: What happens if there's a long-term drought immediately and something like 30% of domestic wells go dry (out of ordinary)? Answer: The Minimum Thresholds are generally set at levels where we do not expect this to occur. The regulations for violations are meant to be based on long-term average and we expect there to be an allowance for unusually dry year periods.

iv. Dominick Amador (Woodard & Curran) walked through GSA-specific water budget summary tables based on sustainable yield conditions.

v. Question: How was urban demand estimated outside of municipal service providers (e.g. domestic wells)? Answer: Urban demand was calculated based on population and per-person usage; outside of the cities, the population was based on census data.

vi. Alyson Watson (Woodard & Curran) provided a description of what water levels would look like under sustainable yield conditions in the subsidence area in the southern end of the Subbasin.

vii. Question: Have you considered using subsidence rates as an indicator? Answer: Yes, but this is more difficult to predict with high accuracy compared to groundwater levels. It is difficult to control subsidence rates directly, and we need to be ready to coordinate with neighboring subbasins on a similar methodology.

viii. Question: How can you go back to 2015 levels (per SGMA regulation) for subsidence if we decided to choose to use groundwater levels as a proxy for subsidence levels/rates? Answer: Probably only through an injection program or similar program designed to increase water levels.

c) Projects and Management Actions

i. Alyson Watson (Woodard & Curran) provided a description of projects and management actions and provided example categories that projects might fall into.

ii. Question: How do projects get credited to a particular GSA/landowner/etc.? Answer: It will largely depend who funds the project.

iii. The project team solicited initial project ideas from CC members and the following were brought up:

1. Reach out to the private growers for additional input.
2. Meter private irrigation wells.

5. CASGEM Update
    a. No updates provided – was tabled for next month.
6. Public Outreach Update
    a. Alyson Watson (Woodard & Curran) expressed the intention to hold a public workshop in first 1-2 weeks of December.
7. Coordination with neighboring basins
    a. Preliminary discussion was held with Delta-Mendota Subbasin: found that Delta-Mendota is slightly behind the Merced Subbasin in terms of data efforts and the project team will likely continue coordination efforts in early 2019.
8. Public comment
    a. Question: Do municipalities have overlying water rights? Answer: Individual landowners have overlying rights; rights of municipalities would be prescriptive.
    b. A request was made to post the PowerPoint slides before the next meeting in case printed copies run out.
9. Next steps and adjourn

Next Regular Meeting
October 22, 2018 at **1:30 p.m.**
Merced, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: October 22, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
2. Approval of minutes for September 24, 2018 meeting
    a. Meeting minutes were approved.
    b. A request was made and approved to have the Self-Help Enterprises and the Leadership Counsel for Justice and Accountability as the next agenda item.
3. Update from Self-Help Enterprises (SHE) and Leadership Counsel for Justice and Accountability (Leadership Counsel)
    a. Maria Herrera (SHE) and Amanda Monaco (Leadership Counsel) provided an overview of their organizations' outreach activities in the Merced Subbasin DACs and the funding received from DWR for reaching disadvantaged communities.
    b. Leadership Counsel works mostly within unincorporated communities and low-income communities that often lack basic infrastructure. Their work includes: outreach and education, GSP development assistance, identification of community water projects, and procurement of professional services.
    c. Funding for Leadership Counsel's SGMA-related work has come from the DWR Prop 1 grant and the Water Foundation.
    d. Leadership Counsel activities conducted in the Merced Subbasin included presentations to Neighbors United for a Better South Merced and to a community group in Delhi. Work has also included a GSP Workshop in April together with SHE and the Union of Concerned Scientists.

e. Maria Herrera (SHE) provided an overview of SHE activities. SHE works in outreach and education, direct community assistance, and GSP development assistance. Their work in the Merced Subbasin includes the SGMA Workshop held in August, outreach to 5 different communities, and support for development of workshop materials including translation.

i. SHE's outreach also provides information on concerns voiced by local communities (e.g. including concerns for having large wells permitted near their communities).

ii. SHE will continue to coordinate with Woodard & Curran and Catalyst in preparation for the upcoming public workshops.

4. Stakeholder Committee update

a. Update from October 22 morning meeting was provided. There was a slightly smaller turn out than normal, but good discussion. Many questions were asked about groundwater rights. A CASGEM update was provided. There was a brief discussion of discuss projects and management actions.

5. Presentation by Woodard & Curran on GSP development

a. Next Steps in GSP Development

i. Alyson Watson (Woodard & Curran) gave an overview of the GSP development timeline.

ii. The path for sustainability requires overcoming the challenge of reducing groundwater pumping while minimizing how much reduction has to be made in total use.

iii. There are three steps to this process: 1) determine extent of groundwater pumping that is sustainable, 2) determine available surface water, and 3) identify potential deficit between demand and available resources.

iv. Water budgets and modeling that has gone into these estimates are being refined. The initial estimates do not yet reflect changes to flow projections resulting from FERC relicensing.

v. Two areas should be addressed to achieve sustainability: reducing groundwater pumping (e.g. though an allocation framework); and identifying projects and management actions (e.g. recharge groundwater, enhance surface water availability, and reduce demand).

vi. Question asked by Alyson whether the information provided is understandable and provides committee members with enough and adequate information to be able to answer questions and talk about this issue with others. Members agree that content is understandable.

b. Groundwater Rights Primer

i. Brad Herrema (Brownstein Hyatt Farber Schreck) provided an informational presentation on groundwater rights and allocation frameworks. A brief list of key points is provided below (see full presentation on Merced SGMA website):

1. In California, a water right is a usufructuary right in which there is a prohibition against waste and unreasonable use.

2. California has a dual system of riparian rights and appropriative rights for both surface water and groundwater.

3. Overlying rights: these rights have the highest priority and are analogous to riparian rights for surface water. All overlying land owners have the right to pump, but this is a correlative right (limited to reasonable use).

4. Appropriative rights: non-overlying owners are allowed to extract surplus water not being used by overlying owners. It is a first in time, first in right use (whoever has

the right first, has priority over other appropriative right users). These can be subject to loss for non-use.

5. If water is imported into the basin this is covered by a "developed water" theory: those who develop means to import the water are entitled to use it.

6. Prescriptive rights: water right acquired through adverse possession of someone else's water right. There are several required elements. Often this is a result of someone taking someone else to court.

7. SGMA does not alter and is not determinative of water rights.

8. Brad Herrema recommends reviewing the Environmental Defense Fund paper on groundwater rights and the pros and cons for different allocation methods (link here).
    a. The comprehensive allocation method has the best chance of surviving judicial challenge but can be highly stakeholder engagement intensive.
    b. Allocation based on Fraction of Historic Pumping does not take into account the correlative nature of groundwater rights, and it can be difficult to get data for this.

9. Question: do you see much of the Central Valley undergoing adjudication in the future? Answer: Brad would not be surprised, but the GSP process does a lot of relevant work.

10. Clarification provided that water rights and allocation are two different things. Example provided by Alyson Waterson (W&C): your correlative water right is the straw (your ability to take water), how much you take (your allocation) is the amount you are using.

c. Projects and Management Actions
    i. Alyson Watson (W&C) gave a high-level overview for the projects and management actions section to enable adequate time for the CASGEM update. This will be revisited in the next meeting. An overview was given of what background work has been conducted and what projects information has been collected. The list presented provided information on projects the consultant team knows currently exist.
    ii. A request made to the committee to contact Woodard & Curran regarding any individuals or groups that should be contacted to collect information on more projects.
    iii. An example list of criteria was given for assessing projects.
    iv. Alyson Watson (W&C) asked the committee whether there are other criteria that should be considered. Several responses from the committee members were provided as follows:
        1. Have specific environmental benefits listed out individually.
        2. Question: if someone already has a project and it is completed how is this taken into account for allocation? Answer: will have to determine how to take this into account and determine if/how this will be credited.

d. Other Updates
    i. Groundwater Data templates and instructions for submitting data have been updated and are available on the MercedSGMA homepage.

6. CASGEM Update provided by Matt Beaman (MID)
    a. Merced Area Groundwater Pool Interests (MAGPI) collects data and submits this to the California Statewide Groundwater Elevation Monitoring program (CASGEM). CASGEM facilitates between DWR and the public.
    b. Data is used to established and create contour maps in groundwater elevations on a seasonal and long-term basis.
    c. DWR determines if Merced is in compliance with groundwater elevation reporting.
    d. CASGEM is still in effect and GSAs need to be in compliance with CASGEM to receive funding and loans. DWR provides monitoring guidelines (e.g. number of wells per area, how often monitoring, and what kind of wells). These guidelines are posted on the Merced SGMA website under the "Guidelines for Submitting Groundwater Data" on the homepage.
    e. The previous plan provided ways to minimize gap areas. Several maps are shown highlighting how wells have been filling gap areas. There are new wells from MID and 4 of the 5 wells are CASGEM wells.
    f. Stevinson Water District has some private wells that could be monitored. Hicham ElTal (MID) stated that these could be included within the datum created with upcoming grant funding for all public wells.
7. Public Outreach update
    a. Charles Gardiner (Catalyst) provided information on the two public workshops that will take place in December:
        i. Dec. 4th Community Workshop – Planada
        ii. Dec. 13th Community Workshop – Franklin-Beechwood
    b. Topics anticipated to include water budgets, where we are with the project, and a brainstorming of projects and management actions.
8. Coordination with neighboring basins
    a. Chowchilla and Delta-Mendota Subbasins will be ready early next year to continue coordination.
9. Public comment
    a. No public comments.
    b. Hicham ElTal offered that MID can provide a presentation on Flood-MAR during the next meeting.
10. Next steps and adjourn
    a. Several GSP development items anticipated to be discussed in the next meeting including: water budgets and documented assumptions, the Hydrogeological Conceptual Model (HCM) GSP section, sustainable yield analysis, and assessment of projects and management actions.

Next Regular Meeting
November 26, 2018 at **1:30 p.m.**
Merced, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: November 26, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☐	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
2. Approval of minutes for October 22, 2018 meeting
    a. Meeting minutes were approved.
3. Stakeholder Committee update
    a. Update from the November 26 morning meeting was provided. W&C staff gave a presentation on the Data Management System (DMS). Comments were requested on the draft Hydrogeologic Conceptual Model (HCM). Some SC members provided some verbal comments. Additional review time was requested and document was re-sent to SC with comments requested by Nov 30. SC comments on the Projects and Management Actions will be discussed during the discussion portion of the Coordinating Committee (CC) meeting.
4. Presentation by Woodard & Curran on GSP development
    a. Next Steps in GSP Development
        i. Alyson Watson (Woodard & Curran) provided a brief overview of the GSP development timeline and what will be covered during the meeting.
        ii. The HCM was sent out to the CC group in early November. This is part of a larger document (the GSP) with other sections. Deadline for comments is November 30th. However, if more time is needed to provide comments, CC members are asked to inform the W&C team.

iii. Water budgets have been updated with inclusion of FERC flows. Sustainable yield for the Merced Subbasin is estimated to be approximately 500,000 TAF per year. Projections that account for FERC flows indicate a need for about a 25% reduction in groundwater use for the subbasin. This percentage reduction is similar to previous estimated without updated FERC flows.

iv. Alyson Watson (W&C) explained the different inflows and outflows of the projected conditions groundwater budget and changes in cumulative storage.

b. Water Allocation Frameworks

i. Alyson Watson (W&C) described different water allocation frameworks possible under SGMA.

ii. The allocation framework chosen will also need to address and connect back to avoiding undesirable results. Projects and management actions will be revisited to address impacts to thresholds. When the GW allocation approach, projects and management actions, and consideration for impacts on thresholds and objectives are combined, the creation of management areas may be considered for specific issues.

iii. Alyson Watson (W&C) reviewed the proposed decision-making timeline for the GSP. November will focus on discussing allocation approaches as well as projects and management actions. Under SGMA, GSAs have broad authority to implement the allocations. In December the CC will discuss making a recommendation to the GSA Boards as to which allocation approach is best for the subbasin. The GSA Boards will consider the approach in January. The CC will review projects and management actions benefits along with the SC in January.

iv. Question: How will we know what impacts these different allocation approaches have? Answer from W&C: We will be doing the technical work to determine these impacts and will discuss this together.

v. Question: How will this impact thresholds? Answer from W&C: The thresholds are driven by undesirable results, which can be addressed by projects and management actions.

vi. Implementation of the GSP will be phased and include monitoring. Updates can be made to the thresholds and the allocation approach every 5 years.

vii. Question: When would we discuss management areas? Answer from W&C: This is planned for February.

viii. Alyson Watson (W&C) explained the different kinds of allocation methods.

1. Pro Rata Approach: Sustainable yield is divided total basin acreage. Advantages are that it is simple, and it recognizes the correlative (everyone has a right to access the basin) nature of groundwater rights. However, this does not account for appropriators/prescriptive rights, and does not differentiate between irrigated and unirrigated acres.

2. Pro Rata Irrigated Areas Approach: This divides the sustainable yield by irrigated and urban areas. It is simple and acknowledges existing pumping. However, the approach does not account for unexercised groundwater rights nor account for appropriators/prescriptive rights.

3. Historical Pumping Approach: This is based on historical use. This is less likely to result in conflict and accounts for appropriators and prescriptive rights. However, it requires more data and if unirrigated acres are excluded this also does not account for unexercised groundwater rights.

4. Comprehensive Approach: The advantages include less likelihood of conflict and an accounting of appropriative use and prescriptive rights. However, this approach requires data not that is currently available, and does not account for unexercised groundwater rights. The approach requires significant outreach and engagement.
5. Key differences between approaches were discussed. Some comments from the SC morning meeting were:
    a. Questions and comments on whether to have a water market.
    b. May need to limit water market access only to those who are in the basin.
    c. Maybe take a hybrid approach with different tiers (e.g. if you are not irrigating you may be in a different tier).
6. Comments from the CC group on allocation approaches:
    a. Prescriptive rights should be taken into account in calculations.
    b. It does not make sense to allocate groundwater where historically it was not used. However, people have the ability to exercise their rights to pump water.
    c. Input from Alyson Watson (W&C): Allocations can be adjusted as people exercise their rights.
    d. CC comment: Monitoring and enforcement will be important. How are we going to monitor what comes online?
    e. Input from Alyson Watson (W&C): GSAs have the authority to enforce.
    f. CC comment: If you allocate by acre, the surface water dependent folks will get less. In the commenter's experience working with surface water it is possible to prohibit the movement of water out of the basin.
    g. Comment: There is concern that people will buy useless land just for the water right.
    h. Question: Can you really do a pro rata allocation approach? Answer (W&C): GSAs cannot affect rights but can check that fees are fair.
    i. Comment: What are the enforcement actions available to GSAs? Answer (W&C): We will bring information to next meeting.
    j. Question: What if an irrigator comes online and decides to pump, but has not historically been pumping?
    k. Comment: With the County Ordinance that has been put into effect, there may likely be fewer new pumpers that will come online.
    l. Input from Alyson Watson (W&C): If there is not a question of substantial change from irrigated to non-irrigated lands, then the question is whether or not rights holders who are not irrigating (and do not intend to irrigate) will be able to sell their rights to others.
    m. Comment: It would not be a bad idea to look at other adjudicated basins and how this worked. Input from W&C: The example from the Mojave Adjudication which used a transferable allocations setup can be presented next meeting.

n. Comment: There will need to be significant outreach especially related to monitoring and data collection for the wells for people to understand this and what is needed.

o. It would be useful to have the per capita usage for the cities per day.

p. Request made to CC members from W&C: Consider the allocation approaches discussed for next meeting.

c. Projects and Management Actions

i. Alyson Watson (W&C) provided an update from the SC meeting discussion.

ii. Question asked about criteria to assess projects: What are they being assessed for? Answer (W&C): The subbasin should be able to show what projects and what potential funding avenues are in the implementation plan for the GSP.

iii. Comment: It could be useful to have a high-level cost/benefit ratio for projects.

iv. Input from Alyson Watson (W&C): The subbasin should determine what to target and identify areas of greatest need, and then determine projects that help best address these.

d. Other Updates

i. Monitoring Networks and the DMS sections of the GSP are underway.

5. Flood-MAR

a. This item was tabled to next meeting.

6. Public Outreach update

a. There are two upcoming Public Workshops: Dec. 4th in Planada, and Dec. 13th in Franklin.

7. Coordination with neighboring basins

a. Chowchilla and Delta-Mendota Subbasins will be ready early next year to continue coordination.

8. Public comment

a. Bill Nicholson from the Local Agency Formation Commission (LAFCo), which regulates boundary changes, gave in input on relevant boundary applications. There is an application for an Owen's Creek Water District, which is on the edge of the basin on the San Joaquin River. There is an annexation for Le Grand-Athelone Water District. This is currently in the sphere of influence for MID but will need to be removed. This might have some impacts to TIWD. Bill will send information out to individual districts and will be looking for input on these applications as they move forward.

9. Next steps and adjourn

a. Summary memo on the water budgets in progress.

b. Merced Subbasin GSA Board took place and the MIUGSA and TIWD Joint Meeting is upcoming.

Next Regular Meeting
December 17, 2018 at **1:30 p.m.**
Merced, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: December 17, 2018 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☐	Bob Kelley	Merced Subbasin GSA
☐	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
2. Approval of minutes for November 26, 2018 meeting
    a. Meeting minutes were approved.
3. Stakeholder Committee update
    a. Update from December 17 morning meeting was provided. Alyson Watson (Woodard & Curran) provided an update on what was discussed in the morning SC meeting.
4. Presentation by Woodard & Curran on GSP development
    a. Next Steps in GSP Development presented by Alyson Watson (W&C). The focus of the meeting is on water allocation frameworks.
    b. Water Allocation Frameworks
        i. Question: Does a violation have to be determined by the Superior Court? Answer (W&C): No, the GSAs have the authority to determine violations.
        ii. Alyson Watson (W&C) provided a brief review of the two different type of groundwater rights that will be discussed during the meeting: prescriptive and overlying (correlative) rights.
        iii. Alyson Watson (W&C) provided a recap of the different allocation methods discussed at the last meeting. The W&C team started from the comments received during the last meetings and worked these into different examples of allocation frameworks.

iv. The W&C team found and corrected a discrepancy in the sustainable yield analysis, which brings the sustainable total yield for the Subbasin to 530,000 acre feet per year.

v. Alyson Watson (W&C) explained that Water that is imported and seeps into the basin through unlined conveyance canals and distribution system belongs to the entity that developed the water. W&C team is working with entities in the basin (e.g. MID and others) to develop estimates of canal seepage.

vi. W&C provided an explanation for the breakdown of different historical use calculations presented over 10-year historical periods.

vii. The SC recommends using historical use rather than projected use as the basis for allocating sustainable yield.

viii. Comment: It would be good to have the baseline set on historical use from a city perspective and look at this in terms of per capita use.

ix. Comment: Cities are going to need to use alternatives, specifically conservation. Cities are also expected to further densify rather than spread, so a per capita use is a better estimation.

x. Alyson Watson (W&C) provided a brief overview of the input from the SC:

    1. There is concern for outside investors coming into water markets
    2. It is recommended to base allocations on historical use
    3. Will need to decide how to handle non-irrigated lands
    4. Several comments voiced a spirit of trying to be inclusive and work out solutions together in a fair way.

xi. Mojave Adjudication Example:

    1. There was a final judgement in 1996, for an area with 5 subbasins. Each year the Watermaster conducts a review and adjustment. This determines the amount that is allocated to each pumper
    2. Comment: Request made to look up how the amount pumpers can have is determined.

xii. A discussion was held on the general allocation approach. Comments and questions are summarized as follows:

    1. Question from W&C: Should there be an allocation for non-irrigated lands?
    2. Comment: They should have an allocation, although it is unclear what the most appropriate number for the allocation should be.
    3. There was a brief discussion on the amounts of irrigated and non-irrigated acres. About a third of the Subbasin's acres could be non-irrigated lands.
    4. Question: Why do we not have other appropriators in the prescriptive use estimates? Answer (W&C): It is a matter of time needed in putting together a more detailed example. If we choose to go this route, more information would be needed.
    5. Question from W&C: Does the Subbasin want to look at historical or projected or look at a hybrid? And should this consider a percentage reduction in GCPD?
    6. Comment: Look at projected use as a baseline.

7. Input from Charles Gardiner (Catalyst): The SC thought numbers for population expansion as stated in the plans (e.g. Urban Water Management Plans) might be too generous to be used for our estimates.
8. The SC wanted to see what the historical baseline would look like using different ranges of years. Question from W&C: Is there another way to do this? Potentially by using different years?
9. Comment (W&C): If a historical baseline is used, a range of years will need to be determined.
10. Comment: The allocation approach has to address overlying water rights.
11. Comment: A partial allocation could be determined for non-irrigated lands through the use of scenarios to see what that looks like.
12. Comment: A structure should be created and regulated for transferring allocations. It could be useful to have some examples of permutations to show what this would look like.

xiii. Alyson Watson (W&C) illustrated a timeline for the implementation of an allocation program from 2020 to 2040, with milestones for every 5-year period.

1. Feedback from CC:
    a. Comment: This seems to make sense, but there will need to be a lot of education.
    b. Comment: It is important to avoid having people think there is a lot of lead time and a general concern that the Subbasin will need to keep up momentum.
    c. Comment: The chosen approach will have to be reasonable and practical. Without metering implementation will be impossible.

c. Other Updates: The beta link requested for the Data Management System is still in progress with an estimated completion time in January.

5. Public Outreach update
    a. There were two public workshops held in December, both with good conversational input and good attendance. The next public workshop will be in late February.
6. Coordination with neighboring basins
    a. There is a memorandum of intent with six concepts with Turlock Basin. In December, the West Turlock GSA approved the MOI. This will go to the Merced Subbasin and East Turlock GSA.
7. Public comment
    a. There were no public comments.
8. Next steps and adjourn
    a. Water Budget Technical Memo and Water Allocation Framework development.

Next Regular Meeting
January 28, 2018 at **1:30 p.m.**
Merced, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: January 28, 2019 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)*	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☐	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1
	*Leah Brown attended for Ken Elwin	

Meeting Notes

1. Call to order
    a. Alyson Watson called the meeting to order and gave a brief overview of agenda items and content.
2. Approval of minutes for December 17, 2018 meeting
    a. Meeting minutes were approved.
3. Stakeholder Committee update
    a. Update from January 28 morning meeting
    b. SC meeting had good turnout with many different viewpoints. Big questions arose when discussing appropriative use and selection of historical period to use as baseline for allocation, and how to address overlying users not currently pumping. Comments ranged from 0% allocation for unirrigated lands to a partial allocation of either a 25 or a 50%. Several SC members stated there should be a process to address these lands in the future, especially if they start at a 0% allocation.
4. Flood-Managed Aquifer Recharge (Flood-MAR)
    a. Hicham ElTal (MID) provided an explanation of Flood-MAR activities in Merced Subbasin and why this is important for Merced. Benefits were identified.
    b. Hicham (MID) explained what must align to have a good Flood-MAR system including hydrology, land availability, recharge potential, and water rights.

c. Current plans and activities include work MID is conducting with DWR. This involves using the MID watershed model to look at precipitation, snowpack and snowmelt.

d. Hicham provided a map of soils where the land has high recharge potential. MID works with DWR on the GRAT (Groundwater Recharge Assessment Tool) which helps determine where recharge is best done, when, how much surface water can be captured, costs, and how much groundwater overdraft can be addressed through this recharge.

e. Hicham explained a good Flood-MAR system must consider water rights with knowledge of water sources and favorable land options. It also must make use of storms. The SWRCB allows taking water in Dec., Jan., and Feb., and only when capacity of the creek is at least 90% of flow that day. There are around 5 storms per year in California that we can try to use.

f. MID is trying to get funding from FEMA for a project on the Grand Canal that goes all the way down to Le Grand.

g. Question: What is the cost of the project? Answer from Hicham: Estimate is between $600,000-$700,000.

h. Hicham explained the configuration of custom analysis that relies on several models including some for irrigation systems, groundwater, upstream watershed, Merced River, etc.

i. MID will engage more with the Merced Streams group, especially in looking for funding.

j. It will be best for the GSAs to determine who is going to take the water when a storm comes.

k. Question: Does the GRAT assess the suitability of areas for recharge? Hicham: Yes. This helps determine what areas are best for recharge and compare areas to help GSAs determine where to prioritize recharge areas.

l. Comment: It would be good for individual landowners to follow this closely. Hicham: The landowners will have to look at it and decide for themselves if this works for them also economically. Yes, they should pay attention closely as information becomes available.

m. Question: It doesn't have to be on a crop area? Hicham: Correct, it can also be a fallowed area, or an area that does not have crops.

n. Question: During the winter times, could water be diverted to Livingston? Hicham: Yes, with some conveyance projects that could be put in place, water could be taken year-round.

o. Question: If there are farmers that have surface water and are in an area for recharge, could they apply? Hicham: Yes, you can buy the water (e.g. Livingston) even if you don't have a water right.

p. Question: Does the flooding affect the NPDES permitting? Hicham: The Irrigated lands Regulatory Program (ILRP) needs to be followed.

5. Temporary and long-term State Water Resources Control Board Permits for Flood Water

   a. Hicham EITal introduced discussion and recommended the Merced Subbasin submit one long term permit to the SWRCB. One, collective permit assists more efficient flood flow decisions during a storm.

   b. Question: How would you figure out the fees? Don't they do this on a per acre basis? Hicham: This depends on how much water you want to pay for. You pay one fee for the water you take.

   c. Question & clarification: Hicham asked during the meeting for a single permit for all diversions in the subbasin. These do not have to be for a project that is already existing.

   d. Comment: One public audience member thinks this is a great idea.

   e. Comment: Committee member recommended GSA legal counsels investigate this and give advice.

f. Reply from Hicham: The SWRCB would rather have one permanent permit.

g. Clarification: Hicham states based on his past experience with discussions in Southern California recharge will never be considered for beneficial use.

h. Comment: Suggestion made permanent permit it preferred because it is harder to take this away as opposed to the temporary permit.

i. General consensus: Would like to bring this to the three GSAs and seek legal counsel and research.

j. Decision: GSAs to get legal counsel on board.

k. Question: What is the timeline for this permit? Hicham: Likely in 2020.

6. Presentation by Woodard & Curran on GSP development

   a. Next Steps in GSP Development

      i. Alyson Watson (Woodard & Curran) reviewed the decision-making timeline and focus of today. The main goal is to agree upon a recommendation for an allocation framework to determine allocation at the GSA level. A preliminary direction for the allocation framework is needed to meet the 2020 deadline. Additional information will refine modeling and allocations prior to implementation. Monitoring and reporting should be the focus for 2020-2025. This timeframe requires outreach on a broad level. There are five-year updates for the plan.

      ii. Hicham (MID) input: Thinks it makes sense not much is complete prior to 2025, but if we wait until 2030 some areas may be racing to hit their undesirable results thresholds. The Subbasin will have monitoring wells and will want to avoid hitting thresholds.

      iii. Comment: It is possible to can wait until 2030, but another 3-year drought occurs so do risks for undesirable results. Response from Alyson (W&C): Once framework is in place, we can determine specific actions be taken once certain thresholds reached. Focus is to determine an approach and use this to determine if there are areas that will have undesirable results.

      iv. Question: What is the guidance on timing for subsidence zones? Answer (W&C): There is no specific guidance in getting to 2015 conditions. Subsidence is what we will look at once we have a framework agreed upon.

   b. Water Allocation Framework

      i. Alyson Watson (W&C) presented the follow ups from the last meeting and the updated allocation framework development. She reviewed steps in determining the allocation methodology which include: determining sustainable yield, subtracting seepage and developed supply, and then allocating the sustainable native yield to overlying and appropriative users.

      ii. W&C did analyses to look at different historical averaging periods including spans of 20, 10, 15, and 5 years (and a 5, 10, and 15 year that exclude drought). Drought increases overlying users' usage.

      iii. The SC recommended using the 10-year period with the drought (2006-2015). There was a question of whether a 40-year period would be feasible. However, there is not adequate data to use 2040.

      iv. Question from Alyson (W&C): How does the CC feel about 10-year period? Answer from CC members: This time period is appropriate.

v. In addressing unirrigated lands at a minimum there should be a process outlined for how to bring in folks who have unirrigated lands into the allocation framework.

vi. Alyson (W&C) provided illustration for partial allocation estimations given to unirrigated lands. These were set up and estimated for 100%, 50%, or 25% or no allocation.

vii. There is a substantially higher number of unirrigated lands in Merced Subbasin GSA than the other GSAs. This can influence the total allocation to the GSAs depending on what partial allocation is given to unirrigated lands.

viii. Comments relayed from the SC meeting:

1. 1.25 AF/A is difficult to have even for operating a dairy.
2. However, folks who have pasture lands/unirrigated lands would like to be a part of the conversation.

ix. Comment: There is concern that the GSAs might not be aware of potential legal actions moving forward.

x. Question: Could we provide an example of what types of allocations would look like for the dry and wet years? Alyson (W&C): This is possible. We want to make sure that we are first getting a clear understanding and ensure the SC and CC have a clear understanding of the average year.

xi. General request: Concern about understanding the allocation framework expressed. W&C will set up separate calls to review and answer questions of content presented.

xii. Question: What about the seepage estimates, where do the numbers for this come from? Alyson (W&C): Seepage numbers come from estimates from MID and Stevinson Water District. W&C is still getting other information from other water conveyors.

xiii. Alyson explained the goal is to have a 2020 GSP that can be approved and is based on the information that we have, which is going to be updated and addresses data needs.

xiv. Question: What is the net loss flow to the Chowchilla? Dominick (W&C): The net value of loss is about 10,000 AF.

xv. Clarification: Numbers presented are to give an estimate based of the best data we have available with the knowledge that the numbers will change. What is presented is a proportional reduction.

xvi. Comment: What will be important is to consider the GSP as a living plan, so that as additional data come in and as questions are answered, these are integrated.

xvii. Comment from Hicham: Hicham asked MIDAC for an opinion, and MIDAC (growers) said they would like to go for a 0% allocation of unirrigated lands.

xviii. Alyson (W&C): With regard to legal challenges, we are not affecting GW rights. If someone wants to pump, we can avert some of this with a challenge process.

xix. W&C will schedule individual meetings with each GSA to discuss further and revisit this next month at CC meeting.

c. Data Management System

i. Reminder that beta link for DMS has been created and sent out to the committees.

d. Other Updates

i. Projects are being reviewed. There are currently 40 in the draft list as of this meeting. These will be reviewed in more detail in the next meeting.

7. Public Outreach update
    a. Flyer for February public workshop was posted and sent out to committees.
8. Coordination with neighboring basins
9. Public comment
    a. None
10. Next steps and adjourn
    a. Water Budget TM – revise TM based on input from GSA staff
    b. Assessing projects and management actions

Next Regular Meeting
March 25, 2018 at **1:30 p.m.**
Merced, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: February 25, 2019 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
☐	Ken Elwin (alternate)*	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Nic Marchini	Merced Subbasin GSA
☐	Rodrigo Espinoza	Merced Subbasin GSA
☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
    a. Alyson Watson (Woodard & Curran) called the meeting to order.
2. Approval of minutes for January 28, 2019 meeting
    a. Meeting minutes approved with no changes.
3. Stakeholder Committee update
    a. Alyson Watson (W&C) provided an update from the February 25 morning meeting. The SC reviewed feedback received from the GSA discussions of allocation frameworks. The SC discussed priorities for projects and management actions to send to the CC. These will be summarized for next meeting for discussion.
4. Presentation by Woodard & Curran on GSP development
    a. Alyson reviewed the decision-making timeline and explained that the CC will be trying to reach an agreement on a framework recommendation to provide to the GSA boards.
    b. Question: Will the plan include the terms required to demonstrate the allocations are being demonstrated/adhered to? Answer: This is up to the GSAs. What would be in the plan is the framework including: the sustainable yield, how this is allocated to the GSAs, and what should be refined and considered in more detail.

c. Clarification: It is anticipated that plan will need to have a process for determining how to handle classification for duck clubs, refuge lands, etc.

d. Comment: It will be important that we have some clarity and a clear expectation of exactly what these allocations are and how they are estimated. Response (W&C): There will need to be a process for verification, especially for seepage.

e. Comment: The plan should include an expectation of how to quantify allocation based on existing water rights.

f. Alyson Watson (W&C) explained the Merced Subbasin Memorandum of Understanding (MOU) requires the CC have unanimous decision on a recommendation to the GSA Boards.

g. Alyson (W&C) provided a brief explanation on state intervention and what this mean in terms of potential fees. *De minimus* users (pumpers using 2AF/Y or less for domestic purposes) are subject to SGMA but not required to be metered.

h. Alyson reviewed the conceptual GSP implementation timeline. Within the first 5 years the GSAs may want to focus on metering and monitoring and implementing projects that already have funding. Outreach is another key component. By 2040 have planned projects online and allocation framework in place.

    i. Comment: The conceptual timeline should include a bullet for triggers for exceeding minimum thresholds up through 2025.

i. Water Allocation Frameworks

    i. Alyson (W&C) reviewed the framework steps 1-4 which include: 1) determining the sustainable yield, 2) estimating developed supply, 3) determine allocation of sustainable yield to appropriators and overlying users, 4) use as basis for allocations to GSA.

    ii. Alyson (W&C) summarized the comments from both the previous SC discussions on the allocation framework and from the GSA review meetings. SC points were:

        1. Important to consider drought years in historical baseline period.
        2. Having a 10-year period seems to make sense.
        3. In general, not in favor of 100% allocation unirrigated lands. Somewhere between 25-50% is a good starting point. Need direction on how this can be used and sold.
        4. Need mechanism to later include these lands if start at a 0% allocation.
        5. Metering is important but should also keep in mind *de minimus* users are not required to be metered under SGMA.

    iii. Alyson summarized feedback from individual GSA review meetings:

        1. Metering should be a priority in first 5 years.
        2. General consensus to review allocation annually, and review seepage potentially every 5 years.
        3. Cities are concerned about potential infill in the future. Keeping allocation at a fixed volume will lower the per capita per day. This needs to be reasonable.
        4. 2020-2030 should not be free-for-all to pump. People are not going to benefit from pumping more and might consequently end up needing to reduce pumping even more. Need to have clear triggers during this time to ensure we avoid any situations where we are in violation.

5. Need to ensure there is a verification method for seepage estimates.
6. Need to consider how to address rangeland, including partial allocations, and will need to be clear on rules for this in case of a water market. (e.g. who and how to sell/buy water in market).

iv. Summary of CC Water Allocation Framework Discussion:

1. Comment: We will have to be open and listen through this process to maintain the big picture of sustainability. We have a limited supply we are trying to allocate, and the allocation methodology is complex. To understand allocation, we must put this into context of water law. SGMA does not allow GSAs to alter water law, but GSAs can control groundwater by regulating it. Within description of sustainable yield, have seepage estimate off the top of the total sustainable yield. Question: is there a seepage credit for the applied surface water on the lands?
2. Answer from Hicham (MID): MID has gone through this situation with rice lands. The water applied to the lands is lost water in his opinion. This is different than seepage estimates which are decidedly directed as developed water.
3. Comment: This would depend on the crop types.
4. Comment from W&C: W&C can ask Brad Herrema, attorney from Brownstein, Hyatt, Farber, and Schreck about this question.
5. Comment from W&C: Accounting for applied water would reduce the 400K AF amount that is considered at the basin scale and is rolled back up to GSA level, but does not mean that it affects the general allocation framework. The question of applied water is something that can be refined later and allow us to still move forward.
6. Question: What about a break down by agencies for the appropriative and prescriptive water use? Answer: The only appropriative users in this group are the cities within MIUGSA.
7. Comment: Suggestion of a 75% allocation for unirrigated lands made by Merced Subbasin GSA (MSGSA).
8. Comment from Hicham (MID): There are no appropriators in MIDAC (MID Advisory Committee). This group is made up of growers. The decision on allocation for unirrigated lands has to consider that there is not an existing financial impact to grazing grounds, but there is a financial impact to those who are pumping now. Hicham will relay the MSGSA suggestion to MIDAC.
9. Comment: We do not know what it will be like in 2040. We do know that MID will be a significant surface water supplier. The lands that are in the MSGSA just have one source. We have the most unexercised (unirrigated) users in our GSA and must to consider them. We are still going to need preserve the ability to produce food.
10. Clarification from Hicham (MID): If we have a GW market, this will be more active in the MSGSA. There will be more financial impact on the growers.
11. Comment: If the subbasin has a water market, need an understanding that there should be no transfers outside the basin.
12. Comment from public: Need to look at permanent crops and how these areas are impacted in wet and dry years.

13. General consensus from CC: The subbasin should have a water market and have 5-year updates.
14. Question: How is this going to effect individual home owners? Answer: You would likely be a *de minimus* user who extracts 2AF/Y or less. The GSAs could charge a fee depending on how they try to fund the GSP implementation. Over time, the benefit is that the groundwater should stabilize.

v. Partial allocation for unirrigated lands discussion:
   1. Comment: Need to start somewhere with partial allocation for unirrigated lands.
   2. Comment: Reiterates suggestion for 75% allocation for unirrigated lands.
   3. Hicham ElTal (MID) will bring the suggestion back to MIDAC.
   4. Larry Harris (TIWD) will talk to folks at TIWD about the suggestion.
   5. Bob Kelley (MSGSA) to look into how this 75% number could move depending on the response from other GSAs.
   6. Question: have we looked at industrial use (e.g. commodity processing facilities) outside the cities? Answer (W&C): Not yet, but W&C can look into this.

vi. Consensus reached for the water allocation framework on the following:
   1. Agreement on overall framework steps.
   2. General support for developing a water market and addressing important considerations that should be included.
   3. Agreement on historical averaging period of 10 years using 2006-2015.
   4. Agreement on review of allocation every 5 years.

vii. Comment on applied water: There could be a credit for return flows using example of adjudications which have attributed these flows to the importing agency. If there's a desire for that type of credit, it is possible to develop a process for determining flows.

viii. Comment from W&C: This could be added to a list of what needs to be refined and addressed in terms of seepage within GSP. Currently, this data is not available.

ix. Comment: People who have grazing land have not contributed to the problem and feel are being punished unfairly.

j. Next Steps in GSP Development
   i. Alyson Watson (W&C) reviewed the overall timeline for draft GSP development.
   ii. Hicham ElTal (MID) states that MID has talked internally about using groundwater elevation levels as a proxy for other indicators with DWR. They could set up a meeting within the next couple of months and talk about the overall methodology in how we are building our GSP.

k. Other Updates
   i. Reminder that the beta test link is available for the Merced GSP data management system.

5. Public Outreach update
   a. The public workshop is scheduled to take place this evening in Livingston.
6. Coordination with neighboring basins

a. Continuing communication with Turlock. More coordination in the next couple of months.

7. Long Term SWRCB Permits for Flood Water
    a. The Long Term Permits presentation is tabled to next month. Alyson confirmed with CC members that the meeting will extend to 4pm for March 25th.
8. Public comment
    a. None.
9. Next steps and adjourn
    a. Water Allocation Framework
    b. Review projects and management actions

Next Regular Meeting
March 25, 2019 at **1:30 p.m.**
Atwater, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item
Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: March 25, 2019 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☒	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☒	Daniel Chavez	Merced Irrigation-Urban GSA
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☒	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
    a. Alyson Watson (Woodard & Curran) welcomed and called meeting to order.
2. Approval of minutes for February 25, 2019 meeting
    a. Meeting minutes from February 25th approved.
    b. CC members found no issue in having this meeting available for listen-in only in the future.
3. Stakeholder Committee update
    a. Update from March 25 morning meeting provided by Alyson Watson (W&C).
4. Presentation by Woodard & Curran on GSP development
    a. Water Allocation Frameworks
        i. Alyson Watson (W&C) reviewed what the group will try to accomplish today, the decision-making timeline, and the conceptual GSP timeline.
        ii. Comment: The Merced Subbasin should start to implement monitoring activities and have a countdown between 2020-2025.
        iii. Alyson (W&C) explained next month's meeting will return to Undesirable Results and Minimum Thresholds.

iv. Comment: If there are projects people can already implement, then they should start to implement or at least be able to implement.

v. Comment: It is important to understand what the loss of recharge water is in the Subbasin.

vi. Response and clarification (W&C): There may be recharge operations on a small scale that are already in place where someone should have an allocation credit that should be taken into account. There needs to be time for that process of reaching out and conducting public outreach.

vii. Comment: A recharge water loss estimation could be done for areas where projects would be implemented.

viii. Response (W&C): To conduct the loss estimation, need to gather enough information for the losses to determine whether an area is worth investing in for recharge. This could be done via scenarios as projects come up.

ix. Comment: This estimation should be done on a case by case basis.

x. Comment: The estimation could produce a map of contours of percentage loss.

xi. Response (W&C): W&C team to discuss internally potential approach for loss estimation.

xii. Comment: In looking at the previous Water Budget technical memo, it would be easier to understand the memo contents if we had the breakdown of the historical water budget numbers. For overlying use, it looks like there are federal lands and *de minimus* users. Where and how do both of these factor into the overlying use?

xiii. Response (W&C): We cannot force the federal lands to comply because they are exempt from SGMA. These acres and water use are pulled out of the analysis, the analysis is conducted, and then these lands and associated water use are put back. *De minimus* users are not exempt, they just cannot be required to meter under SGMA. The W&C team is also verifying the number of acres for federal lands.

xiv. Comment: Overlying user allocation is a critical part of the process going forward, especially with Merced Subbasin GSA being primarily overlying users. The MSGSA is concerned that overlying rights be considered and respected. The MSGSA has to manage the white areas and liability for their lack of surface water connection.

xv. Alyson (W&C): We would like to get to an agreement on a partial allocation during this meeting.

xvi. Comment: MSGSA would propose a geographic designation for the basin. Totals would be 327K AF for MSGSA, 151K AF for MIUGSA, and 12K AF for TIWD.

xvii. Alyson (W&C): To clarify, that proposal would reflect a 100% allocation for unirrigated lands.

xviii. Comment: MIUGSA recommends holding off on groundwater credits until we have the allocation finalized. Why not wait until we can fill those data gaps? We want to address the data gaps to better understand what the implications are of our allocation framework.

xix. Comment: MIUGSA is ok with a 100% allocation, as long as the Subbasin does not allow credits to be exchanged until the GSAs have more data.

xx. Comment: We need to clean up our assumptions before we make this kind of policy decision.

xxi. Both MSGSA and MIUGSA representatives reiterate that there is likely less water out there than we think there is.

xxii. Alyson (W&C): For GSP contents, we can have a preliminary framework, which includes how much water we have and how we are considering undeveloped and developed acres.

xxiii. General clarification and agreement on allocation framework: Agreement reached on a 100% allocation to unirrigated lands, but with the caveat that GSAs will not allow transfer of credits until all three GSAs agree on parameters for trading and fill in data gaps / finalize the allocations.

xxiv. Clarification: W&C can run sustainable yield scenario under this condition and see how that impacts undesirable results.

xxv. Water Allocation Framework Agreement:

1. Determine sustainable yield
2. Subtract groundwater originating from developed supply to obtain sustainable yield of native groundwater
3. Allocate sustainable yield of native groundwater to Overlying Users and Appropriative Users based on proportion of historical use
    a. Use 2006 through 2015 as the averaging period for historical use
    b. Appropriative user allocations based on fraction of historical use among appropriators
    c. Allocation to overliers will be based on acreage. All developed and undeveloped acreage (not including federal lands) to receive an allocation initially. GSAs agree that no water supply credits can be exchanged until and unless all three GSAs agree on parameters for trading and key data gaps are filled.
4. Use this framework to establish total allocations to each GSA. GSAs can modify implementation and allocations within their own boundaries.

xxvi. The above agreement was summarized as the Coordinating Committee recommendation and sent to GSA Board staff.

xxvii. Question: How long will it take for GSP approval?

xxviii. Response (MID and W&C): Estimate is that DWR may need to take the full time of two or more years. Review of only the critically overdrafted basins would take two years.

b. Projects and Management Actions

i. Review of revised project handout and current draft list of projects including short list provided by W&C team. Follow ups for gathering additional project information will be conducted in preparation for next meeting.

c. Climate Change Analysis

i. Alyson (W&C) explained W&C team is following the DWR guidance and moving forward on the climate change analysis. A section summary is anticipated for next meeting.

ii. Question: Do the climate change analyses seem to provide drier or wetter future conditions?

iii. Response (MID): From analysis conducted for DWR Flood-MAR, future conditions look slightly drier.

d. Next Steps in GSP Development

i. Alyson (W&C) reviewed the section schedule, including release dates for admin and SC & CC section drafts in preparation for GSP public draft.

e. Other Updates

i. Alyson Watson (W&C) provided overview of Undesirable Results including what these would be described as under a sustainable yield run. The W&C team is currently working on the implementation and the sustainable yield period for this analysis. Information on annual production numbers and relevant slides can be provided.

5. Public Outreach update

a. The next public workshop is anticipated to take place in May, and likely within the McSwain area.

6. Coordination with neighboring basins

a. W&C team will circle back with Chowchilla and Delta-Mendota and are also setting up a meeting with DWR to review methodology for sustainability indicators.

7. Long Term SWRCB Permits for Flood Water

a. Darren Cordova (MBK Engineers) provided a presentation on Groundwater Recharge/Extraction Permits. Topics for discussion included background & beneficial use, standard permit, temporary permit, potential alternative options. Purpose of presentation is to provide information on permitting from the state. MBK has worked previously with MID. For details, please see presentation which will be posted to the Merced SGMA website.

b. Standard Permit process includes preparation and submission of application to Appropriate Water and Underground Storage Supplement, which takes about a month or two to put this application together and submit. Submittal includes water availability analysis to demonstrate "reasonable likelihood" that water is available for appropriation. Also have to undergo environmental documentation needed for CEQA compliance. Cost for this estimated at $150K but would not include CEQA.

c. Question: What kind of information would be needed? Answer (MBK): Need to have information on the groundwater basin as a whole.

d. Comment: There will be a place in the GSP where we will talk about supplemental water.

e. Comment: For cost would need a couple more zeros for the estimates of associated cost if you are included in an Environmental Impact Report.

f. Question: If you get a temporary permit, when can you use it? Answer: Have to use the within the 180 days, otherwise can ask for extension.

g. Comment: If you file again, you will have to justify need for both permit requests.

h. Comment: The state board is starting to watch larger flows a little more closely and are starting to want permits for that in the future. The subbasin might need something to get the ball moving.

i. Alternative Options: SWRCB considering an expedited standard permit process for applicants diverting high flows for groundwater recharge/extraction. If you have an existing post 1914 water right, you can submit a Change Petition. Estimated to take between 3-5 years. Filing fees up to $6,710 per water right.

j. Comment: Have to prove that you are not initiating a new right.

k. Comment: When you do the flood control capture and recharge, you cannot count this as beneficial use under your water right, but you can put this in your GSP. You can put in a recharge basin to capture flood water and are therefore diverting/mitigating a nuisance for the entire basin.

l. Question: What about a permit for specific streams?

m. Answer (W&C): We have talked in this group about submitting a single long term permit for the subbasin.

n. Comment: We have to have the projects first to be able to have the diversion points you will need to identify in the application.

o. Comment: If we want to exercise pre-1914 rights, we should identify projects and people who are able to recharge.

p. Question: Who would hold the water right on someone else's land? Answer (MID): Good question, may need to investigate this.

q. Comment: All of the GSAs could hold the water right. Response from MID: That would be preferred.

r. Alyson (W&C): If the CC were to move forward with a recommendation on this, we would need to have a project put in the GSP.

s. Comment: We could say that for the GSP could have one recharging water right identified under one project.

t. Comment: It would be helpful if we show a map that provides all areas where we would like to be able to implement recharge.

u. Comment: Something similar was done in another subbasin using a site specific approach. In this case, had to get specific sites and provide this data to the state board.

v. Comment: We could look at getting a cost estimate on a programmatic EIR? And an estimate on the overall acreage that could benefit from this?

w. Comment: First task is to come up with a project, and work on the 90% permit establishing which streams are we talking about and where are we able to move the water.

x. Comment: This can be seen as two different things. There's the GSP – including the projects we are thinking about implementing for the basin. Second, is what streams and what waters can be used to pursue implementation.

y. Comment: We should try to pursue this permit process now, at least to set up a study.

z. Alyson (W&C): Would we need to have a fee and scope of work for this?

aa. Comment: We can come up with an add hoc committee to discuss this.

bb. Group agreement: Ad hoc committee will be established to determine a fee and scope for pursuing a Long Term Permit. Members of the committee will include Hicham ElTal, Larry Harris, and Nic Marchini

cc. Clarification: It is possible to include both surface water and groundwater within this permitting process. This does make it more complicated for the SWRCB folks. However, the process is similar.

8. Public comment
    a. None.
9. Next steps and adjourn
    a. Focus for April will be on Minimum Thresholds and Measurable Objectives

Next Regular Meeting
April 22, 2019 at **1:30 p.m.**

Atwater, CA – Castle Conference Center at Castle Airport (subject to change)
Information also available online at mercedsgma.org

Action may be taken on any item

Note: If you need disability-related modification or accommodation in order to participate in this meeting, please contact Merced County, Community and Economic Development staff at 209-385-7654 at least 48 hours prior to the start of the meeting.

MEETING NOTES – Merced GSP

SUBJECT: Merced GSP Coordinating Committee Meeting

DATE/TIME: April 22, 2019 at 1:30 PM

LOCATION: Castle Conference Center at Castle Airport, 1900 Airdrome Entry, Atwater, CA 95301

Coordinating Committee Members In Attendance:

	Representative	GSA
☐	Stephanie Dietz	Merced Irrigation-Urban GSA
☒	Justin Vinson	Merced Irrigation-Urban GSA
☐	Daniel Chavez	Merced Irrigation-Urban GSA
☒	Ken Elwin (alternate)	Merced Irrigation-Urban GSA
☒	Bob Kelley	Merced Subbasin GSA
☒	Mike Gallo	Merced Subbasin GSA
☐	Nic Marchini	Merced Subbasin GSA
☐	George Park (alternate)	Merced Subbasin GSA
☒	Larry Harris	Turner Island Water District GSA #1
☐	Scott Skinner (alternate)	Turner Island Water District GSA #1

Meeting Notes

1. Call to order
    a. Alyson Watson (Woodard & Curran) called meeting to order. Members introduced themselves. A new member, Mike Gallo, for Merced Subbasin GSA has been added to the Coordinating Committee and replaced Rodrigo Espinoza.
2. Approval of minutes for March 25, 2019 meeting
    a. Meeting minutes from March 25th are approved with one abstention from Mike Gallo and one change. One sentence was added to include that the Water Allocation Framework Agreement was summarized as a Coordinating Committee recommendation and sent to GSA Board staff.
3. Stakeholder Committee update
    a. Update from April 22 morning meeting provided by Alyson Watson (W&C).
4. Presentation by Woodard & Curran on GSP development
    a. Climate Change Analysis
        i. Alyson Watson (W&C) described the regulations that apply for the climate change analysis and described the overall process used for Merced GSP.
        ii. The approach is consistent with the Department of Water Resources (DWR) recommended approach. A change factor from DWR is applied to the Projected Data Baseline to simulate the impact of climate change. This creates the Climate Change Baseline, which is put into the

Merced model. The output is the Climate Change Water Budget. The change (or perturbed) variables include streamflow, precipitation, and evapotranspiration (ET).

iii. Question: What are the modifications and how are they determined? Answer (W&C): We followed the DWR guidance, which provides the modifications (or change factors) and how they are determined.

iv. Alyson Watson (W&C) provided an example of precipitation using the Climate Change Analysis. The dark line is the regional average baseline. The blue line is the changed, or perturbed precipitation using factors from DWR. Generally, precipitation during a typical event is projected to be similar to the baseline conditions, but under climate change peak rain events are projected to be higher.

v. Similar DWR factors are used for ET. An example given from orchards shows a seasonal pattern of peaking in the summer months and a projected average increase in these months of 8%.

vi. Question: Is the climate change over 50 years, or over 1 year? Answer (W&C): We are applying a 2070 scenario and applying 50 years of hydrology.

vii. Question: Is this assuming the same cropping pattern? Answer (W&C): We met with GSAs to talk about changes to cropping pattern. We assumed 2040 conditions in urban build out. The projected water budget has many assumptions (e.g. assumptions on population change, etc.). We are doing the analysis to get an order of magnitude understanding of how potentially significant this can be for the basin, and see how we can adaptively manage.

viii. For surface water supplies, projections indicate that in wetter years (wetter season) there would be greater surface water, and in drier years (drier seasons) there would be less surface water.

ix. For groundwater production it is assumed there will be a change in groundwater pumping. The graph shows the difference in groundwater pumping with the climate change scenario. In general, there is an increase in groundwater demand as result of climate change conditions.

x. Summary of climate change scenario: Changed storage depletion is projected to increase from 82K AFY to 130K AFY. This analysis did not rerun the MIDH2O model to see how operations would change. The purpose of analysis was to get an order of magnitude understanding of how climate change might affect the basin.

xi. Clarification from W&C: This analysis does not include management actions and projects.

xii. Question: Is this going to be implemented in the plan? Will the budget reflect these climate changes? Or stay as it is? Answer (W&C): This is up to the group. It is not recommended to take and plan for this directly because there is so much uncertainty. However, we can revise our planning target if we find we are on this trajectory. We are going to do an update in 2025 and could update our targets then if needed.

b. Undesirable Results & Minimum Thresholds

i. Alyson Watson (W&C) explained Undesirable Results (URs) and Minimum Thresholds (MTs), provided definitions and reviewed what was discussed in previous meetings.

ii. The purpose is to try to bring the basin into balance. The GSP will need to define what is significant and unreasonable for URs. It is important to prevent these URs, because if they are violated there can be state intervention.

iii. Sustainable Management Criteria Definitions: There may be a specific groundwater condition where wells went dry and enough wells went dry that we determine this should not happen again. This could be defined as an UR. An MT can be set at a depth at which

this is not going to happen. Our Measurable Objective (MO) will be set at a shallower depth (this is a depth we are trying to reach). We want to work between these two (the MO and the MT) within the Margin of Operational Flexibility. There are no triggers for meeting the MOs. A violation occurs if URs occur. MTs are set to avoid URs. One well being in violation once is not significant and unreasonable, but a certain percentage going dry could be. Specifications can be established for dry years. The goal is to identify a way to prevent URs.

iv. Chronic Lowering of Groundwater Levels: This was discussed qualitatively for URs and needs to be quantified. Methods used for this include two levels of monitoring wells. This does not include the broader monitoring network, but is the subset used to establish MTs. CASGEM wells were used as a starting point for these monitoring wells because they follow closely to SGMA requirements. There should be monitoring wells in all three aquifers (above, below and outside Corcoran Clay). W&C looked at domestic wells and used the Merced County database. W&C looked at the depth of the shallowest domestic well and removed statistical outliers. The shallowest domestic well within a 2-mile radius buffer from each CASGEM well was compared against MTs. An example hydrograph was provided to show MTs, observed data, and a run from 2040 with 50 years of hydrology get to 2090 for Sustainable Yield.

v. Clarification: Other basins have used a method to say that if 25% of wells with MTs have surpassed MTs then this is UR. Individual wells may have different MTs.

vi. Alyson Watson (W&C) explained there is an area (identified by a red circle) on the slide with a high level of uncertainty for determining MTs. Some CASGEM wells are new, some do not have enough historical data to calibrate for the model. Alyson asks the group what are there issues in this area? Are you aware of areas where wells are not deep enough? Or have been dug deeper?

vii. W&C also looked at the distribution of domestic well depths. There are a significant number of 125 ft wells (about 70 at this depth). Are these wells still there, have they been replaced?

viii. Feedback from CC group:

1. Comment: Have not seen any domestic wells that are dry but have seen trucked water going around.
2. Comment (from public): In Meadowbrook area with California American Water Company they have a contract with a trucked water entity, which is required to stay within the company's jurisdiction.

ix. Alyson (W&C) explained there are a few options for moving forward including: identifying this area as a data gap and include in the GSP how this will be addressed, or establish this as an official Management Area.

x. Comment (MID): Interim thresholds and monitoring wells could be set up in that area.

xi. Alyson (W&C) asked group for input on how to approach URs. Should a certain percentage be used to determine what constitutes a UR?

xii. Comment (MID): SGMA allows room for flexibility in continuous drought. Establishing a percentage to determine URs is a good idea.

xiii. Comment (TIWD): In the SC meeting this morning, we discussed that we can set up mitigation plans in areas where we going to surpass meet MTs.

xiv. Comment (MID): Suggests to start with all of these ideas.