DELTA-MENDOTA SGMA

Consolidated WY2022 Annual Report

For the Delta-Mendota Subbasin

March 2023

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For the Delta-Mendota Subbasin

Prepared by:

March 2023

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Executive Summary

In 2014, the California legislature enacted the Sustainable Groundwater Management Act (SGMA) in response to continued overdraft of California's groundwater resources. The Delta-Mendota Subbasin (Subbasin) (5-022.07) is one of 21 alluvial basins and subbasins identified by the California Department of Water Resources (DWR) as being in a state of critical overdraft. Beginning in 2017, Groundwater Sustainability Agencies (GSAs) within the Subbasin formed to address the long-term reliability of groundwater through the development of six Groundwater Sustainability Plans (GSPs) for the following regions: Aliso Water District, Farmers Water District, Fresno County Management Areas A and B, Grassland, Northern & Central Delta-Mendota Region, and San Joaquin River Exchange Contractors. The six Delta-Mendota Subbasin GSPs were developed in a coordinated fashion with the goal of achieving sustainability for the Subbasin as a whole. The GSAs adopted their respective GSPs and submitted them to DWR on January 23, 2020, prior to the January 31, 2020 deadline. On January 21, 2022, DWR released an "Incomplete" determination for all six Delta-Mendota Subbasin GSPs and Common Chapter. All six revised GSPs and the Common Chapter addressing deficiencies identified by DWR were resubmitted to DWR by the July 20, 2022 deadline.

This Water Year 2022 (WY2022) Annual Report for the Delta-Mendota Subbasin was prepared as a consolidated effort for the entire Subbasin and is in compliance with California Code of Regulations (CCR) Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 7 Annual Reports and Periodic Evaluations by the Agency. WY2022 includes the period from October 1, 2021 through September 30, 2022 and compares these new data against previously-collected data to develop an understanding of Subbasin conditions through the current reporting year.

Throughout the Subbasin, groundwater elevations during WY2022 were largely above their respective minimum thresholds, which were revised along with all numeric sustainable management criteria (SMC) to use consistent methodology across the six Subbasin GSPs as requested by DWR in their "Incomplete" determination letter. The revised SMC were included in the revised Subbasin GSPs and Common Chapter submitted in July 2022. For wells that are currently operating below or fluctuating near their minimum threshold, each GSP region will assess if undesirable results are observed at the locations of those wells and will respond with the appropriate projects and management actions as described in their respective GSPs. All six GSP regions are currently on track to either meet their interim goals for the chronic lowering of groundwater levels sustainability indicator and change in storage sustainability indicator by 2025 or will work to implement projects and management actions in order to meet the 2025 interim goals established.

California Code of Regulations - GSP Regulation Sections	Annual Report Elements	Section(s) and page numbers(s) where requirements for Annual Report elements are included
Article 5	**Plan Contents**	
Subarticle 4	**Monitoring Networks**	
§ 354.40	**Reporting Monitoring Data to the Department**	
	Monitoring data shall be stored in the data management system developed pursuant to Section 352.6. A copy of the monitoring data shall be included in the Annual Report and submitted electronically on forms provided by the Department.	Appendix A
	Note: Authority cited: Section 107.33.2, Water Code. Reference: Sections 10728, 10728.2, 10733.2, and 10733.8, Water Code.	
Article 7	**Annual Reports and Periodic Evaluations by Agency**	
§ 356.2	**Annual Reports**	
	Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:	
	(a) General information, including an executive summary and a location map depicting the basin covered by the report.	Executive Summary and General Information Figure 1
	(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:	
	(1) Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows:	
	(A) Groundwater elevation contour maps for each principal aquifer in the basin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions.	1. Groundwater Elevation Data Figure 2, Figure 3, Figure 4, Figure 5
	(B) Hydrographs of groundwater elevations and water year type using historical data to the greatest extent available, including from January 1, 2015, to current reporting year.	Appendix A
	(2) Groundwater extraction for the preceding water year. Data shall be collected using the best available measurement methods and shall be presented in a table that summarizes groundwater extractions by water use sector and identifies the method of measurement (direct or estimate) and accuracy of measurements, and a map that illustrates the general location and volume of groundwater extractions.	2. Groundwater Extraction Data Table 1, Figure 6
	(3) Surface water supply used or available for use, for groundwater recharge or in-lieu use shall be reported based on quantitative data that describes the annual volume and sources for the preceding water year.	3. Surface Water Supply Table 2
	(4) Total water use shall be collected using the best available measurement methods and shall be reported in a table that summarizes total water use by water use sector, water source type, and identifies the method of measurement (direct or estimate) and accuracy of measurements. Existing water use data from the most recent Urban Water Management Plans or Agricultural Water Management Plans within the basin may be used, as long as the data are reported by water year.	4. Total Water Use Table 3
	(5) Change in groundwater in storage shall include the following:	
	(A) Change in groundwater in storage maps for each principal aquifer in the basin.	5. Change in Groundwater Storage Figure 9, Figure 10

California Code of Regulations - GSP Regulation Sections	Annual Report Elements	Section(s) and page numbers(s) where requirements for Annual Report elements are included
	(B) A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the basin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.	5. Change in Groundwater Storage Figure 7, Figure 8
	(c) A description of progress towards implementing the Plan, including achieving interim milestones, and implementation of projects or management actions since the previous annual report.	6. Plan Implementation

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General Information

The Groundwater Sustainability Agencies (GSAs) of the Delta-Mendota Subbasin (Subbasin) have collaborated to prepare this Consolidated Annual Report for Water Year 2022 (WY2022), defined as the period from October 1, 2021 to September 30, 2022, in compliance with California Code of Regulations (CCR) Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 7 Annual Reports and Periodic Evaluations by the Agency. CCR 23 §356.2 outlines the annual report's required content. Data and conditions following the Subbasin's "current" water year of WY2013, as defined in the Delta-Mendota Subbasin's Groundwater Sustainability Plans (GSPs), through WY2022 are included in this Annual Report in order to describe trends and fill data gaps leading up to WY2022.

The Delta-Mendota Subbasin (DWR Basin 5-022.07) is located in the northwestern portion of the San Joaquin Valley Groundwater Basin and adjoins nine (9) other subbasins in the San Joaquin Valley Groundwater Basin. The Delta-Mendota Subbasin boundaries generally correspond to DWR's California's Groundwater Bulletin 118 – Update 2003 (Bulletin 118) groundwater basin boundaries descriptions, with jurisdictional boundary modifications incorporated into the 2016 and 2018 Bulletin 118 groundwater basin boundary definitions.

The western San Joaquin Valley is a highly agricultural region with an economy dependent on the agricultural industry. There are no large cities or industries in the Delta-Mendota Subbasin to provide an alternative economic base; hence, the availability of Central Valley Project (CVP) and State Water Project (SWP) imported supplies and other surface water supplies (primarily from the San Joaquin and Kings Rivers) are essential elements to the economic health of the region. Other uses of CVP and local surface water in the Subbasin are for municipal and industrial (M&I) purposes and wildlife refuge water supply. The Delta-Mendota Subbasin, and the six GSP regions it contains, are shown in **Figure 1**.

Groundwater is a key component of overall water supplies in the Delta-Mendota Subbasin. For areas with access to surface water, agricultural, M&I, and wildlife refuge beneficial uses may be supplemented by groundwater, while other areas within the Subbasin may rely solely on groundwater for irrigation and/or potable purposes. M&I water use, which is a small share of total water use in the Subbasin, occurs primarily within the cities and local communities which predominantly use groundwater to meet those demands. The largest M&I use areas in the Delta-Mendota Subbasin, based on the 2021 American Community Survey 5-Year Estimates from the U.S. Census Bureau, are the cities of Patterson (population 23,517)[1] and Los Banos (population 44,421)[2].

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[1] Source: https://data.census.gov/cedsci/profile?g=1600000US0656112.

[2] Source: https://data.census.gov/cedsci/profile?g=1600000US0644028.

Smaller communities in the Subbasin include Grayson, Tranquillity, Mendota, Firebaugh, Dos Palos, Santa Nella, Newman, Gustine, Crows Landing, Westley, Volta, and Vernalis, all of which have economies greatly dependent on agricultural production and groundwater.

This Annual Report is broken into the following six sections:

1. Groundwater Elevation Data
2. Groundwater Extraction Data
3. Surface Water Supply
4. Total Water Use/Consumptive Use
5. Change in Groundwater Storage
6. Plan Implementation

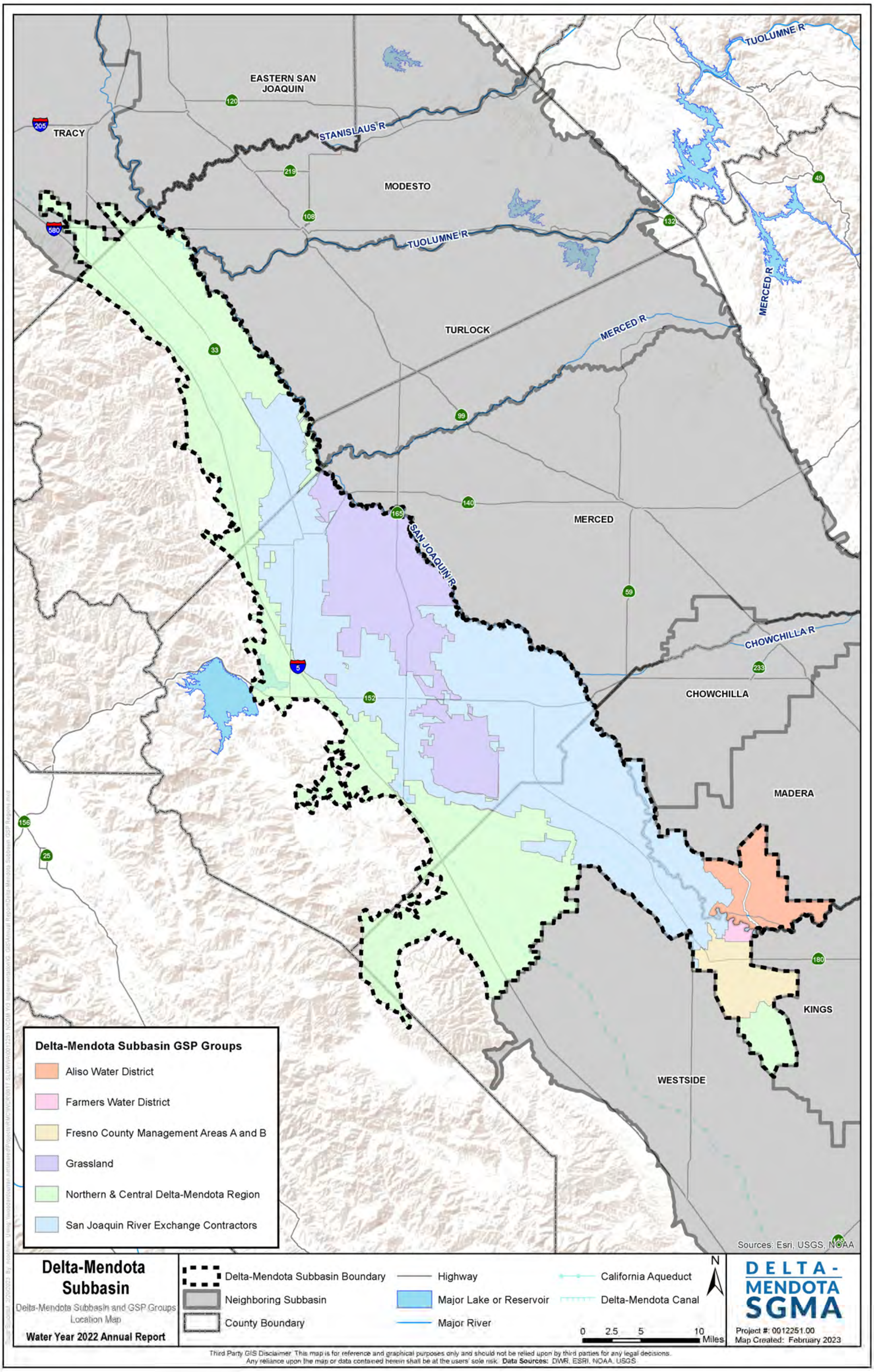

Figure 1. Delta-Mendota Subbasin and GSP Regions

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1. Groundwater Elevation Data

Groundwater elevation data are presented below in groundwater surface elevation contour maps. These maps were generated from groundwater elevation data collected from wells in the six Subbasin GSP monitoring networks to illustrate the seasonal high and seasonal low conditions in each principal aquifer (Upper Aquifer and Lower Aquifer) in the Delta-Mendota Subbasin during WY2022, with measurements from additional wells also incorporated in order to provide adequate Subbasin-wide coverage. Seasonal high is defined as any groundwater level measurement recorded between February and April, and seasonal low is defined as any groundwater level measurement recorded in September or October.

Hydrographs of groundwater elevations, including historical data through WY2022 and indicating water year type, are included in **Appendix A** for each well in the Subbasin's representative monitoring network for the chronic lowering of groundwater levels sustainability indicator. Since the end of the 2012-2016 drought (starting in WY2017), groundwater elevations at many locations have largely recovered to pre-drought levels and are generally similar to or higher than WY2012 pre-drought levels. During WY2019, groundwater elevations generally remained similar to WY2012 and WY2017 levels. Dry and critically dry conditions during WY2020 through WY2022 have, however, resulted in stable or declining groundwater levels throughout much of the Delta-Mendota Subbasin.

Figure 2 and **Figure 3** present contour maps of groundwater elevations for WY2022 seasonal high (February to April 2022) and seasonal low (September to October 2021), respectively, for the Upper Aquifer. During WY2022 seasonal high conditions, groundwater elevations ranged from about 0 feet above mean sea level (ft above MSL) to 140 ft above MSL throughout the Subbasin (**Figure 2**). Groundwater generally flowed in the north to northeast direction throughout the Subbasin; however, groundwater flowed in the southwest direction along the southern boundary with Westside Subbasin. During WY2022 seasonal low conditions, groundwater elevations again ranged from about 10 ft above MSL to 140 ft above MSL with similar flow direction patterns as observed during seasonal high conditions in the Subbasin (**Figure 3**). Differences in groundwater elevations between seasonal high and seasonal low conditions during WY2022 can likely be attributed to increased groundwater pumping just prior to the seasonal low period (September to October 2021) and irrigation during the prior water year, and groundwater level recovery during winter and spring due to precipitation and recharge following the prior irrigation season.

It should be noted that within the Grassland GSP region, groundwater elevations are higher during the seasonal low condition (**Figure 3**) than the seasonal high condition (**Figure 2**) due to operations at the Grassland National Wildlife Refuge (NWR) where groundwater is pumped for environmental uses (refuge irrigation) and recirculated. The irrigation season for the Grassland

NWR continues into the late fall while agricultural irrigation typically ends in the early fall. This results in a mounding effect in the fall in the Grassland GSP region and creates a false high due to the irrigation needs at the Grassland NWR.

Figure 4 and **Figure 5** present contour maps for groundwater elevations for WY2022 seasonal high (February to April 2022) and seasonal low (September to October 2021), respectively, for the Lower Aquifer. A great majority of wells perforated in the Lower Aquifer with groundwater level measurements during WY2022 seasonal high and seasonal low conditions are located within the Northern & Central Delta-Mendota Region and in the southern portion of the Subbasin around the Fresno County Management Areas A and B GSP region and Tranquillity Irrigation District area. Lower Aquifer monitoring wells in the middle of the Subbasin remain a data gap that the regions are currently working to address.

During WY2022 seasonal high conditions, groundwater elevations in the Lower Aquifer ranged from about -80 ft MSL to 100 ft MSL (**Figure 4**). During WY2022 seasonal low conditions, groundwater elevations ranged from -100 ft MSL to 110 ft MSL (**Figure 5**). The large range in groundwater elevations are due to a combination of Lower Aquifer elevations (high in the west along the Coastal Range and lower to the east near the Valley floor) and pumping. Groundwater flow patterns Subbasin-wide in the Lower Aquifer are similar to the Upper Aquifer during seasonal high and seasonal low conditions, generally to the north and northeastern direction. Similar to the Upper Aquifer, differences in groundwater elevations between seasonal high and seasonal low conditions during WY2022 can likely be attributed to increased groundwater pumping just prior to the seasonal low period (September to October 2021) and irrigation during the prior water year, and groundwater level recovery during winter and spring due to precipitation and recharge as a result of prior irrigation season.

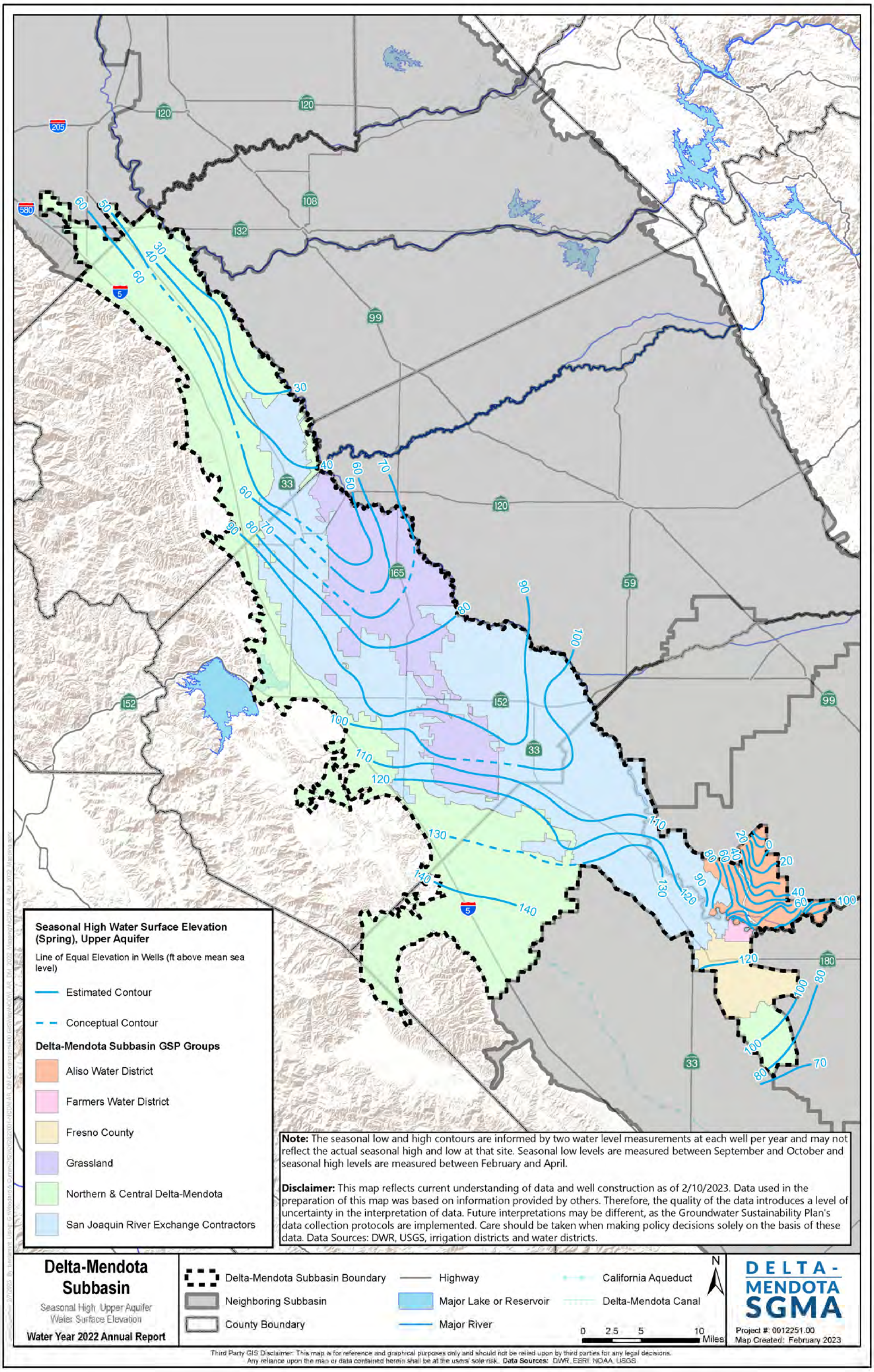

Figure 2. WY2022 Seasonal High Groundwater Elevations, Upper Aquifer

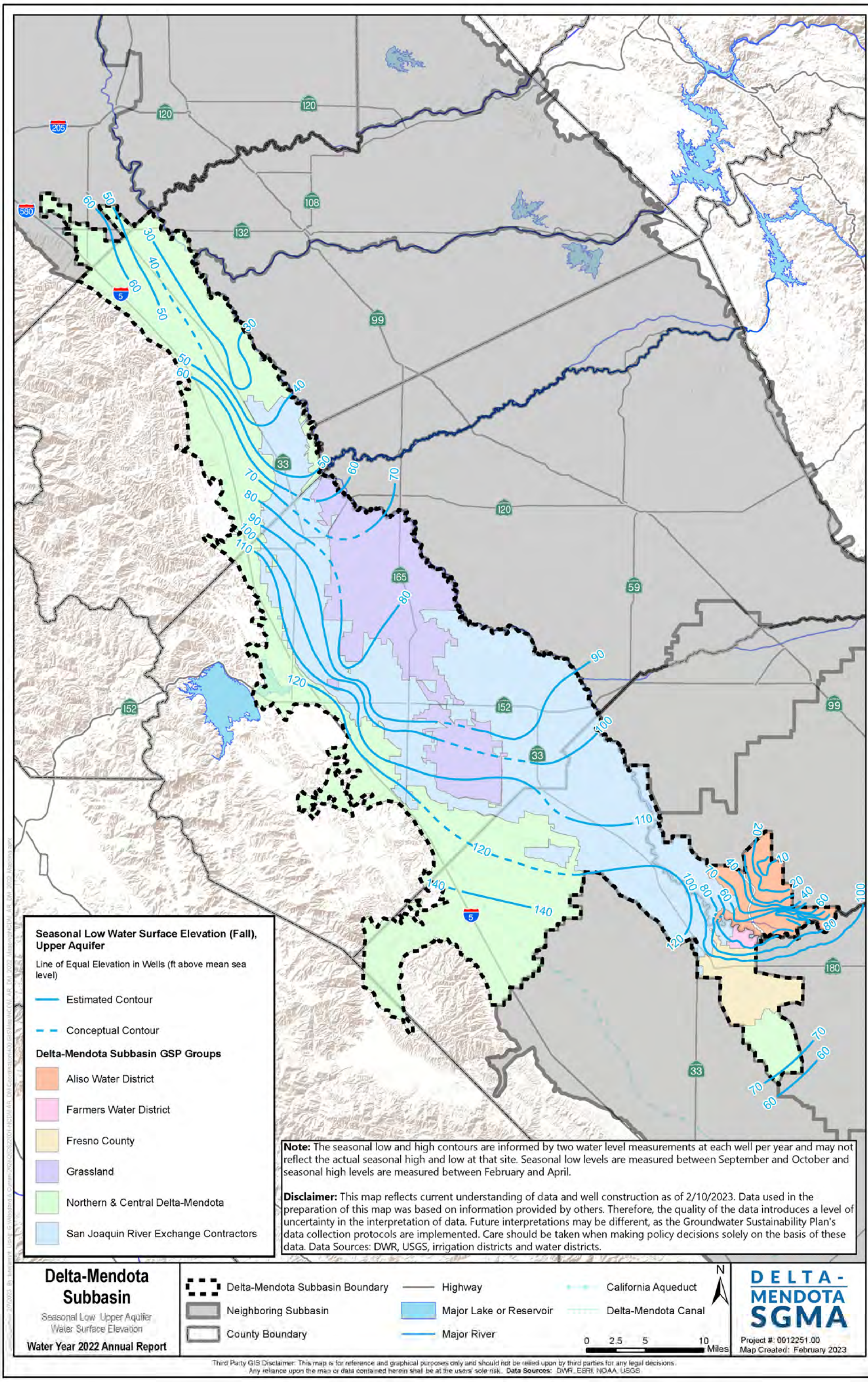

Figure 3. WY2022 Seasonal Low Groundwater Elevations, Upper Aquifer

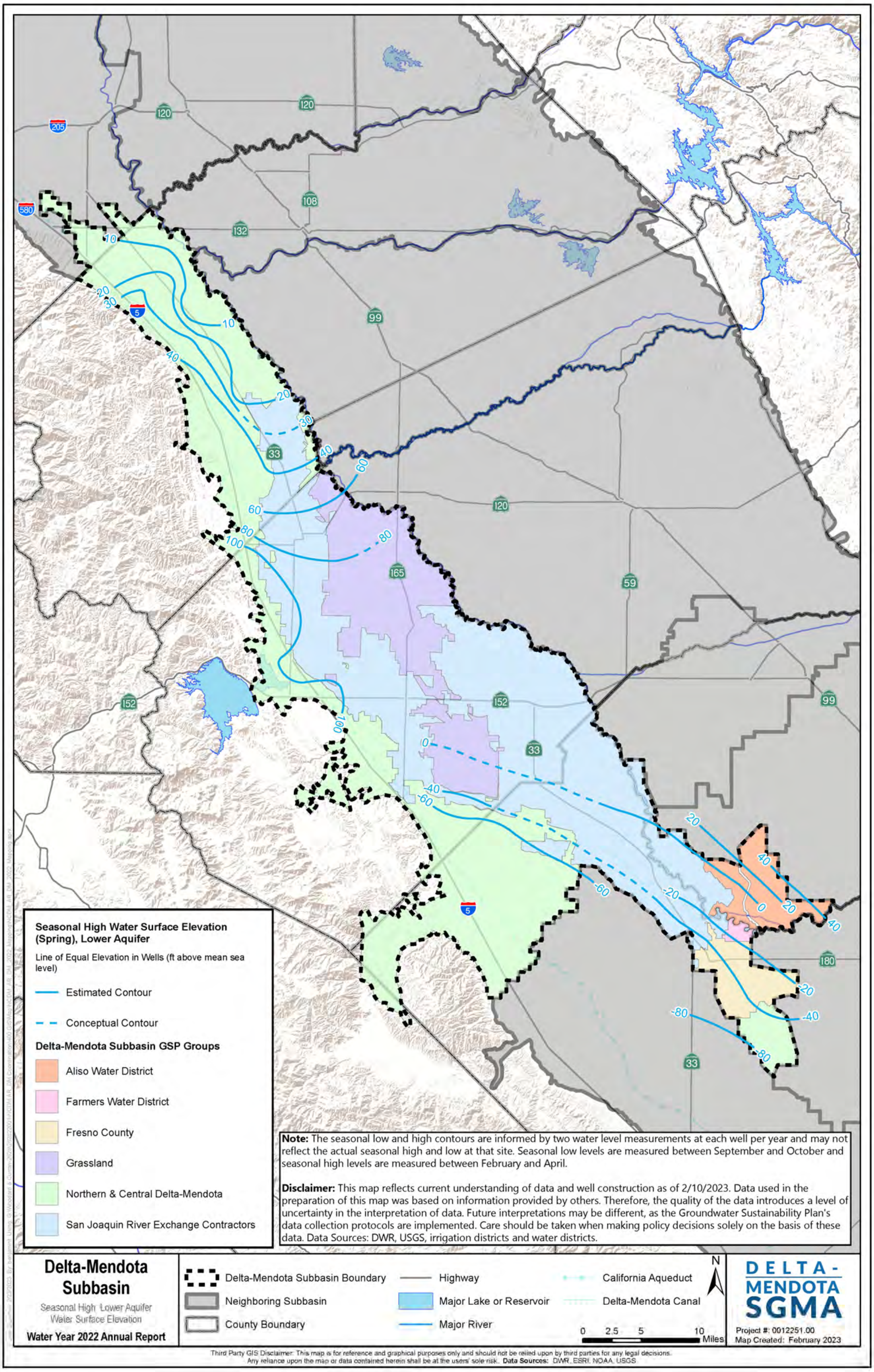

Figure 4. WY2022 Seasonal High Groundwater Elevations, Lower Aquifer

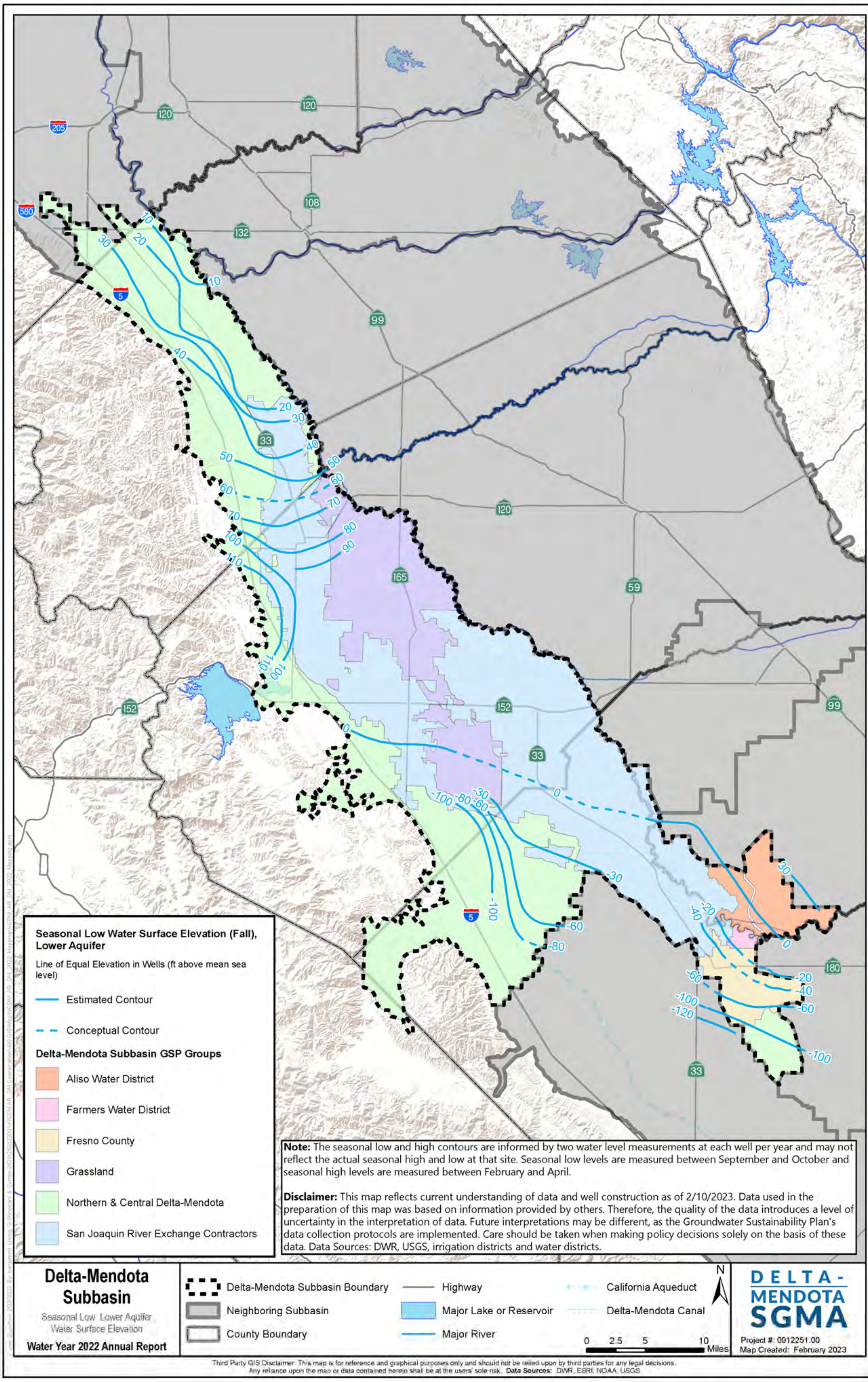

Figure 5. WY2022 Seasonal Low Groundwater Elevations, Lower Aquifer

2. Groundwater Extraction Data

The following WY2022 groundwater extraction data, shown in **Table 1**, are a combination of direct measurements and estimates from each of the six GSP regions in the Delta-Mendota Subbasin. The accuracy of the measurements and estimates vary on a GSP region and site-by-site basis. The measurement method also varies across the six Subbasin GSP regions and largely consists of self-reported groundwater extraction volumes from each GSA.

Agricultural groundwater pumping is the largest water use sector by volume in the Delta-Mendota Subbasin at an estimated 501,600 acre-feet (AF) of extraction during WY2022, representing approximately 89% of total groundwater extractions in the Delta-Mendota Subbasin (**Table 1**). Managed Wetlands (34,000 AF), Urban/Domestic/Municipal (21,900 AF), and Industrial (6,400 AF) comprise the remaining 11% of total groundwater extractions in the Subbasin during WY2022 (**Table 1**). During WY2022, there were no quantifiable groundwater extractions for Managed Recharge, Native Vegetation, or Outside Subbasin water use sectors. Future annual reports will collect and report extraction data according to the water use sectors identified in **Table 1**.

Table 1. WY2022 Groundwater Extraction by Water Use Sector, Delta-Mendota Subbasin

Groundwater Extraction (Acre-Feet)			
Water Use Sector	**WY2022 Total**	**Measurement Method (Direct or Estimate)** [1]	**Measurement Accuracy (%)**
Urban/Domestic/Municipal	21,900	Estimate	N/A
Industrial	6,400	Estimate	N/A
Agricultural	501,600	Estimate	N/A
Managed Wetlands	34,000	Direct	0-5%
Managed Recharge	0	N/A	N/A
Native Vegetation	0	N/A	N/A
Other: Outside Subbasin	0	N/A	N/A
Total	**563,900**	**Estimate**	**N/A**

[1] Measurements include a combination of direct measurements and estimated values; therefore, measurement method is reported as estimate in these cases.

Figure 6 shows the general location and volume of groundwater extractions for each of the six GSP regions during WY2022. Overall, groundwater extraction by GSP region is presented by the area covered by the individual GSP and reflects, to some extent, the availability of surface water supplies within each GSP region. For example, Farmers Water District is solely reliant on groundwater while the remaining five GSP regions conjunctively use groundwater and surface water. Surface water rights and contracted imported surface water volumes vary among the GSP regions where, for example, the San Joaquin River Exchange Contractors are reliant on their senior surface water rights, and agencies in the central portion of the Northern & Central Delta-Mendota GSP Region hold CVP contracts with water rights junior to their neighbors and thus subject to shortages. For region-specific information about groundwater use and hydrogeologic conditions unique to each GSP region, refer to the individual six Subbasin GSPs.

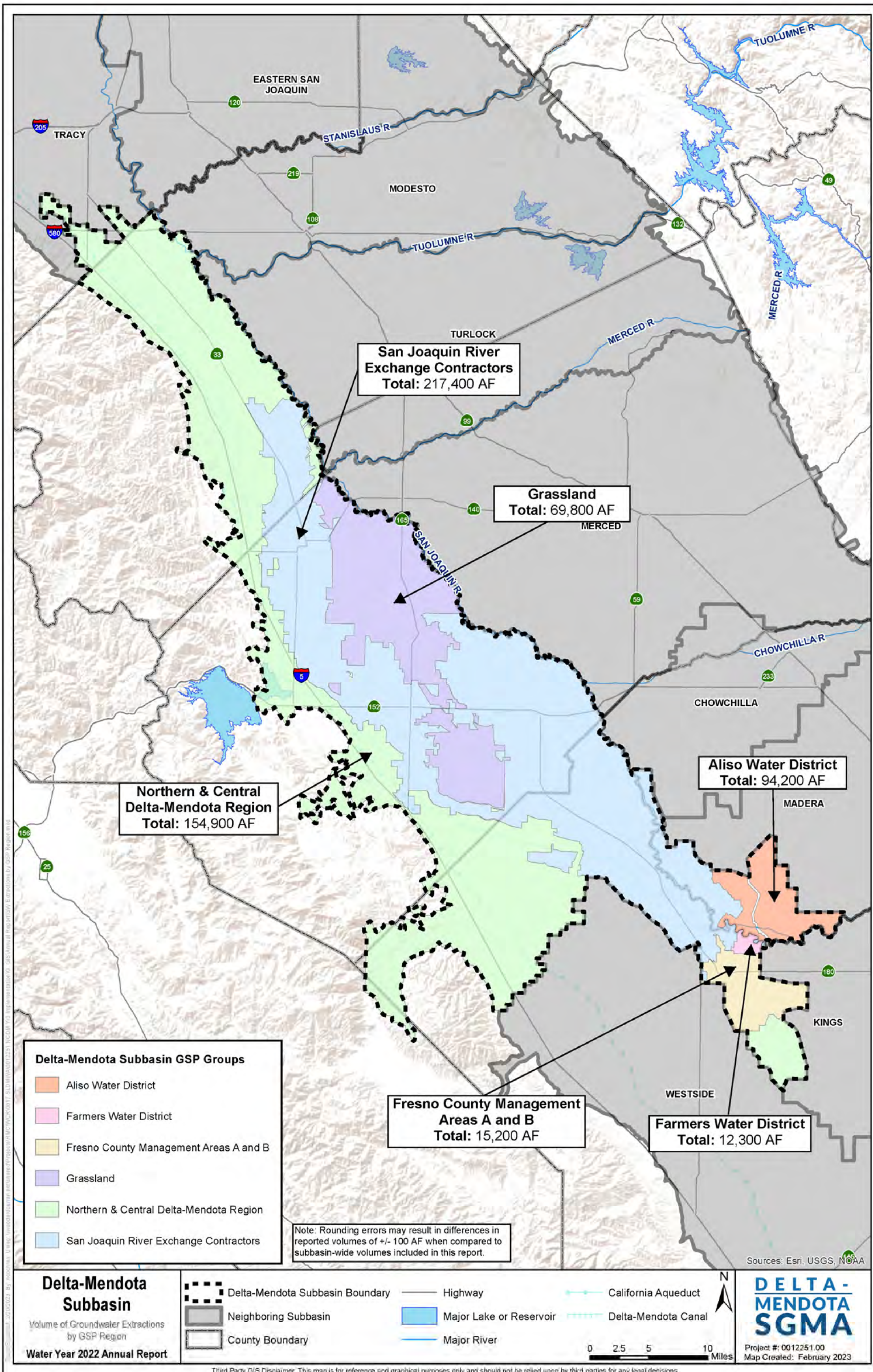

Figure 6. WY2022 General Location and Volume of Groundwater Extractions

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3. Surface Water Supply for Recharge

The following surface water supply data are a combination of direct measurements and estimates from each of the six GSP regions in the Delta-Mendota Subbasin.

CVP water accounts for the largest surface water source by volume at an estimated 837,100 AF during WY2022, representing approximately 79% of total surface water used within the Delta-Mendota Subbasin (**Table 2**). Water supplies from the Kings and San Joaquin Rivers (Other) account for 111,000 AF (11% of total) of surface water used during WY2022 (**Table 2**). The remaining 9% of surface water supplies during WY2022 consist of Local Imported Supplies (81,700 AF); Recycled Water (18,600 AF), which is sourced from the North Valley Regional Recycled Water Program; water supplies sourced from local creeks, which include any naturally-occurring surface water course other than the Kings or San Joaquin Rivers (4,400 AF); and State Water Project (SWP) water (500 AF), where Oak Flat Water District is the only SWP contractor in the Delta-Mendota Subbasin (**Table 2**). Agriculture is the predominant surface water use sector within the Delta-Mendota Subbasin, with a lesser volume of CVP water delivered to Urban/Domestic/Municipal users and wildlife refuges.

Table 2. WY2022 Surface Water Supply, Delta-Mendota Subbasin

Surface Water Supply (Acre-Feet)	
Surface Water Source	**WY2022 Total**
Central Valley Project (CVP)	837,100
State Water Project (SWP)	500
Colorado River Project	--
Local Supplies [1]	4,400
Local Imported Supplies	81,700
Recycled Water	18,600
Desalination	--
Other [2]	111,000
Total	**1,053,300**

[1] Surface water supplies sourced from local creeks, which include any naturally-occurring surface water course other than the Kings or San Joaquin Rivers.

[2] Surface water supplies sourced from the Kings and/or San Joaquin Rivers.

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4. Total Water Use

Total water use by water use sector and supply is shown in **Table 3**. The measurement method varies across the six Subbasin GSP regions and largely consists of self-reported volumes from each GSA. The data presented in **Table 3** is a summation of data from the six GSP regions and reflects a variety of methods for data calculation and estimation. These data are a combination of direct measurements and estimates from each of the six GSP regions in the Delta-Mendota Subbasin. The difference between these values and the sum of the various supplies available to the Subbasin (groundwater, surface water, and recycled/reuse water) reflects water lost through canal leakage, pipe leakage, and other percolating waters.

Agricultural water use comprises approximately 82% of the total water use in the Delta-Mendota Subbasin during WY2022 and is estimated to be 1,135,500 AF (**Table 3**). Managed Wetlands water use comprises approximately 17% of the total water use in the Subbasin during WY2022 at an estimated volume of 233,500 AF (**Table 3**). Collectively, Urban/Domestic/ Municipal (16,700 AF) and Industrial (2,600 AF) comprise the remaining 1% of total water use in the Subbasin during WY2022 (**Table 3**).

Table 3. WY2022 Total Water Use, Delta-Mendota Subbasin

Summary of Total Water Use (Acre-Feet)			
Total Water Use	**WY2022 Total [1]**	**Measurement Method (Direct or Estimate)**	**Measurement Accuracy (%)**
Urban/Domestic/Municipal			
Groundwater	14,800	Estimate	N/A
Surface Water	1,900	Estimate	N/A
Recycled Water	0	N/A	N/A
Reused Water	0	N/A	N/A
Other	0	N/A	N/A
Total	*16,700*	*Estimate*	*N/A*
Industrial			
Groundwater	2,600	Estimate	N/A
Surface Water	0	N/A	N/A
Recycled Water	0	N/A	N/A
Reused Water	0	N/A	N/A
Other	0	N/A	N/A
Total	*2,600*	*Estimate*	*N/A*
Agricultural			
Groundwater	370,200	Estimate	N/A
Surface Water	732,800	Estimate	N/a
Recycled Water	18,600	Direct	0-5%
Reused Water [2]	13,900	Estimate	N/A
Other	0	N/A	N/A
Total	*1,135,500*	*Estimate*	*N/A*

Summary of Total Water Use (Acre-Feet)			
Total Water Use	**WY2022 Total [1]**	**Measurement Method (Direct or Estimate)**	**Measurement Accuracy (%)**
Managed Wetlands			
Groundwater	34,000	Direct	0-5%
Surface Water	199,500	Direct	0-5%
Recycled Water	0	N/A	N/A
Reused Water	0	N/A	N/A
Other	0	N/A	N/A
Total	*233,500*	*Direct*	*0-5%*
Managed Recharge			
Groundwater	0	N/A	N/A
Surface Water	0	N/A	N/A
Recycled Water	0	N/A	N/A
Reused Water	0	N/A	N/A
Other	0	N/A	N/A
Total	*0*	N/A	N/A
Native Vegetation			
Groundwater	0	N/A	N/A
Surface Water	0	N/A	N/A
Recycled Water	0	N/A	N/A
Reused Water	0	N/A	N/A
Other	0	N/A	N/A
Total	*0*	N/A	N/A
Other: N/A			
Groundwater	0	N/A	N/A
Surface Water	0	N/A	N/A
Recycled Water	0	N/A	N/A
Reused Water	0	N/A	N/A
Other	0	N/A	N/A
Total	*0*	N/A	N/A
Total	***1,388,300***	***Estimate***	***N/A***

[1] Differences in reported volumes in Table 3 compared to Tables 1 and 2 account for actual water use in Table 3 (incorporating water loss through canal leakage, pipe leakage, and other percolating waters), compared to extracted groundwater in Table 1 and metered contracted surface water supplies in Table 2.

[2] Includes drain water/recirculated water utilized within Mercy Springs Water District, Oro Loma Water District, Panoche Water District, and Patterson Irrigation District service areas.

5. Change in Groundwater Storage

The change in groundwater storage for the Delta-Mendota Subbasin is shown below in a series of graphs depicting groundwater use and annual change in groundwater storage calculated from seasonal groundwater elevation highs in 2021 and seasonal groundwater elevation highs in 2022, along with the cumulative change in groundwater storage calculated using annual change in groundwater storage between seasonal groundwater elevation highs from 2013 and seasonal groundwater elevation highs from 2022. **Table 4** also shows the change in groundwater stored by principal aquifer cumulatively during these same periods.

Upper Aquifer change in groundwater storage calculated for the period between 2021 and 2022 seasonal groundwater elevation highs was estimated using two methods chosen by the respective GSP regions and summed to a Subbasin total: change in groundwater elevation contours used by the Aliso Water District, Farmers Water District, and Fresno County Management Areas A and B GSP regions; and representative hydrographs used by the Grassland GSP Region, Northern & Central Delta-Mendota GSP Region, and San Joaquin River Exchange Contractors GSP Region. The results of these estimations are presented in **Table 4**. As calculated, between 2021 seasonal groundwater elevation highs and 2022 seasonal groundwater elevation highs, groundwater stored in the Upper Aquifer decreased by approximately 387,300 AF, which can be attributed to consecutive dry (WY2020) and critically dry conditions (WY2021 and WY2022) that resulted in increased reliance on Upper Aquifer pumping due to less surface water supplies available Subbasin-wide (**Table 4**).

Cumulative change in groundwater storage in the Upper Aquifer between 2013 seasonal groundwater elevation highs and 2022 seasonal groundwater elevation highs is presented in **Table 4** and was estimated utilizing the same methods on an annual basis by GSP region[3,4,5] as previously described. Cumulatively, from seasonal groundwater elevation high in 2013 through seasonal groundwater elevation high in 2022, groundwater stored in the Upper Aquifer decreased by approximately 741,500 AF (**Table 4**). It should be noted that the period in question included the height of the 2012-2016 drought (WY2014 through WY2016) which was then followed by normal and wet conditions through WY2019 and dry conditions in WY2020 and Shasta Critical conditions in WY2021 and WY2022.

[3] For Aliso Water District, Upper Aquifer annual change in groundwater storage between 2013 seasonal high and 2017 seasonal high groundwater conditions was derived from the Projected Water Budget presented in the Aliso Water District GSP.

[4] For Grassland and Northern & Central Delta-Mendota Region GSP regions, Upper Aquifer annual change in groundwater storage between 2012 seasonal high and 2019 seasonal high groundwater conditions were derived from the Projected Water Budgets presented in their respective GSPs.

[5] For Grassland GSP Region, Upper Aquifer annual change in groundwater storage for WY2021 was calculated by calibrating the water budget to historic below normal water year conditions.

Lower Aquifer change in groundwater storage between the 2021 seasonal high in groundwater elevations and the 2022 seasonal high in groundwater elevations, presented in **Table 4**, was estimated utilizing two methods chosen by the respective GSP regions and summed for the Subbasin total: change in land surface using the best available data[6,7,8,9] was used by the Aliso Water District, Grassland, Northern & Central Delta-Mendota Region, and San Joaquin River Exchange Contractors GSP regions; and change in groundwater elevation at GSP monitoring wells was utilized by the Farmers Water District and Fresno Management Areas A and B GSP regions. Between seasonal high groundwater elevations of 2021 and 2022, groundwater stored in the Lower Aquifer decreased by approximately 71,700 AF, which is likely the result of the Lower Aquifer being a confined system and reduced availability of surface water in the Subbasin resulting in increased groundwater use during the dry conditions in WY2020 and Shasta Critical conditions in WY2021 and WY2022 (**Table 4**).

Cumulative change in groundwater storage in the Lower Aquifer from the 2013 seasonal high groundwater elevations through the 2022 seasonal high groundwater elevations was estimated utilizing the same GSP-selected methodologies and sources[10], on an annual basis, as implemented for estimating change in groundwater storage between the seasonal groundwater elevation highs of 2021 and 2022, as described above. Cumulatively, groundwater stored in the Lower Aquifer decreased by approximately 527,600 AF (**Table 4**). As with the Upper Aquifer, it

[6] Inelastic land subsidence is largely the result of groundwater pumping from the Lower Aquifer but is not directly equivalent to Lower Aquifer pumping.

[7] The following source was utilized to calculate Lower Aquifer change in groundwater storage between the 2021 and 2022 seasonal high groundwater elevations for the Aliso Water District and Grassland GSP regions:

San Joaquin River Restoration Program. 2021. *December 2021 Table (Bureau of Reclamation Static GSP Survey for Subsidence Monitoring, Central Valley California)*. Retrieved from http://www.restoresjr.net/science/subsidence-monitoring/. Note: Additional refinements provided by Kenneth D. Schmidt & Associates using additional local data.

[8] The following source was utilized to calculate Lower Aquifer change in groundwater storage between the 2021 and 2022 seasonal high groundwater elevations for the San Joaquin River Exchange Contractors GSP region, where the average annual land subsidence from December 2013 to December 2022 was used:

San Joaquin River Restoration Program. 2022. *December 2022 Table (Bureau of Reclamation Static GSP Survey for Subsidence Monitoring, Central Valley California)*. Retrieved from http://www.restoresjr.net/science/subsidence-monitoring/.

[9] For the Northern & Central Delta-Mendota GSP Region, in addition to the *Bureau of Reclamation Static GPS Survey for Subsidence Monitoring, Central Valley California* (December 2022), the Nevada Geodetic Laboratory data set (http://geodesy.unr.edu/) and local data collected by Patterson Irrigation District, West Stanislaus Irrigation District, and Tranquillity Irrigation District were used to provide complete spatial coverage of the Northern & Central Delta-Mendota GSP Region.

[10] Lower Aquifer change in groundwater storage between 2013 and 2019 seasonal high conditions for the Northern & Central Delta-Mendota Region GSP was derived from the current and projected baseline water budgets presented in the GSP (November 2019).

should be noted that the period in question included the height of the 2012-2016 drought (WY2014 through WY2016) which was then followed by normal and wet conditions through WY2019 and dry conditions in WY2020 and Shasta Critical conditions in WY2021 and WY2022.

Table 4. Annual and Cumulative Change in Storage by Principal Aquifer from Seasonal High 2013 to Seasonal High 2022, Delta-Mendota Subbasin

Change in Storage (Acre-Feet)		
Principal Aquifer	**Annual Change in Storage, Seasonal High 2021 to Seasonal High 2022** [1]	**Cumulative Change in Storage, Seasonal High 2013 to Seasonal High 2022** [1]
Upper Aquifer	-387,300	-741,500
Lower Aquifer	-71,700	-527,600
Total	**-459,000**	**-1,269,100**

[1] Rounding errors may result in differences in reported volumes by ± 100 AF.

Figure 7 shows annual change in groundwater stored by water year type with cumulative change in groundwater storage at the Subbasin level as calculated using the methods previously described. In general, groundwater stored largely decreases during Dry and Shasta Critical years and increases during Wet and Normal years. Following the end of the 2012-2016 drought (starting in WY2017), groundwater stored has increased due to increased precipitation and availability of imported surface water supplies. As a result, the negative trend in cumulative change in storage turned into a positive trend through WY2018 and plateaued through WY2020 and began to decrease in WY2021 and WY2022 due to critically dry conditions and a resulting increased reliance on groundwater.

Figure 8 shows annual groundwater extraction estimates with cumulative change in groundwater storage at the Subbasin level. Groundwater extractions are greater in volume during Dry and Shasta Critical years as compared to Normal and Wet years, where increased precipitation and availability of imported water supplies result in a reduced reliance on groundwater. **Figure 8** demonstrates an inverse relationship between change in storage and groundwater extraction, where cumulative change in storage becomes more negative as groundwater extraction increases and becomes more positive as groundwater extraction decreases. Cumulative change in storage long-term trends are heavily impacted by consecutive Dry and Shasta Critical years (as evident in WY2021 and WY2022), with limited surface water availability and increased groundwater use, creating a compounding depletion of groundwater storage.

Figure 9 and **Figure 10** present change in groundwater storage by principal aquifer (Upper Aquifer and Lower Aquifer) by GSP region cumulatively for the period from spring 2013 to spring 2022 (periods of high groundwater elevations) and annually between spring 2021 and spring 2022, respectively. Cumulative change in storage depicted in **Figure 9** captures the height of the 2012-2016 drought (occurring during WY2014 through WY2016) as well as wetter conditions that occurred during WY2017 through WY2019 and the return of dry and critically dry conditions in WY2020, WY2021, and WY2022. Groundwater is a critically important water supply source during drought with decreased precipitation, higher temperatures, and little to no available imported surface water supplies. **Figure 9** demonstrates the impact the 2012-2016 drought and on-going drought has had on the Delta-Mendota Subbasin and differences in water sources available within each of the GSP groups. Wet conditions during WY2019 resulted in increased recharge in the Upper Aquifer due to increased precipitation and imported surface water deliveries as well as reduced reliance on Lower Aquifer pumping due to availability of surface water supplies. During WY2020, the impacts of wet conditions during WY2019 and sizable late spring precipitation are evident as change in storage is similar to WY2016 conditions (**Figure 10**). As dry conditions persisted through WY2021 and WY2022, groundwater storage began to decrease following relatively stable conditions since the end of the 2012-2016 drought.

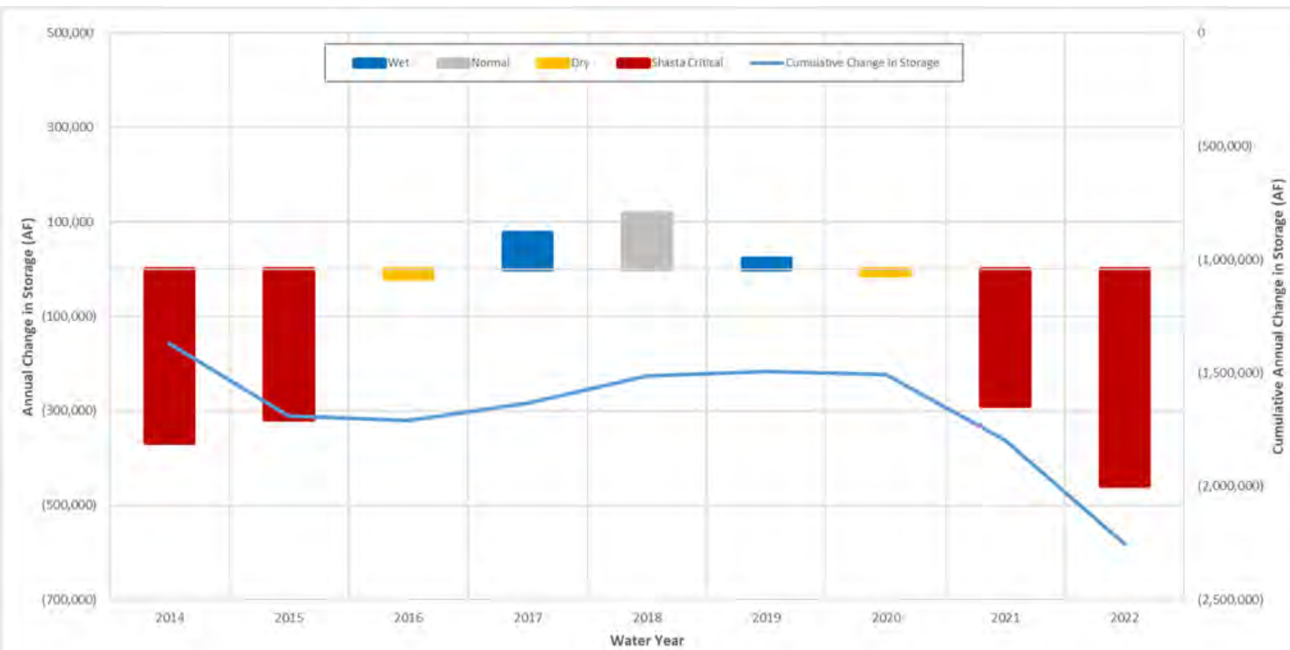

Figure 7. Annual Change in Storage and Cumulative Change in Storage, Seasonal High 2013 to Seasonal High 2022 [11]

[11] Water year types are mapped in the following manner according to the San Joaquin River Water Year Index water year types: Wet = Wet; Normal = Below Normal and Above Normal; Dry = Dry and Critical. Shasta Critical years are designated upon the request of the San Joaquin River Exchange Contractors and Grassland GSP regions as well as Tranquillity Irrigation District as this designation impacts surface water deliveries to exchange contracts and managed wetlands through the CVP. Shasta Critical designations are dependent on inflow to Shasta Reservoir and U.S. Bureau of Reclamation's operating rules for CVP deliveries.

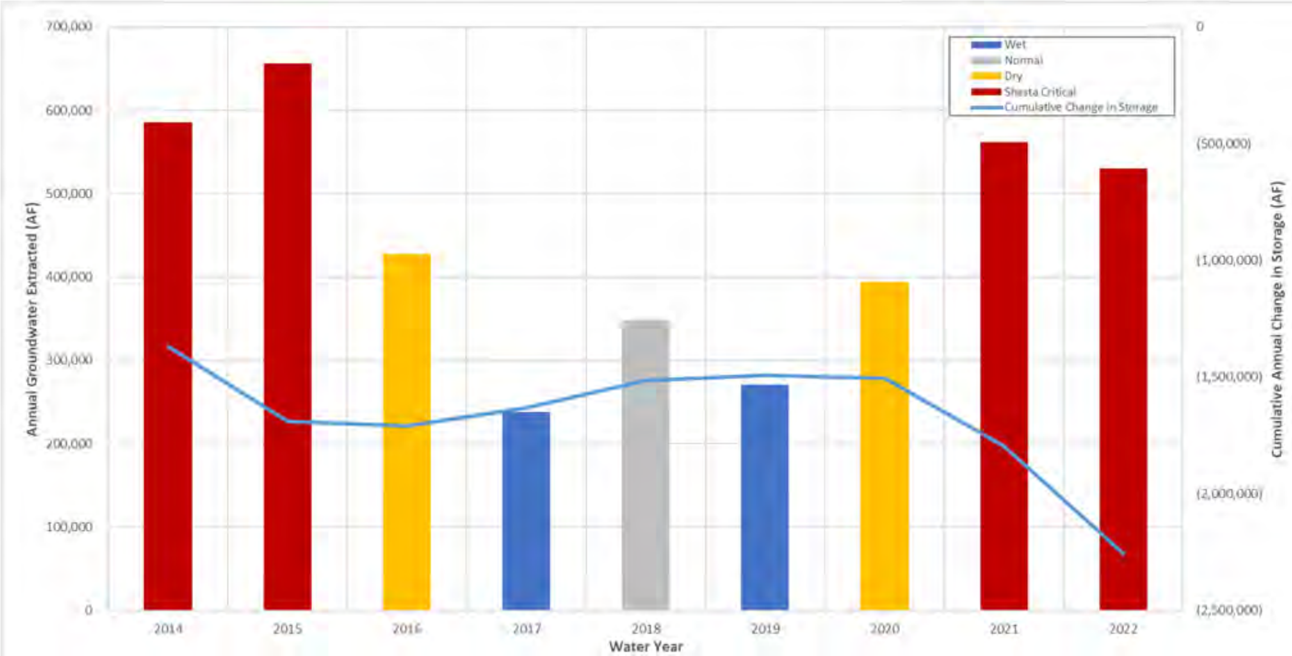

Figure 8. Groundwater Extraction and Cumulative Change in Storage, WY2014 to WY2022 [12]

[12] Water year types are mapped in the following manner according to the San Joaquin River Water Year Index water year types: Wet = Wet; Normal = Below Normal and Above Normal; Dry = Dry and Critical. Shasta Critical years are designated upon the request of the San Joaquin River Exchange Contractors and Grassland GSP regions as well as Tranquillity Irrigation District as this designation impacts surface water deliveries to exchange contracts and managed wetlands through the CVP. Shasta Critical designations are dependent on inflow to Shasta Reservoir and U.S. Bureau of Reclamation's operating rules for CVP deliveries.

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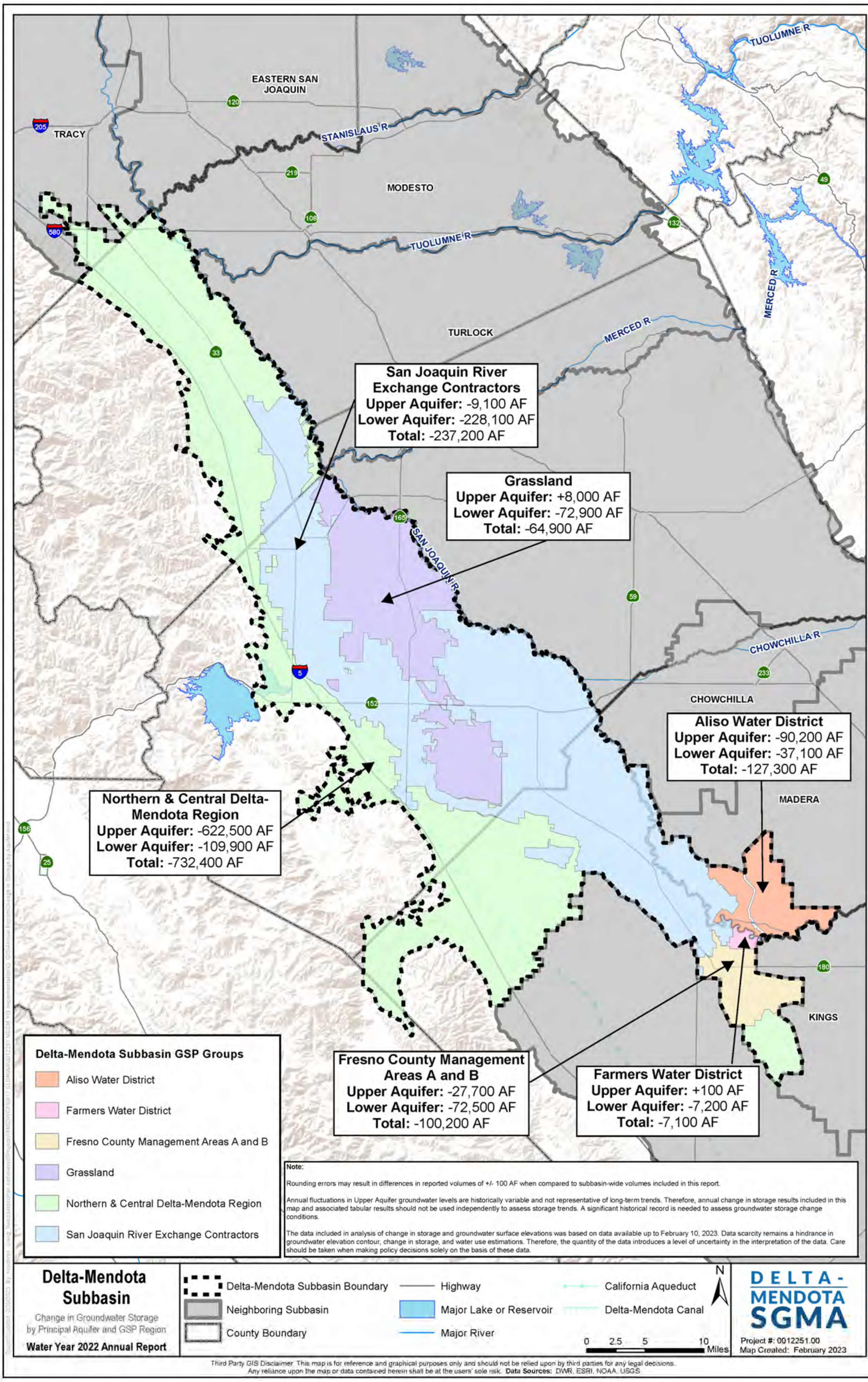

Figure 9. Seasonal High 2013 to Seasonal High 2022 Cumulative Change in Groundwater Storage by Principal Aquifer[13]

[13] There are minimal Lower Aquifer groundwater extractions within the Grassland GSP Region. The -72,900 AF cumulative Lower Aquifer change in storage in the Grassland GSP Region is influenced by Lower Aquifer groundwater extractions outside of the Subbasin and detected as a historic subsidence hotspot (depicted in Figure 3-21 in the Grassland GSP).

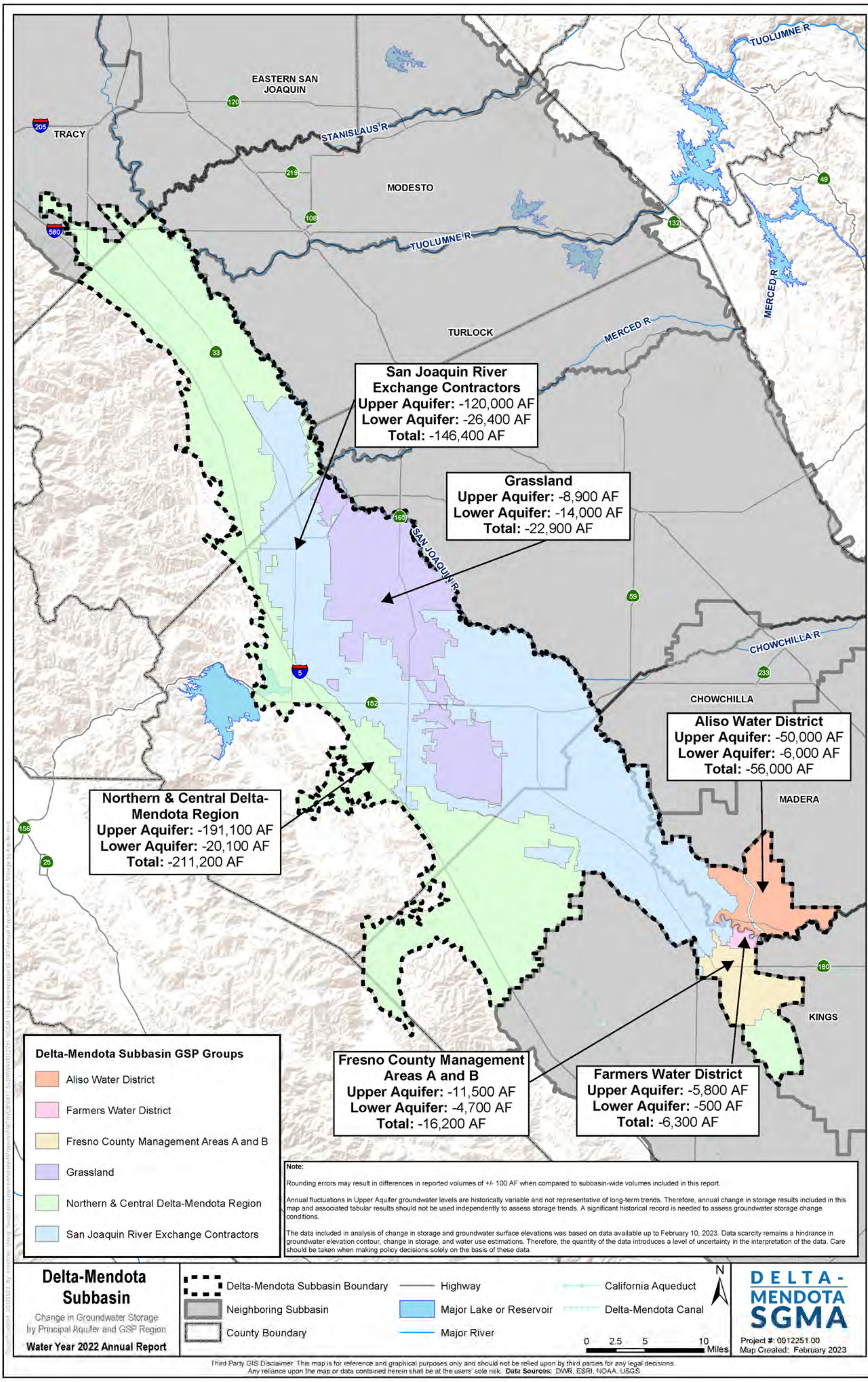

Figure 10. Seasonal High 2021 to Seasonal High 2022 Change in Groundwater Storage by Principal Aquifer

6. Plan Implementation

WY2022 marks the third year of GSP implementation for the Delta-Mendota Subbasin. The following subsections describe progress made by each of the six GSP regions toward implementing their respective Plans, including progress towards achieving interim milestones and the implementation of projects and management actions. Cumulatively, these efforts provide the required advancement towards achieving and maintaining groundwater sustainability in the Delta-Mendota Subbasin.

6.1 Aliso Water District GSP Region Progress

The Aliso Water District GSA (AWDGSA) continues to progress towards implementing projects and management actions to reach long-term sustainability. In WY2022, the AWDGSA has continued progress on pursuing water rights on the Chowchilla Bypass (Bypass) flood control structure. At the time of writing this Annual Report, the State Water Resources Control Board (SWRCB) authorized and approved the Temporary Water Right Permit for AWDGSA to appropriate water by temporary permit pursuant to Water Code, Section 1425 *et seq*. The application allows the diversion of about 10,000 acre-feet of available San Joaquin River flood water from the Bypass to underground storage and ultimately use for irrigation purposes. The AWDGSA continues to pursue a permanent appropriate water right permit.

Following the authorization from the SWRCB and funding from DWR's Sustainable Groundwater Management (SGM) Program SGMA Implementation – Round 1 awarded in April 2022, the AWDGSA made progress on the Chowchilla Bypass Recharge Project (formally known as the Cottonwood Creek Recharge Project, outlined in the GSP) to recharge flood water on a 75-acre site east of the Bypass. In accompaniment to the recharge project, the AWDGSA also received SGM Program SGMA Implementation – Round 1 funding to:

1. Revise the 2020 Groundwater Sustainability Plan (GSP) to be consistent across the Delta-Mendota Subbasin (completed and submitted to DWR in July 2022).
2. Conduct a composite well study to better quantify Upper Aquifer and Lower Aquifer pumping with more certainty, as most of the wells within the AWDGSA are composite wells.
3. Install deep, sub-Corcoran Clay monitor wells to fill Lower Aquifer data gaps by better quantifying vertical groundwater flow across the two principal aquifers and horizontal flow across the AWDGSA boundary.

In addition to SGM Program SGMA Implementation – Round 1 funding, the AWDGSA applied for Round 2 funding in December 2022 (anticipated draft award in June 2023) dedicated to increase monitoring, fill data gaps, and to conduct an interconnected surface water–groundwater study to establish more defined sustainable management criteria in the 2025 GSP update.

6.2 Farmers Water District GSP Region Progress

During WY2022, the Farmers Water District (FWD) GSA conducted the following GSP implementation activities:

- **Representative Monitoring and Data Collection Activities.** FWD GSA monitored groundwater conditions in the Farmers Water District GSA Plan Area. Data collected from the monitoring indicate continued adherence to established measurable objectives and interim milestones in the areas of groundwater storage, subsidence, water quality, and interconnected surface waters. The Lower Aquifer representative monitoring site (RMS) well (31J6) was below the minimum threshold established in the revised FWD GSP. FWD does not extract from the Lower Aquifer and therefore does not contribute to the lowering of groundwater levels. Monitoring data were uploaded to DWR's SGMA Portal and to the Delta-Mendota Subbasin Coordinated data management system (DMS).
- **Revised Farmers Water District Groundwater Sustainability Plan.** DWR released its initial determination on the 2020 GSPs in early 2022. The six Delta-Mendota Subbasin GSPs were identified as "Incomplete" and were granted six months to address the four deficiencies identified by DWR. During this time FWD and the five other GSP groups held several Coordination Committee meetings in order to determine how to address the necessary changes required by DWR.

6.3 Fresno County Management Areas A and B GSP Region Progress

During WY2022, the Fresno County Management Area A&B GSAs (Fresno County GSAs) conducted the following GSP implementation activities:

- **Representative Monitoring and Data Collection Activities.** The Fresno County GSAs monitored groundwater conditions in the Fresno County GSAs Plan Area. Data collected from the monitoring indicates continued adherence to established measurable objectives and interim milestones in the areas of groundwater storage, subsidence, water quality, and interconnected surface waters. The Lower Aquifer RMS well (31J6) was below the minimum threshold established in revised GSP. Fresno County GSAs do not pump groundwater from the Lower Aquifer, therefore they do not contribute to its lowering groundwater elevation. Monitoring data were uploaded to DWR's SGMA Portal and to the Delta-Mendota Subbasin Coordinated DMS.
- **Data Gaps**. The Fresno County GSAs have identified a potential monitoring well site near the Mendota Wildlife Area (MWA) data gap. The landowner is located just east of the MWA and it is anticipated a monitoring well will be installed during WY2023.
- **Revised Fresno County Management Area A & B Groundwater Sustainability Plan.** DWR released its initial determination on the 2020 GSPs in early 2022. The six Delta-Mendota Subbasin GSPs were identified as "Incomplete" and were granted six months to address the four deficiencies identified by DWR. During this time FCMA and the five

other GSP groups held several Coordination Committee meetings in order to determine how to address the necessary changes required by DWR.

6.4 Grassland GSP Region Progress

The Grassland GSP Group (GSP Region) submitted the Grassland GSP in January 2020, starting the GSP Region's SGMA implementation period. In its first three years of implementation, the GSP Region increased and refined monitoring efforts, developed improvements to the GSP Region's water budget, continued stakeholder outreach, and participated as a sub-applicant in the Delta-Mendota Subbasin's SGM Program SGMA Implementation – Round 1 grant application administered by DWR. In addition to Round 1 funding (awarded in March 2022), the GSP Region applied for SGM Program SGMA Implementation – Round 2 grant funding in December 2022 (draft awards anticipated in June 2023). In July 2022, the Grassland GSP was revised to address items of concern raised by the Department of Water Resources (DWR) in its initial "Incomplete" Determination Letter dated January 21, 2022. This progress in SGMA implementation supports the achievement of the Delta-Mendota Subbasin's sustainability goal. The Sustainable Management Criteria outlined in this Progress Towards Implementation reflect the coordinated effort at the Subbasin level through the Coordination Committee and Technical Working Group.

Monitoring Implementation

As a function of local groundwater management and a requirement of the GSP implementation, the Grassland GSP Region's member agencies have continued monitoring for the applicable sustainability indicators in the region: declining groundwater levels, change in groundwater storage, interconnected surface water, groundwater quality, and subsidence.

Representative Monitoring Network and Sustainable Management Criteria Analysis

There are four representative monitoring networks to support the sustainable management criteria assessments: Upper Aquifer groundwater levels monitoring network, Lower Aquifer groundwater levels monitoring network, groundwater quality monitoring network, and subsidence monitoring network.

Upper Aquifer Groundwater Levels Representative Monitoring Network

Upper Aquifer groundwater surface elevation monitoring across the Grassland GSP Region serves to study the annual and cumulative trends in changes to Upper Aquifer groundwater levels, Upper Aquifer groundwater storage, and gradient impacts to interconnected surface water, as described in Chapter 4 of the Grassland GSP. The results are identified in the hydrographs contained in **Appendix A** and **Table 5**. Once sufficient data is available, all Upper Aquifer wells will be compared with a 4-year rolling average of annual groundwater level seasonal low measurements (September and/or October) to the minimum threshold to determine if an undesirable result is occurring. During the current reporting period, however, there is not enough data to accurately do so. Still, more than 50% of representative monitoring sites in the GSP Region have WY2021 seasonal low data above the assigned minimum threshold. Note that many of the representative monitoring sites for groundwater levels are peripheral to the GSP boundary and are subject to surrounding agricultural pumping effects.

Following the 2022 GSP revision process, the representative monitoring network kept the changes documented in the WY2022 Delta-Mendota Subbasin Annual Report. State wells 08S09E34G001M, 08S10E30E001M, and 11S11E04N001M remain unlocatable. The GSP Region may entertain the option of installing additional monitor wells in close proximity to these state wells and use the historic data to analyze long-term trends. **Table 5** reflects the current representative sites and respective sustainable management criteria.

Lower Aquifer Groundwater Levels Representative Monitoring Network

The Lower Aquifer groundwater levels representative monitoring is useful to understand the Lower Aquifer groundwater levels, Lower Aquifer groundwater storage, and impacts related to subsidence. The Grassland GSP Region has identified the Lower Aquifer as a data gap, considering the lack of Lower Aquifer wells to use for monitoring. This is due to the historic minimal groundwater extractions in the Lower Aquifer within the GSP Region. It is currently not financially feasible to install additional Lower Aquifer groundwater monitoring sites; however, the Grassland GSP Region has initiated regular monitoring of several Lower Aquifer wells within the GSP Region that are intended to have sustainable management criteria assigned once enough data has been collected. The Grassland GSP Region's member agencies are continuing to explore financial assistance opportunities to support closing the data gap in the Lower Aquifer.

Lower Aquifer groundwater level monitoring results are reported in **Table 5**; however, sustainable management criteria for these wells have not been established. Meaningful interim goals, measurable objectives, and minimum thresholds will be established in future GSP updates once sufficient data is gathered.

Table 5. Grassland GSP Region – Groundwater Levels Representative Monitoring Results

Representative Water Level Monitoring Results							
Representative Monitoring Well		WY2022 Seasonal Low (Oct/Sept)[1]	2025 Interim Goal	2030 Interim Goal	2035 Interim Goal	2040 Measurable Objective	Minimum Threshold
		Units in Water Surface Elevation (ft)					
Monitoring Site ID	**DMS ID**	**Upper Aquifer Groundwater Levels**					
2PU-3	19-003	99.8	≥91.8	≥91.8	≥91.8	≥91.8	90.5
1PU-1	11-013	81.0	≥80.4	≥80.4	≥80.4	≥80.4	76.8
08S09E34G001M[2]	11-014	See Footnote 2	≥80.7	≥80.7	≥80.7	≥80.7	68.1
08S10E30E001M[2]	11-015	See Footnote 2	≥75.7	≥75.7	≥75.7	≥75.7	72.8
11S12E30H002M	11-017	116.8	≥116.6	≥116.6	≥116.6	≥116.6	90.2
11S11E04N001M[2]	11-016	See Footnote 2	≥92.8	≥92.8	≥92.8	≥92.8	83.1
1MU-1	11-007	80.9	≥91.1	≥91.1	≥91.1	≥91.1	79.9
1MU-2	11-008	76.1	≥93.2	≥93.2	≥93.2	≥93.2	82.3
1MU-3	11-009	77.6	≥77.3	≥77.3	≥77.3	≥77.3	63.4
3PU-2[3]	11-019	See Footnote 3	≥27.0	≥27.0	≥27.0	≥27.0	27.0
Monitoring Site ID	**DMS ID**	**Lower Aquifer Groundwater Levels**					
1ML-1	11-001	-23.0	To Be Determined Lower aquifer representative monitoring wells have been identified for the monitoring network; however, no historical data exists. The Grassland GSP Region participants will monitor the sites and intend to use the gathered data to establish meaningful interim goals, measurable objectives, and minimum thresholds in future GSP Updates				
1ML-2	11-002	-31.0					
1ML-3	11-003	-29.4					
1ML-4	11-004	-31.0					
1ML-5	11-005	6.9					
1ML-6	11-006	7.6					

[1] Once enough data is available, rolling averages will be compared from the start of GSP implementation in 2020.

[2] Unable to locate well sites in the field. These wells were removed from the representative monitoring network on April 1, 2021. Details regarding their removal are available in the Delta-Mendota Subbasin 2020 Water Year Annual Report. Due to sufficient historic data from these wells, the GSP Region plans to potentially install new observation wells nearby and use the historic data as a reference for the long-term trends.

[3] Seasonal low data not available for Water Year 2022.

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Groundwater Quality Representative Monitoring Network (GWQRM)

Upper and Lower Aquifer groundwater quality monitoring results are reported in **Table 6**. The sustainable management criteria were changed to reflect drinking water standards per Subbasin coordination, but it is worth noting that drinking water users are not present in the Grassland GSP Region. Following the 2022 sampling event, less than 50% of the wells are below the minimum threshold. 1PL-1 (11-010) and 3PU-1 (11-018) have historically had higher concentrations of dissolved solids; higher salt content is expected at these sites due to being close to drainages that run back to the San Joaquin River. Since 1PL-1 and 3PU-1 are above the minimum threshold as of the current report period, the GSP Region will continue to monitor and track the water quality in these sites. During the 2022 GSP revision process, changes to the GWQRMN were made to replace monitoring site 2PU-3 (19-003). 2PU-3 was removed from the GWQRMN due to well alterations but may be added back to the network if it is determined that the alterations did not completely change the well's physical properties. **Table 6** reflects the current network. It should be noted that samples from M3 and LT were taken during WY2022 and additional monitoring is required to determine long-term trends.

Table 6. Grassland GSP Region – Groundwater Quality Representative Monitoring Results

2022 Water Year Groundwater Quality Representative Monitoring Results							
		2022	2025	2030	2035	2040	Minimum Threshold
		Representative Monitoring Result	Interim Goal	Interim Goal	Interim Goal	Measurable Objective	
DMS ID	Local Well ID	TDS (mg/L)	TDS (mg/L)	TDS (mg/L)	TDS (mg/L)	TDS (mg/L)	*TDS (mg/L)*
19-002	**2PU-1**	580	<1,000				1,000
19-004[1]	**M3**	2,100					1,000
11-021[1]	**LT**	1,600					1,000
11-018	**3PU-1**	1,100					1,000
11-012	**1PL-3**	780					1,000
11-011	**1PL-2**	560					1,000
11-010	**1PL-1**	1,500					1,000

[1] 11-021 and 19-004 were added to the network, while 19-003 was removed during July 2022 GSP Revisions.

Subsidence Representative Monitoring Network

The United States Bureau of Reclamation (USBR) San Joaquin River Restoration Program's (SJRRP) subsidence monitoring data is used for subsidence monitoring in the GSP region. The Grassland GSP Region selected three USBR SJRRP subsidence monitoring sites within or directly bordered with the Grassland GSP Region to serve in the representative monitoring network.

December 2018 through December 2021 (WYs 2019 through 2022) land surface elevations at the three representative monitoring network sites are depicted in **Table 7**. However, unlike the groundwater level, groundwater quality, and change in storage sustainable management criteria, which are results-based, the subsidence sustainable management criteria are based on cumulative inelastic subsidence caused by groundwater extraction during the implementation period (2020-2040). As of the current reporting period, **Table 8** shows the Grassland GSP Region is on track to be below the 5-Year Interim Milestone of no more than 1 foot of additional subsidence. The extended period average subsidence rates in the Grassland GSP Region are also provided as reference to historic trends.

The Grassland GSP Region supports efforts to expand the USBR SJRRP's subsidence monitoring activities and enhance scientific understanding of subsidence trends in the Subbasin. It is worth noting that while December is theoretically outside the elastic subsidence window and most of the Subbasin is no longer pumping, pumping within Grassland GSP Region may occur during dry winters.

Table 7. Grassland GSP Region – Subsidence Representative Monitoring Results

Subsidence Sustainable Management Criteria Monitoring				
Monitoring Point	2019 Water Year	2020 Water Year	2021 Water Year	2022 Water Year
	Land Surface Elevation (NAVD 1988, Feet above MSL, rounded to the nearest 0.1 ft)			
	Dec-18	Dec-19	Dec-20	Dec-21
108	78.6	78.6	78.4	78.3
152	83.9	84.0	83.8	83.7
137	100.3	100.2	100.1	99.9
Source: San Joaquin River Restoration Program Subsidence Monitoring https://www.restoresjr.net/science/subsidence-monitoring/				

Table 8. Grassland GSP Region – Subsidence Sustainable Management Criteria Monitoring

Historic Period Average Rate of Land Surface Elevation Change Compared to Modern Period Average Rate of Land Surface Elevation Change											
Monitoring Point	**Water Year 2020**	**Water Year 2021**	**Water Year 2022**	**Cumulative Inelastic Subsidence During Implementation (Dec 2019 – Dec - 2021) (ft)**	**Subsidence Rate During Implementation (Dec 2019 - 2021) (ft/yr)**	**Historic Subsidence Rate (Dec 2011 -2019) (ft/yr)**	**2025**	**2030**	**2035**	**2040**	**Minimum Threshold**
	December 2019	**December 2020 GSE**	**December 2021 GSE**				**Interim Goals**			**Measurable Objective**	*December 2020 through December 2040 Period*
108	78.63	78.40	78.28	-0.35	-0.12	-0.06	No more that 1-ft additional subsidence	No more that 0.5-ft additional subsidence	No more that 0.25-ft additional subsidence	No additional subsidence	Inelastic subsidence of no more than 2 feet
152	84.03	83.80	83.67	-0.36	-0.12	-0.08					
137	100.20	100.08	99.87	-0.33	-0.11	-0.11					

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The subsidence rate during SGMA implementation of **Table 8** were generated using USBR subsidence monitoring data beginning with December 2019 results to capture the GSP implementation horizon (2020-2040). This historic rate of subsidence utilized USBR results beginning with December 2011, as that was the initial survey year. Each year, the influence of the annual change at each site influences the long-term trend, generating the rate for comparison to the sustainable management criteria. The annual results that were averaged to generate the extended period averages for the past three reporting periods are presented below in **Table 9**.

Table 9. Extended Period Average Subsidence

Extended Period Average Calculation				
First Year	**Second Year**	Monitoring Point		
		108	**152**	**137**
		Annual Subsidence (ft/year)		
Dec-11	Dec-12	-	-0.06	-0.10
Dec-12	Dec-13	-	-0.23	-0.28
Dec-13	Dec-14	0.01	0.21	0.04
Dec-14	Dec-15	-0.21	-0.48	-0.16
Dec-15	Dec-16	-0.09	-0.07	-0.13
Dec-16	Dec-17	0.00	0.00	-0.05
Dec-17	Dec-18	-0.10	-0.10	-0.12
Dec-18	Dec-19	0.01	0.02	-0.08
Dec-19	Dec-20	-0.15	-0.17	-0.10
Dec-20	Dec-21	-0.12	-0.13	-0.21
Extended Period Average	**Dec 2011 - Dec 2018**	**-0.08**	**-0.10**	**-0.11**
	Dec 2011 - Dec 2019	**-0.06**	**-0.08**	**-0.11**
	Dec 2011 - Dec 2020	**-0.08**	**-0.10**	**-0.11**
	Dec 2011 - Dec 2021	**-0.08**	**-0.10**	**-0.12**

Supplemental Monitoring Efforts

In addition to the representative monitoring network, member agency Grassland Water District (GWD) has installed 12 shallow monitoring wells to monitor the influence of water management on shallow groundwater and Upper Aquifer conditions. The shallow wells were installed in 2018; therefore, there was no historic record to advise the 2020 GSP development or 2022 Revised GSP. The Grassland GSP Region has continued to monitor and review the shallow monitoring data to refine its understanding of the groundwater trends in the Region and inform subsequent annual reports and the first GSP 5-year update.

Data from these shallow monitoring wells were used to support the Upper Aquifer change in storage analysis for WY2022.

In addition to the shallow monitoring efforts, GWD also engages in a robust surface and groundwater quality monitoring program to maintain the health of the managed wetlands that predominantly cover the GSP Region. This data is used to augment the understanding of the groundwater quality conditions in the Grassland GSP Region.

Changes to the Representative Monitoring Network

During the 2022 GSP Revision process, changes to Grassland GSP Region's representative monitoring network were made, including the addition of two GWQRMN wells. The changes also included the removal of one GWQRMN well along with three Upper Aquifer groundwater level monitoring wells. The removal of the three Upper Aquifer groundwater level wells was detailed in the WY2020 Delta-Mendota Subbasin Annual Report. In future updates, the GSP Region may entertain installing new monitor wells near these sites to use the historical data as a reference for long-term trends. These modifications to the representative monitoring network remain current and are depicted in **Figure 11** and **Figure 12**.

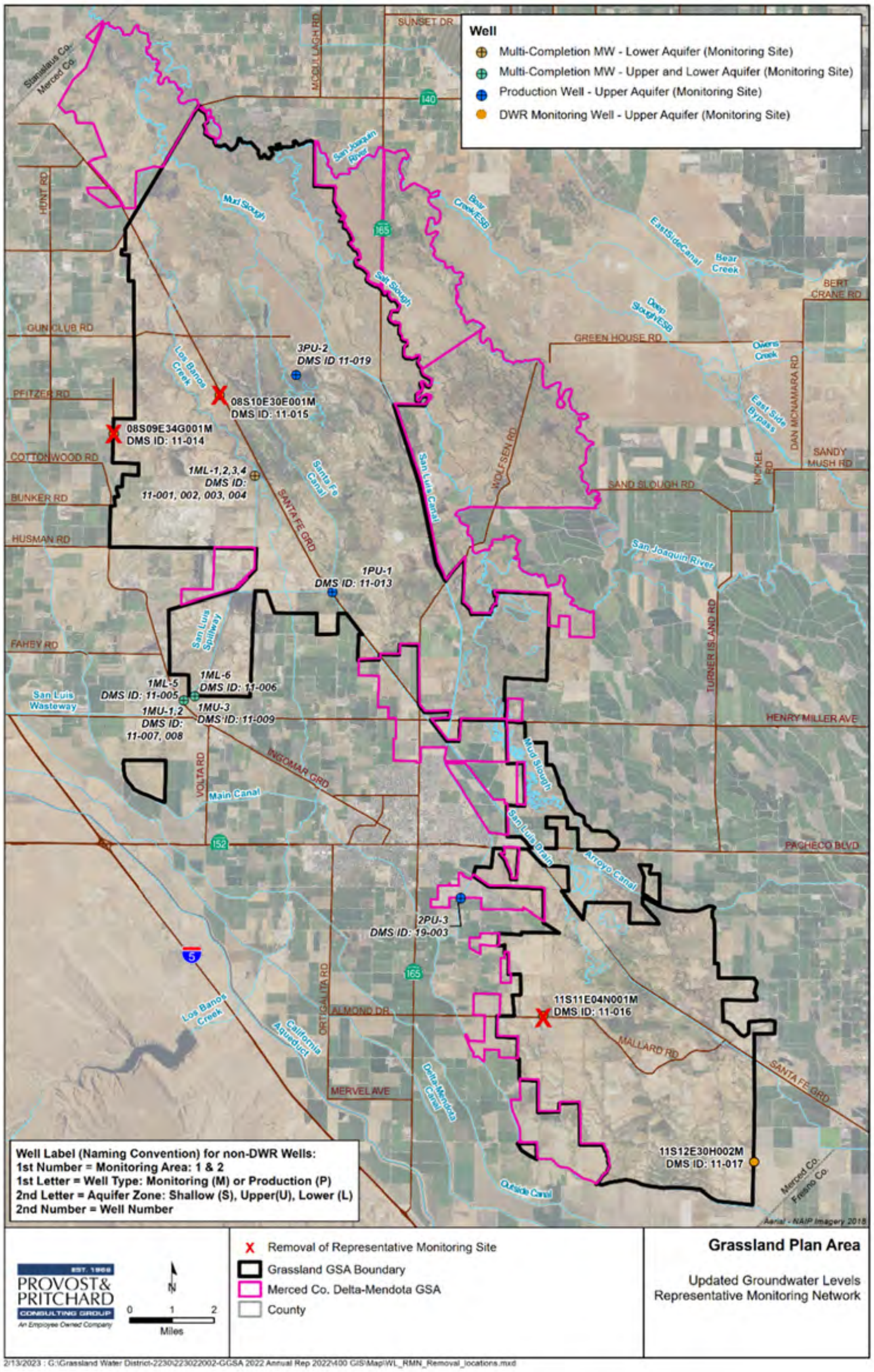

Figure 11. Changes to the Representative Groundwater Level Monitoring Network per the 2022 Revised GSP

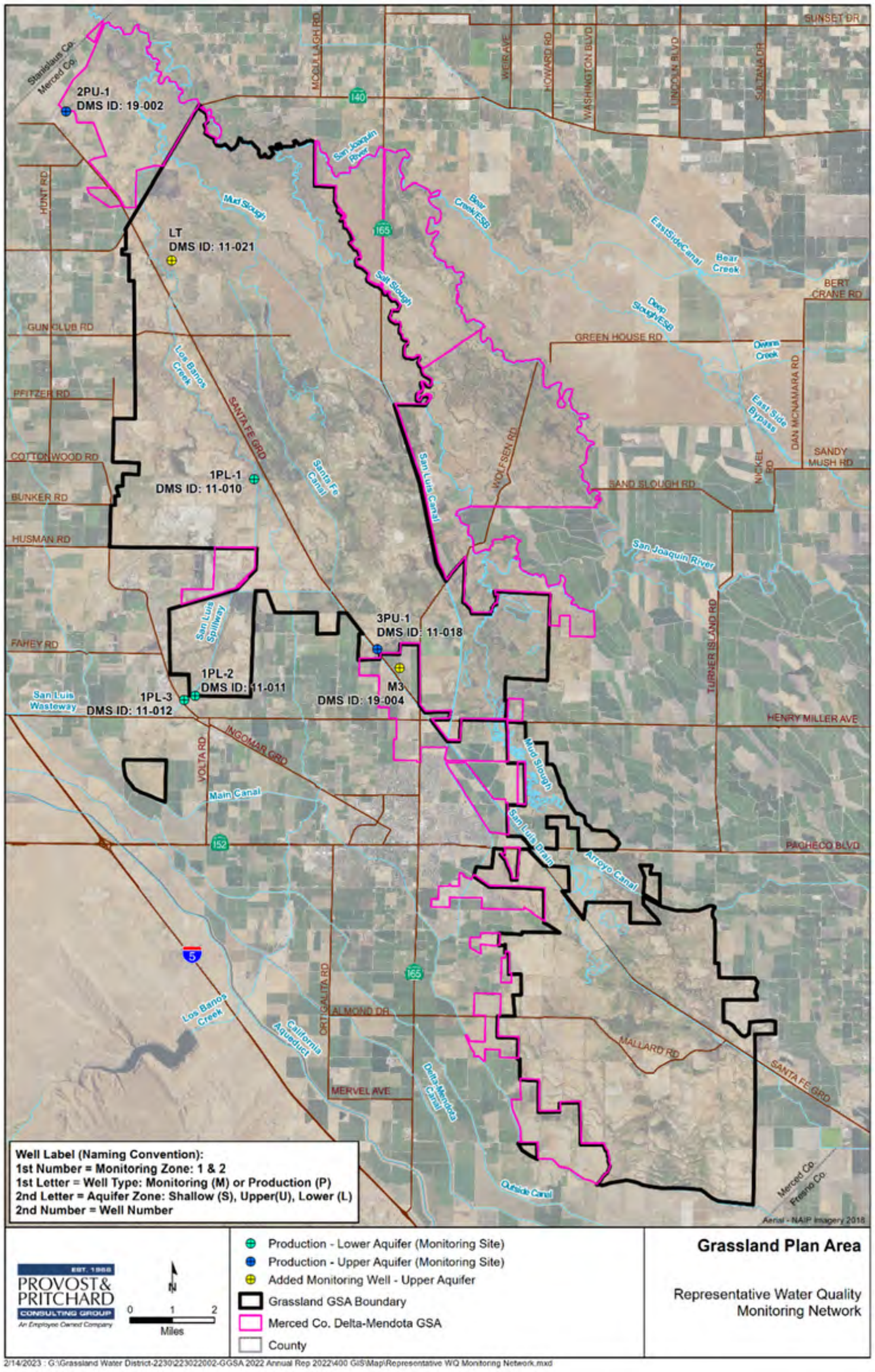

Figure 12. Changes to the Representative Groundwater Quality Monitoring Network per the 2022 Revised GSP

Subsidence Analysis for Lower Aquifer Change in Storage

In addition to the subsidence data review for sustainable management criteria purposes, the Grassland GSP Region performs a subsidence analysis to evaluate the annual Lower Aquifer change in storage within the Grassland GSP Region. The exercise uses USBR's SJRRP subsidence monitoring results, recognized as the best available data in the region despite the incomplete coverage in the central Grassland GSP Region and entire Delta-Mendota Subbasin. To refine the incomplete coverage, consultant hydrogeologist Kenneth D. Schmidt & Associates (KDSA) developed land surface elevation contours supported by KDSA's decades of professional experience studying groundwater conditions and subsidence in the region as well as the available USBR SJRRP monitoring results from December 2020 vs. December 2021, representing WY2021 vs. WY2022. Those contours are presented in **Figure 13**, with USBR's raster map depicting their interpretation of subsidence in the region underlay.

During the WY2022 analysis, the USBR monitoring stations indicated a -0.1 foot change in ground surface elevation, which is comparable to the historic rate of subsidence in the GSP Region. In previous reporting periods, there has been a quality control concern with the USBR SJRRP data, specifically in the northern GSP Region that resulted in the illusion of a steeper land surface elevation decline. The Grassland GSP Region aims to improve representative subsidence monitoring stations in the GSP Region and will continue to review USBR results for quality control concerns.

Grassland GSP Region encourages opportunities to improve the understanding of subsidence in the GSP Region and have supported a subbasin-wide subsidence evaluation underway for the Delta-Mendota Subbasin and detailed in the projects and management actions section of this Progress Towards Implementation section. It is not financially feasible for Grassland GSP Region or its member agencies to implement a private subsidence monitoring program, nor can the member agencies mitigate subsidence, based on their sustainable water management being mostly limited to the Upper Aquifer and surface water deliveries.

There are few Lower Aquifer groundwater extractions within the Grassland GSP Region and the neighboring San Joaquin Exchange Contract GSP Region; therefore, the subsidence results and resultant Lower Aquifer change in storage are correlated with Lower Aquifer pumping from the adjacent subbasin. This external influence can be seen in **Figure 13**, as the neighboring subbasin's subsidence hotspot extends its influence into the Delta-Mendota Subbasin.

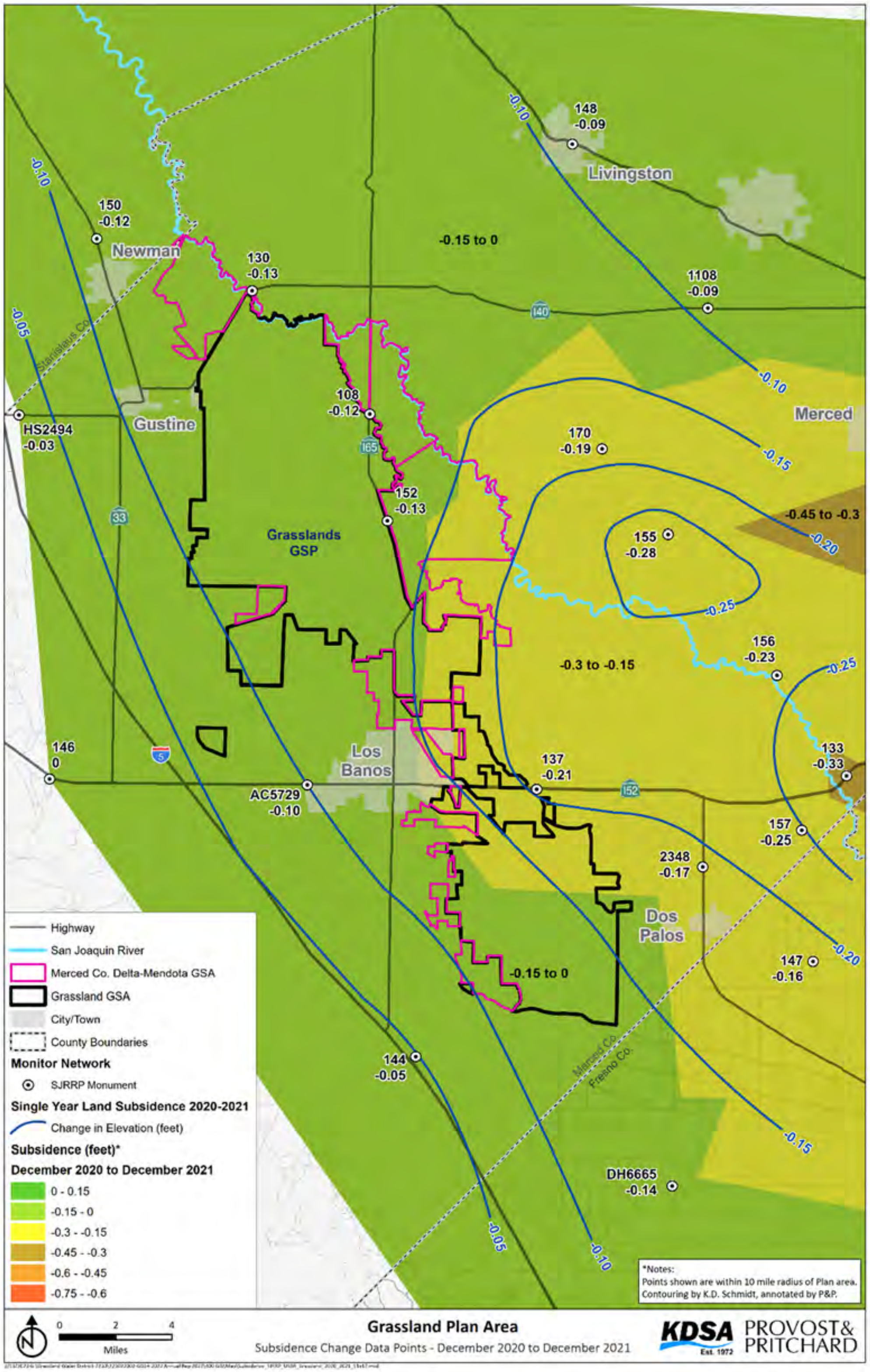

Figure 13. Annual Subsidence December 2020 to December 2021 (USBR SJRRP data, refined by KDSA)

Water Budget Refinement

Within WYs 2020 and 2021, Grassland GSP Region has coordinated with Audubon California and its consultant team, which are working to develop water budgets for target wetlands in the Central Valley, with the intention of filling in GSP data gaps where possible. Grassland GSP Region staff and their consultant team met video-telephonically four times and are continuing coordination with Audubon California and their team on refining the best methodology for water budgets through information and method sharing. In WY2023, the Grassland GSP Region plans to improve estimates of groundwater extraction for agricultural use by comparing various evapotranspiration data sources.

Projects and Management Actions

Although the Grassland GSP Region is recognized as being historically and projectably sustainable, the greater Delta-Mendota Subbasin is classified as a critically overdrafted basin. To support the Delta-Mendota Subbasin's sustainability goals and to improve the understanding of groundwater conditions within the GSP Region, the Grassland GSP Region has and continues to identify potential projects and management actions in alignment with those objectives. Descriptions of potential projects that have gained traction since the last Annual Report are included below.

Completed Project: Subsidence Characterization Study for the Delta-Mendota Subbasin

The Delta-Mendota Subbasin GSP Regions' respective member agencies have contracted a subsidence characterization study to resolve many of the subsidence data gaps, better understand causation of subsidence in the subbasin, and facilitate identification of mitigation measures that the member agencies can implement to address the issue of subsidence and its impact on integrity of critical infrastructure and flood damage in the Subbasin. The project kicked off in 2021 and was completed in June 2022.

Proposed Project: Flood Water Capture Project

The Grassland GSP Region participated as a sub-applicant in the Delta-Mendota Subbasin's SGM Program SGMA Implementation – Round 2 grant application with the "Flood Water Capture Project" (draft awards anticipated in June 2023).

The GSP Region wishes to improve water conveyance facilities and water control structures to allow for the temporary storage of flood water and other surface water supplies in order to facilitate optimal wetland habitat management in the spring and summer months. The Project is anticipated to be under construction in 2023, and operational by 2024.

The Project will provide significant water supply and habitat benefits. The temporary holding ponds could provide up to approximately 2,000 AF of surface water storage. This will allow for the irrigation of up to 1,000 acres of managed wetlands within the GWD and Grassland Resource Conservation District (GRCD), which will significantly increase the biological value of that habitat. Groundwater recharge associated with 500 acres of temporary holding ponds is estimated to be approximately 500 AF per year, which will improve groundwater conditions within the GSP Region Plan area. When filled, the temporary ponds will also provide habitat values for migratory birds and other wildlife on site.

Proposed Project: Los Banos Creek Regulation and Storage Project

A group of local agencies, including Grassland GSP Region's member agency GWD, San Luis Water District (SLWD), and the San Joaquin River Exchange Contractors Water Authority (SJRECWA) have initiated a project to regulate available water supplies by conveying water from SLWD Turnout 9-1 on its Lateral 9 into the Los Banos Creek Detention Reservoir (LBCDR or reservoir), located about five miles southwest of Los Banos in Merced County. A proof of concept for the project was developed in 2020 and completed in January 2021, in which the reservoir was used to regulate Participant fall water supplies for release during the winter to supplement storm water releases from LBCDR. Facilities are under design and the project footprint is being evaluated for environmental and cultural clearances, with construction anticipated in late 2023/early 2024.

LBCDR and its dam facilities are federally owned by USBR and State operated by DWR as part of the San Luis Unit of the Central Valley Project (CVP) and State Water Project to provide flood control protection to the San Luis Canal/California Aqueduct and City of Los Banos. The California Department of Parks and Recreation (DPR) operates the public recreational facilities at LBCDR.

The project consists of five components: altering LBCDR operations to allow for 8,000 AF of project participant groundwater storage and beneficial release; utilizing/modifying SLWD California Aqueduct Pump Station 8 and SLWD Lateral 9 Pump Station to pump 30-36 cubic feet per second (cfs) into the LBCDR; a 36-inch discharge pipeline from Lateral 9 to the reservoir; a 450 cfs box culvert crossing of the LBC at Canyon Road (just downstream of the LBCDR or outlet); and extending the existing LBCDR boat ramp. An instantaneous release flow of 250 cfs will be available during peak summer or fall months, for typically 16 days, and split between the project participants. The proposed project facilities are estimated to cost $3.0 million plus engineering, permitting, cultural and environmental costs of $600,000 for a total of $3.6 million. Funding is pending for the GSP Region, Central California Irrigation District (CCID), and SLWD for this project. The estimated yield is 8,500 AF of Spring releases of LBC stored water in wet years and 8,000 AF of Summer/Fall Participants' stored water.

The Project yield would provide numerous benefits including:

- Improved water supply management and reliability
- Development of additional Incremental Level 4 refuge water supply
- Increased flood control protection to downstream facilities
- Increased access to LBCDR recreational facilities during most flood release scenarios
- Increased recreational opportunities at LBCDR, along LBC and in the GSP Region
- Enhanced environmental conditions at LBCDR, along LBC and in the GSP Region
- Improved Rural/Disadvantaged Community (DAC) water supply and water quality
- Improved dry year water supplies
- Improved groundwater recharge

6.5 Northern & Central Delta-Mendota Region GSP Region Progress

On January 21, 2022, DWR released an "Incomplete" determination for the Northern & Central Delta-Mendota Region GSP along with the other five Subbasin GSPs and Common Chapter. The Northern and Central Delta-Mendota GSAs worked collaboratively with the other Subbasin GSAs to address deficiencies identified by DWR in the Common Chapter and revised the Northern & Central Delta-Mendota Region GSP accordingly. As a result, all sustainable management criteria definitions and methodologies have been updated and are documented in the Northern & Central Delta-Mendota Region revised GSP (June 2022).[14] Although the seasonal high groundwater level monitoring event during WY2022 (February through April 2022) for the chronic lowering of groundwater levels sustainability indicator took place prior to adoption of the revised Northern & Central Delta-Mendota Region GSP, all analyses and assessments of sustainable conditions are evaluated against the sustainable management criteria documented in the revised GSP and Common Chapter as the prevailing version of the adopted GSP.

During WY2022, groundwater level measurements were collected during the seasonal high (February through April 2022) and seasonal low (September through October 2022) monitoring events for all wells in the representative groundwater level monitoring network. As agreed upon and documented in the revised Common Chapter, undesirable results relative to the chronic lowering of groundwater levels sustainability indicator occur when 50% of representative monitoring sites by principal aquifer in a GSP area exceed the minimum threshold (6 out of 12 wells in the Upper Aquifer, 9 out of 18 wells in the Lower Aquifer)[15]. The

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[14] The adopted Groundwater Sustainability Plan for the Northern & Central Delta-Mendota Region (November 2019; revised June 2022) can be accessed at https://sgma.water.ca.gov/portal/gsp/preview/13.

[15] The groundwater levels representative network contains an additional 5 wells in the Upper Aquifer and 3 wells in the Lower Aquifer where insufficient data are currently available to establish sustainable management criteria (either five years of monitoring data following WY2016 or following construction of the well is needed). These

groundwater elevation indicating a chronic lowering of groundwater levels that may lead to undesirable results is an elevation that is lower than the historical seasonal low, where the seasonal low occurs between September and October. The historic seasonal low is a fixed elevation at each representative monitoring site based on available groundwater level data prior to the end of WY2016. To account for future year-to-year variations in hydrology, compliance with the minimum threshold will be compared with a 4-year rolling average of annual groundwater level measurements during the seasonal low period.

Table 10 includes the minimum thresholds and measurable objectives for representative groundwater level monitoring sites in the Northern and Central Delta-Mendota regions as well as the 4-year average seasonal low groundwater elevation between calendar year 2019 and 2022. Only two minimum threshold exceedances occurred based on the 4-year rolling average, where DMS ID No. 01-003 in the Lower Aquifer exceeded the minimum threshold by 2.50 feet and DMS ID No. 01-005 in the Upper Aquifer exceeded the minimum threshold by 18.74 feet. Therefore, undesirable results for the chronic lowering of groundwater levels did not occur in the Northern and Central Delta-Mendota regions in WY2022. One well in the Patterson Irrigation District GSA was reported going dry in November 2022, according to DWR's Dry Well Reporting System dataset published to the SGMA Data Viewer.[16] An interim solution was provided to supply water to the well owner.

As part of the Year 5 Interim Milestones, all Subbasin GSAs will coordinate to develop shorter-term (or "acute") groundwater level thresholds for the 2025 GSP and Common Chapter update to be set at levels that avoid short-term undesirable results, particularly for domestic water users, groundwater dependent ecosystems, interconnected surface water, and subsidence when present. In subsequent annual reports (following completion of the 5-year GSP update), both the historic seasonal low minimum threshold value and acute groundwater elevation thresholds will apply, whichever is more protective.

wells are excluded from the total representative well count in each aquifer as a more conservative approach to determining if undesirable results are occurring.

[16] Local Reported Dry Wells dataset published to the SGMA Data Viewer and available at https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#currentconditions.

While undesirable results for the chronic lowering of groundwater levels sustainability indicator did not occur in WY2022, there were single groundwater level measurement minimum threshold exceedances that were observed at the following wells (by DMS ID Nos.) during the seasonal high and seasonal low periods; these exceedance can be seen in the well-specific hydrographs:

WY2022 Seasonal High

February 2022	*March 2022*	*April 2022*
• 01-005	• 01-005	• 01-005
• 07-028	• 01-006	• 06-002
		• 07-005

WY2022 Seasonal Low

September 2022	*October 2022*
• 01-003	• 01-003
• 01-004	• 01-004
• 01-005	• 01-005
• 01-007	• 01-006
• 06-003	• 01-007
• 07-005	• 07-005
• 07-028	• 07-009
	• 07-014
	• 07-028

DMS ID Nos. 01-005, 01-006, 07-005, and 07-028 continued to decline through the end of WY2022; DMS ID 06-002 recovered to above the minimum threshold by September 2022; and data are not yet available to evaluate potential groundwater level recovery following minimum threshold exceedances that occurred in September and October 2022. Compounding impacts of dry conditions during WY2020 through WY2022 and the resulting increased reliance on groundwater during the spring and summer months were observed in groundwater level measurements taken during the WY2022 seasonal low event.

WY2022 groundwater level conditions reflect current drought conditions. Recent downward trends in groundwater elevations were observed at the following wells and should be monitored by the GSAs to avoid experiencing undesirable results in the near future: Well DMS ID Nos. 01-003, 01-004, 01-005, 01-006, 01-007, 02-009, 03-001, 06-002, 07-005, 07-009, 07-010, 07-014, 07-015, and 07-028. Hydrographs with numeric sustainable management criteria for all representative monitoring sites in the groundwater level monitoring network for the Northern and Central Delta-Mendota Regions are included in **Appendix A**.

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Table 10. WY 2022 Groundwater Levels Sustainable Management Criteria Analysis – Northern & Central Delta-Mendota Region

Data Management System (DMS) ID	CASGEM ID (if applicable)	Local ID	Principal Aquifer	Minimum Threshold (feet above msl NAVD88) [1]	Measurable Objective (feet above msl NAVD88) [1]	4-Year Average Seasonal Low Groundwater Elevation, 2019-2022 (feet above msl NAVD88)
01-001	375509N1212609W001	MP030.43R	Lower	-44.9	-13.4	-10.7
01-002	375313N1212242W001	MP033.71L	Lower	-36.1	-18.9	15.5
01-003	374061N1211212W001	MP045.78R	Lower	-21.79	62.3	-24.3
01-004	372907N1210875W002	MC10-2	Upper	158.9	161.8	159.0
01-005	372424N1210754W001	MP058.28L	Upper	110.6	179.6	91.9
01-006	372604N1210611W001	91	Lower	77.1	94	80.6
01-007		MP021.12L	Lower	12.3	56.7	15.1
01-008		MP051.66L	Lower	-44.9	2.4	-7.5
02-002		WELL 02 - NORTH 5TH STREET	Lower	-18.3	33.7	16.0
02-009		Keystone well	Upper	-6.2	29.8	30.9
03-001	375015N1211011W001	MW-2	Upper	30.7	46.7	34.9
03-002		MW-3	Upper	7.7	67.2	29.0
03-003 [2]		WSJ003	Upper	TBD	TBD	-
04-001	376129N1212942W001	121	Lower	-17.6	-3.6	11.0
06-001	374316N1210994W001	P259-1	Lower	-52.3	16.1	-11.3
06-002	374316N1210994W003	P259-3	Upper	31.5	44.6	34.1
06-003	375774N1212096W001	WSID 3	Lower	-9.1	18.5	20.8
06-004 [3]		MP031.31L1-L2Well1	Upper	14.8	30.5	38.0
07-002	370173N1208999W001	MC15-1	Lower	1.6	10.8	17.8
07-003	370173N1208999W002	MC15-2	Upper	62.5	89.9	88.4
07-005	369097N1207554W001	MP091.68R	Lower	-84.7	-41.8	-68.6

Data Management System (DMS) ID	CASGEM ID (if applicable)	Local ID	Principal Aquifer	Minimum Threshold (feet above msl NAVD88) [1]	Measurable Objective (feet above msl NAVD88) [1]	4-Year Average Seasonal Low Groundwater Elevation, 2019-2022 (feet above msl NAVD88)
07-007	368896N1206702W001	MC18-1	Lower	-53.4	-26.6	-15.6
07-008 [4]	367885N1206510W001	PWD 48	Lower	-63	-47	-34.0
07-009	366000N1202300W001	KRCDTID03	Upper	49.3	73.9	64.6
07-010	366500N1202500W001	KRCDTID02	Upper	64	96.2	92.5
07-012 [2,3]		GDA003	Upper	TBD	TBD	-
07-014		TW-4	Lower	-133.5	-47.2	-58.5
07-015		TW-5	Lower	-147	-65	-39.1
07-016		Well 01	Lower	-2.4	74.6	77.3
07-017 [2]		Well 1	Upper	TBD	TBD	-
07-018 [2]		WSJ001	Upper	TBD	TBD	-
07-028	369064N1207276W001	MP093.27L / Well 500	Lower	-88.2	-64.8	-80.9
07-029 [5]		CDMGSA-01A	Upper	TBD	TBD	-
07-030 [5]		CDMGSA-01B	Lower	TBD	TBD	-
07-031 [2]		CDMGSA-01C	Lower	TBD	TBD	-
07-032 [2]		CDMGSA-01D	Lower	TBD	TBD	-
07-035	368871N1206355W001	MP098.74L	Upper	-99.8	95.2	48.3
08-002		MP102.04L / Well M-1	Upper	50.7	83.7	86.8

[1] TBD = To be determined

[2] Numeric sustainable management criteria to be established based on methodologies described in the Common Chapter and Northern & Central Delta-Mendota Region GSP when sufficient monitoring has taken place (either five years of monitoring data following WY2016 or following construction of the well).

[3] DMS ID No. 06-004 was temporary inaccessible in September and October 2022 and unable to be monitored. DMS ID No. 07-012 was also unable to be monitored in September or October 2022, but no numeric sustainable management criteria have been established due to insufficient historical record.

[4] DMS ID No. 07-008 not monitored in WY2022. A replacement well is to be identified in WY2023 due to issues prohibiting on-going monitoring.

[5] DMS ID Nos. 07-029 and 07-030 to be removed from the monitoring network starting in WY2023. No measurements obtained during WY2022. Based on data collected, wells found to be perforated in non-water bearing strata.

Groundwater quality samples were collected between May and August during WY2022 at 27 of the 37 representative monitoring sites.[17] Inoperable pumps/lack of pumps is the primary reason for missing groundwater quality monitoring results for WY2022. Groundwater quality sampling results for WY2022 are presented in **Table 11** and chemographs are included in **Appendix B**.

The revised Northern & Central Delta-Mendota Region GSP only includes sampling of total dissolved solids (TDS), as salinity is identified as the primary constituent of concern in the Delta-Mendota Subbasin. This approach was agreed upon with the other five Subbasin GSPs in an effort to address deficiencies regarding coordination across the Subbasin GSPs as identified in DWR's January 2022 determination letter. As documented in the revised GSP, minimum thresholds are established at 1,000 milligrams per liter (mg/L) TDS (the upper limit of the Secondary Maximum Contaminant Level) and measurable objectives are established at less than 1,000 mg/L TDS to be achieved by 2040 in areas of the Subbasin where current groundwater quality as of revised GSP development (June 2022) does not exceed 1,000 mg/L TDS. The Year 5 Interim Milestones for TDS are to maintain salinity consistent with the measurable objectives. For representative monitoring sites that exceeded the minimum threshold at the time of revised GSP development in June 2022, existing regulatory water quality compliance and remediation programs will apply and no numeric sustainable management criteria were established, though monitoring of TDS concentrations will continue to ensure further degradation does not occur as a result of groundwater pumping or other groundwater management activities.

Of the total 22 out of 37 representative monitoring sites with established numeric sustainable management criteria (i.e., current conditions are below 1,000 mg/L TDS), 16 representative sites were sampled for TDS in WY2022 (7 sites in the Upper Aquifer and 9 sites in the Lower Aquifer), of which 13 sites (6 sites in the Upper Aquifer and 7 sites in the Lower Aquifer) were below the minimum threshold and measurable objective indicating sustainable conditions. Three representative sites exceeded the minimum threshold and measurable objective (DMS ID Nos. 02-009 in the Upper Aquifer and 02-002 and 07-016 in the Lower Aquifer). Additional TDS sampling in WY2023 will be conducted to verify increasing trends in TDS concentrations. It should be noted that sustainable management criteria established are for ambient groundwater quality, and additional treatment and/or blending is required to meeting water quality standards for potable use. Given that an undesirable result is defined as more than 50% of representative monitoring sites by principal aquifer in a GSP area exceeding the minimum

[17] DMS ID Nos. 02-002 and 02-009 were sampled after the monitoring window in September and October 2022, respectively, due to issues related to chain of custody issues with the certified lab; it should be noted that these samples were collected following a significant rainfall event on September 19, 2022. DMS ID No. 07-028 was sampled prior to the monitoring window in March 2022 due to miscommunication with the responsible monitoring entity.

threshold (as documented in the revised Common Chapter), no undesirable results were observed in WY2022.

Table 11. WY2022 Groundwater Quality Monitoring Results – Northern & Central Delta-Mendota Region

DMS ID	State Well Number	Master Site Code	Local ID	Status	Well Use	Aquifer	Sample Date	TDS Result (mg/L)	Minimum Threshold (TDS, mg/L) [1]	Measurable Objective (TDS, mg/L) [1]	If not sampled, why?	Comments
01-001	04S06E36C001M	375509N1212609W001	MP030.43R	Inactive	Irrigation	Lower	-	-	1,000	< 1,000	Well removed and static water level too low to get submersible pump for sampling	
01-002	05S07E05F001M	375313N1212242W001	MP033.71L	Inactive	Irrigation	Lower	-	-	1,000	< 1,000	Well destroyed	Evaluating need for replacement well in representative monitoring network during WY2022
01-003	06S08E20D002M	374061N1211212W001	MP045.78R	Inactive	Irrigation	Lower	8/24/22	1,200	N/A	N/A	Well pump not in service and no accessible port for sampling	Well owner is in the process of repairing pump
01-004	07S08E28R002M	372907N1210875W002	MC10-2	Active	Monitoring	Upper	7/26/22	440	1,000	< 1,000		
01-006		372604N1210611W001	91	Active	Irrigation	Lower	-	-	1,000	< 1,000		
01-007		376429N1213651W001	MP021.12L	Unknown	Unknown	Lower	8/24/22	900	1,000	< 1,000		
01-008		373330N1210857W001	MP051.66L	Unknown	Unknown	Lower	8/24/22	660	1,000	< 1,000		
01-018			Gemperle well	Unknown	Unknown	Upper (assumed)	-	-	1,000	< 1,000	Power to well removed and not reinstalled until after sampling window	
02-002		374712N1211328W002	WELL 02 – NORTH 5TH STREET	Active	Public Supply	Lower	9/20/22	1,050	1,000	< 1,000		Sampled outside of monitoring window due to chain of custody issues with certified lab
02-009			Keystone well	Active	Irrigation	Upper	10/4/22	1,230	1,000	< 1,000		Sampled outside of monitoring window due to chain of custody issues with certified lab
03-001		375015N1211011W001	MW-2	Active	Monitoring	Upper	8/23/22	1,500	N/A	N/A		
03-003	05S/08E-16R		WSJ003	Unknown	Irrigation	Upper	8/23/22	1,500	N/A	N/A		
03-007		374410N1210638W001	MW-1	Active	Monitoring	Upper	8/23/22	680	1,000	< 1,000		
04-001		376129N1212942W001	121	Active	Irrigation	Lower	-	-	1,000	< 1,000	Pump inoperable	
06-001	06S08E09E001M	374316N1210994W001	P259-1	Active	Monitoring	Lower	8/23/22	720	1,000	< 1,000		
06-002	06S08E09E003M	374316N1210994W003	P259-3	Active	Monitoring	Upper	7/27/22	690	1,000	< 1,000		Sampled as part of Irrigated Lands Regulatory Program
06-003		375774N1212096W001	WSID 3	Active	Monitoring	Lower	-	-	1,000	< 1,000	Inoperable	Plans to replace with ARRA 28 once construction details are confirmed
06-004		375830N1212024W001	MP031.31L1-L2Well1	Unknown	Unknown	Upper	-	-	N/A	N/A	Inoperable	Plans to remove from network once replacement is identified
07-002	10S10E32L001M	370173N1208999W001	MC15-1	Active	Monitoring	Lower	8/5/22	410	1,000	< 1,000		
07-003	10S10E32L002M	370173N1208999W002	MC15-2	Active	Monitoring	Upper	8/5/22	430	1,000	< 1,000		
07-007	12S12E16E003M	368896N1206702W001	MC18-1	Active	Monitoring	Lower	8/26/22	980	1,000	< 1,000		
07-008	13S12E22F001M	367885N1206510W001	PWD 48	Active	Irrigation	Lower	8/26/22	1,400	N/A	N/A		

DMS ID	State Well Number	Master Site Code	Local ID	Status	Well Use	Aquifer	Sample Date	TDS Result (mg/L)	Minimum Threshold (TDS, mg/L) [1]	Measurable Objective (TDS, mg/L) [1]	If not sampled, why?	Comments
07-012	12S/12E-16B	368910N1206609W002	GDA003	Unknown	Irrigation	Upper	8/26/22	3,000	N/A	N/A		
07-014		366758N1202678W001	TW-4	Active	Nested Monitoring	Lower	7/26/22	780	1,000	< 1,000		
07-015		366430N1202404W001	TW-5	Active	Monitoring	Lower	7/26/22	840	1,000	< 1,000		
07-016		371004N1210072W001	Well 01	Active	Public Supply	Lower	8/23/22	1,100	1,000	< 1,000		
07-017		370929N1209258W001	Well 1	Active	Public Supply	Upper	8/23/22	420	1,000	< 1,000		
07-018	15S/16E-20		WSJ001	Inactive	Domestic	Upper	7/27/22	2,400	N/A	N/A		
07-028		369064N1207276W001	MP093.27L	Active	Irrigation	Lower	3/23/22	1,300	N/A	N/A		Sampled outside of monitoring window due to miscommunication with monitoring entity
07-029			CDMGSA-01A	Active	Monitoring	Upper	-	-	N/A	N/A	Well to be removed from representative network in WY2023	Dry well, perforated in non-water bearing strata
07-030			CDMGSA-01B	Active	Monitoring	Lower	-	-	N/A	N/A	Well to be removed from representative network in WY2023	Dry well, perforated in non-water bearing strata
07-031			CDMGSA-01C	Active	Monitoring	Lower	8/11/22	1,500	N/A	N/A		
07-032			CDMGSA-01D	Active	Monitoring	Lower	8/11/22	1,900	N/A	N/A		
07-033			TW-4 Upper	Active	Monitoring	Upper	7/27/22	840	1,000	< 1,000		
07-034		369057N1207470W001	MP092.20R	Active	Irrigation	Lower (assumed)	6/1/22	1,400	N/A	N/A		
07-035		368871N1206355W001	MP098.74L	Active	Irrigation	Upper	-	-	N/A	N/A	Unknown	
08-002			MP102.04L	Active	Irrigation	Upper	7/13/22	3,190	N/A	N/A		

[1] N/A indicates no numeric sustainable management criteria established as existing conditions exceed TDS thresholds. Existing regulatory water quality compliance and remediation programs will apply (including but not limited to CV-SALTS Salt Control Program, the County Drought Plan requirements for State Small Water Systems and Domestic Wells [SB 552], the Safe and Affordable Funding for Equity and Resilience [SAFER] program, and the Bureau of Reclamations Refuge Water Supply Program).

Land subsidence results for WY2021 and for WY2022 to date, as presented in **Table 12**, indicate the Northern and Central Delta-Mendota Regions are on track to meeting the Year 5 interim milestones, based on limited available data. The U.S. Bureau of Reclamation (USBR) conducted its bi-annual subsidence benchmark survey along the Delta-Mendota Canal (DMC) during July 2021 following a one-year delay due to the COVID-19 pandemic; with the next survey tentatively planned for July 2023. Due to efforts focused on GSP revisions throughout the majority of WY2022 and on-going discussion regarding frequency and timing of subsidence monitoring, limited additional subsidence data were collected in WY2022. Review of the TRE Altamira InSAR Dataset from October 2021 to October 2022, available through the SGMA Data Viewer[18], indicates vertical displacement was between -0.1 and 0.1 feet throughout the majority of the Northern and Central Delta-Mendota regions, where maximum vertical displacement between -0.6 and -0.4 feet was observed in Fresno Slough Water District; between -0.4 and -0.2 feet was observed in the Tranquillity Irrigation District area and along the eastern boundary of Panoche Water District; and between -0.2 and -0.1 feet was observed in small portions of San Luis Water District and Pacheco Water District as well as the northern portion of Panoche Water District.

Each responsible monitoring entity will ensure monitoring is conducted during the same period (e.g., Spring or Fall) every other year, with preference for attempting to align monitoring with USBR's DMC subsidence benchmark survey (now anticipated to take place in odd years). Data will continue to be collected and evaluated from publicly available sources (such as UNAVCO and DWR's SGMA Data Viewer) on an annual basis and used to supplement survey data.

[18] TRE Altamira InSAR dataset showing vertical displacement raster data from October 2021 to October 2022 is available at https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub.

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Table 12. WY2021 and WY2022 Land Subsidence Monitoring Results – Northern & Central Delta-Mendota Region

DMS ID	Responsible Monitoring Entity/Program	WY2021 Elevation Survey		WY2022 Elevation Survey		Difference in Elevation (feet, GSE)	Minimum Threshold (total feet, inelastic land subsidence)	Measurable Objective (total feet, inelastic subsidence)	Year 5 Interim Milestone (total feet, inelastic subsidence) [2]
		Date	Elevation (feet, GSE)	Date	Elevation (feet, GSE)				
01-009	UNAVCO	9/30/2021	131.70	9/30/2022	131.69	-0.01	2	0	1
01-010 [1]	USBR DMC subsidence survey	July 2021	192.04	-	-	-	2	0	1
01-011 [1]	USBR DMC subsidence survey	July 2021	192.35	-	-	-	2	0	1
01-012 [1]	USBR DMC subsidence survey	July 2021	191.11	-	-	-	2	0	1
01-013 [1]	USBR DMC subsidence survey	July 2021	190.07	-	-	-	2	0	1
01-014 [1]	USBR DMC subsidence survey	July 2021	189.72	-	-	-	2	0	1
01-015 [2]	UNAVCO	6/29/2021	12.790	-	-	-	2	0	1
01-016 [1]	USBR DMC subsidence survey	July 2021	184.88	-	-	-	2	0	1
01-017 [1]	USBR DMC subsidence survey	July 2021	178.64	-	-	-	2	0	1
02-003	City of Patterson	3/15/2021	122.93	-	-	-	2	0	1
02-004 [1]	USBR DMC subsidence survey	July 2021	188.29	-	-	-	2	0	1
02-005	City of Patterson	3/15/2021	106.24	-	-	-	2	0	1
02-006	City of Patterson	3/15/2021	102.7	-	-	-	2	0	1
02-007	City of Patterson	3/15/2021	115.7	-	-	-	2	0	1
02-008	City of Patterson	3/15/2021	80.8	-	-	-	2	0	1
03-004	Patterson Irrigation District	12/31/2020	101.82	-	-	-	2	0	1
03-005	Patterson Irrigation District	12/31/2020	67.16	-	-	-	2	0	1
03-006	Patterson Irrigation District	12/31/2020	55.20	-	-	-	2	0	1
04-003	West Stanislaus Irrigation District	12/31/2020	102.75	12/31/2021	102.59	-0.16	2	0	1
04-004	West Stanislaus Irrigation District	12/31/2020	171.38	12/31/2021	171.07	-0.31	2	0	1
04-005	West Stanislaus Irrigation District	12/31/2020	42.20	12/31/2021	42.06	-0.14	2	0	1
06-006 [1]	USBR DMC subsidence survey	July 2021	187.44	-	-	-	2	0	1
07-019	Tranquillity Irrigation District	12/10/2020	157.49	7/21/2022	157.04	-0.45	2	0	1
07-020 [3]	DWR / San Luis Water District	-	-	-	-	-	2	0	1
07-021 [1]	USBR DMC subsidence survey	July 2021	179.70	-	-	-	2	0	1
07-022 [1]	USBR DMC subsidence survey	July 2021	176.46	-	-	-	2	0	1
07-023 [1]	USBR DMC subsidence survey	July 2021	174.18	-	-	-	2	0	1
07-024 [1]	USBR DMC subsidence survey	July 2021	165.61	-	-	-	2	0	1
07-025 [1]	USBR DMC subsidence survey	July 2021	162.81	-	-	-	2	0	1
07-026	Tranquillity Irrigation District	12/10/2020	160.36	7/21/2022	159.96	-0.4	2	0	1
07-027	Tranquillity Irrigation District	12/10/2020	169.10	7/21/2022	168.93	-0.17	2	0	1

[1] Monitored as part of USBR's DMC subsidence survey, which is conducted every two years and tentatively scheduled for 2023.
[2] DMS ID 01-015 (P259) is monitored by UNAVCO and has been inoperable since July 2021, with latest data transmitted in June 2021 (https://www.unavco.org/instrumentation/networks/status/nota/overview/P259).
[3] San Luis Water District, as the responsible monitoring entity, is in discussions with DWR to coordinate monitoring in alternate years. No land survey is scheduled to date.

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Depletions of interconnected surface water sustainability indicators has been identified as a data gap within the Delta-Mendota Subbasin. As documented in the Delta-Mendota Subbasins GSP Common Chapter (revised June 2022), until the GSAs are able to collect additional data necessary to set quantitative sustainable management criteria, the sustainable management criteria in the Upper Aquifer for the chronic lowering of groundwater levels sustainability indicator will serve as proxy as sustainable management criteria are designed to maintain groundwater levels above historic low conditions and are understood to be protective of interconnected surface water and local natural resources and downstream beneficial uses and users. By the 2025 GSP update, the Subbasin GSAs anticipate developing a representative monitoring network for interconnected surface water that includes existing sites monitored as part of the San Joaquin River Restoration Program in addition to sites to be installed using funding received as part of the SGM Program SGMA Implementation – Round 1 grant funding awarded by DWR in April 2022. In the event additional funding is received under the SGM Program SGMA Implementation – Round 2 grant application submitted in December 2022, additional evaluation/characterization will take place to determine if additional interconnected surface water monitoring sites are needed and if sufficient monitoring is established on both sides of the San Joaquin River.

Table 13 and **Table 14** provide updates on projects and management actions, respectively, that occurred in the Northern and Central Delta-Mendota Regions during WY2022. For more detailed descriptions of all projects and management actions, refer to Chapter 7 *Sustainability Implementation* of the Northern & Central Delta-Mendota Region GSP.[19]

Table 13. Northern & Central Delta-Mendota Region WY2022 Projects Updates, Tier 1 and Tier 2

Project	Tier	Project Proponent	Status
Los Banos Creek Recharge and Recovery Project	1	San Luis Water District	Preliminary design completed in 2018; Pending funding for California Environmental Quality Act (CEQA)/permitting, design, and construction; Funding received as part of DWR's SGM Program SGMA Implementation – Round 1 Grant awarded in April 2022
Orestimba Creek Recharge and Recovery Project	1	Del Puerto Water District	Preliminary design complete; CEQA/permitting anticipated to be complete in early 2023; Design anticipated to be complete in early 2023; Construction anticipated to begin in February 2023
North Valley Regional Recycled Water Program	1	Del Puerto Water District	Completed in March 2020

[19] The adopted Groundwater Sustainability Plan for the Northern & Central Delta-Mendota Region (November 2019; revised June 2022) can be accessed at https://sgma.water.ca.gov/portal/gsp/preview/13.

Project	Tier	Project Proponent	Status
(NVRRWP) – Modesto and Early Turlock Years			
City of Patterson Percolation Ponds for Stormwater Capture and Recharge	1	City of Patterson	Included in Water Master Plan; Project still in conceptual and Environmental Impact Report (EIR) phase (linked to planned development); however, project design activities commenced in WY2022
Kaljian Drainwater Reuse Project	1	San Luis Water District	Preliminary design and CEQA/permitting in progress, developing a Master Plan for drainwater (Fall 2021); Design planned between 2020 and 2025 (100% design planned in phases); Construction planned in phases beginning in 2025 (construction planned in phases)
West Stanislaus Irrigation District Lateral 4-North Recapture and Recirculation Reservoir	1	West Stanislaus Irrigation District	Feasibility study began in April 2021 and completed in September 2021; Design is anticipated to take eight months with CEQA completed in parallel; Funding received as part of the SGM Program SGMA Implementation – Round 1 Grant awarded in April 2022
Revision to Tranquillity Irrigation District Lower Aquifer Pumping	1	Tranquillity Irrigation District	Well Water Operations Plan established in 2017 and implemented on an annual basis
Del Puerto Canyon Reservoir Project	2	Del Puerto Water District	CEQA completed in October 2021; NEPA draft released in November 2021; Preliminary design completed in 2022; Permitting and final design are anticipated to be complete in 2024; Construction is estimated to be complete in 2028
Little Salado Creek Groundwater Recharge and Flood Control Basin	2	Stanislaus County	Project will be constructed as part of the mitigation activities related to the construction and operation of the Crows Landing Industrial Business Park (CLIBP). CLIBP has been certified by the County Board of Supervisors and Phase 1 (first 115 acres) is moving forward. The Little Salado Flood Control Project is scheduled for development in subsequent phases of the overall CLIBP project.
Patterson Irrigation District Groundwater Bank and/or Flood-Managed Aquifer Recharge (MAR)-type Project	2	Patterson Irrigation District	Consultant retained in 2021 for Feasibility Study; Purchased potential property for small project
West Stanislaus Irrigation District Lateral 4-South Recapture and Recirculation Reservoir	2	West Stanislaus Irrigation District	Preliminary design completed in September 2021
Ortigalita Creek Groundwater Recharge and Recovery Project	2	San Luis Water District	Funding requested under DWR's SGM Program SGMA Implementation – Round 2 Grant submitted in December 2022

Table 14. Northern & Central Delta-Mendota Region WY2022 Management Actions Updates, Tier 1

Management Action	Status
Lower Aquifer Pumping Rules for Minimizing Subsidence	Several GSAs have adopted ordinances requiring the registration of wells and/or reporting of pumping. The Central Delta-Mendota GSA has developed a draft Administrative Policy for metering/reporting.
Maximizing Use of Other Water Supplies	No formal policies implemented.
Increasing GSA Access to and Input on Well Permits	Governor Newsom's Executive Order N-7-22 provides additional clarity and authority in the role GSAs play in well permitting. Merced and Stanislaus Counties have updated their well permitting process and requirements.
Drought Contingency Planning in Urban Area	Included in the City of Patterson's adopted 2020 Urban Water Management Plan.
Fill Data Gaps	Funding was awarded in April 2022 to fill data gaps in interconnected surface water and subsidence monitoring under the SGM Round 1 Implementation grant. Additional funding for interconnected surface water monitoring was requested under the SGM Round 2 Implementation grant application submitted in December 2022.

The Northern and Central Delta-Mendota GSAs worked collaboratively to submit the revised Northern & Central Delta-Mendota Region GSP to DWR in July 2022 to address all deficiencies identified in DWR's "Incomplete" determination letter, released in January 2022. As one of six GSP regions in the Delta-Mendota Subbasins, the Northern & Central Delta-Mendota regions worked with the other five GSP regions to address deficiencies identified in DWR's determination letter for the Common Chapter, which was submitted as a revised appendix to the GSP in July 2022, and to carry those revisions forward into the Northern & Central Delta-Mendota Region GSP.

In terms of outreach, the Northern and Central Delta-Mendota GSAs continued to hold publicly noticed regular board and council meetings (with topics including GSP implementation updates) as well as Northern and Central Delta-Mendota Activity Management Committees meetings during WY2022 according to the Brown Act. Individual GSAs included SGMA/GSP information with water bills to customers, on their respective websites, and/or as part of noticing of local board and council meetings.

6.6 San Joaquin River Exchange Contractors GSP Region Progress

Groundwater has been sustainably managed within the San Joaquin River Exchange Contractors (SJREC) GSP area historically prior to SGMA requirements and has continued to be sustainably managed during implementation. Groundwater management for the fourth annual report, WY2022, is consistent with the SJREC GSP submitted to DWR in January 2020 and the updated

SJREC GSP submitted in July 2022. Projects and Management Actions will continually be reviewed and implemented to maintain regional sustainability.

In 2009, Central California Irrigation District (CCID) completed a study on the impacts of declining water levels in the Los Banos Creek area to domestic and agricultural wells in the region. In 2010, a multi-agency agreement, which is still active, was made to reduce groundwater extractions if water levels in a representative well was below an established trigger level. Although this management action was implemented well before SGMA, it mimics the expectations the state has on local water managers. In March 2022, the SJREC reviewed water levels from representative wells in each management area described in the GSP. The water level in the Los Banos Creek subarea of Monitoring Zone C was below the trigger water level. Management actions were imposed to reduced groundwater extractions from the area to be protective of the local resource and the domestic wells in the region. Additionally, water levels in Monitoring Zone A were reviewed in March 2022, where the groundwater level was below the established trigger and groundwater extractions were restricted to protect the local area.

SJREC have partnered with Del Puerto Water District to expand the Orestimba Creek Recharge and Recovery project to reduce impacts to lands in their respective districts which are subject to multiple hazards, including flooding and drought. DWR has awarded CCID $809,264 through the Integrated Regional Water Management (IRWM) Grant Program for the project. Further, the project was awarded about $5,600,000 in funds from the Stormwater Grant (SWG) Program administer by the State Water Resources Control Board. The project started construction in February 2023 and is expected to be operational by February 2024. This project will improve groundwater storage, improve water quality, and reduce inelastic land subsidence in the region.

The SJREC have partnered with Grassland Water District (GWD) and San Luis Water District (SLWD) on the Los Banos Creek Storage Project. In Fall 2020, the project partners successfully completed a pilot project to pump conserved water into the Los Banos Creek Detention Reservoir. The pilot project included the installation of a temporary pipeline from an existing pump station down into the reservoir. Currently, a joint CEQA/NEPA document is under development. Construction of the project is scheduled for 2024. Refer to the SJREC GSP Section 4.1.3 for more details on the project. The Project Partners have received $600,000 from the SGM Program SGMA Implementation – Round 1 grant funding from DWR, awarded in April 2022.

SJREC was awarded $1,000,000 in SGM Program SGMA Implementation – Round 1 grant funding from DWR in April 2022 to construct a recharge project along Los Banos Creek. The project will reduce flooding downstream, while also improving groundwater storage, restoring riparian habitat, and improving the water quality for a Disadvantaged Community downstream. Environmental review is scheduled for summer 2023 and construction in 2024.

The SJREC GSP Group is preparing for the next GSP update and submittal with a focus on protecting the resource for the area's most vulnerable communities.

6.7 Subbasin-Wide GSP Progress

On January 21, 2022, DWR released an "Incomplete" determination for all six Delta-Mendota Subbasins GSPs and Common Chapter. The Delta-Mendota Subbasin Technical Working Group and Delta-Mendota Coordination Committee met on numerous occasions between January and June 2022 to identify common methodology and approaches to address DWR's identified deficiencies in each GSP and the Common Chapter. Delta-Mendota Subbasin and DWR representatives held four meetings between February and April 2022 to discuss deficiencies identified in DWR's determination letter and proposed approach to sufficiently address each deficiency. All six revised GSPs and Common Chapter addressing deficiencies identified by DWR were resubmitted to DWR by the July 20, 2022 deadline.

Additionally, the Delta-Mendota Subbasin GSP groups continued to contribute towards the Well Census and Inventory Project and Subsidence Characterization and Project Feasibility Determination Project, both of which are funded under the Proposition 68 Sustainable Groundwater Management Planning Grant – Round 3 and completed in March 2022 and June 2022, respectively.

The Well Census and Inventory Project includes a Subbasin-wide well census and development of a well inventory to identify wells and their associated construction not previously identified as part of GSP development. The Well Census and Inventory Report was completed in February 2022, and the GSAs were provided datasets specific to their areas in March 2022. The goal of the project was to develop a dataset that located and classified groundwater wells for the purpose of creating a start of an inventory within GSA boundaries and create a living dataset that will be maintained and updated over time. The results of the report will be used to reevaluate and update the representative monitoring networks in the six Subbasin GSPs as well as determine or confirm well construction to establish groundwater use patterns by principal aquifer in the Subbasin in addition to other groundwater management-related purposes.

The Subsidence Characterization and Project Feasibility Determination Project (or Subsidence Study) identified areas of concern for inelastic land subsidence in the Subbasin using existing data sources (both publicly-available and collected as part of GSP implementation) to inform the subsidence causation evaluation and tool development. Input from Subbasin GSAs was used to recommend wells for installation of flow totalizing meters, transducers, and/or other instrumentation and/or benchmarks and/or extensometers to establish a correlation between groundwater use, groundwater levels, and subsidence. A Conceptual Master Plan was developed to address additional data collection needs, tool development, potential projects and management actions, and the timing and cost estimates for implementation. The Subsidence Study was completed in June 2022.

In February 2022, the Delta-Mendota Subbasin submitted an application totaling more than $10 million in projects that support GSP implementation under DWR's SGM Program SGMA Implementation – Round 1 for critically overdrafted basins. In March 2022, the Subbasin was notified that the full anticipated award about of $7.6 million would be awarded to the Subbasin. Activities to be funded under this grant include the several groundwater recharge projects, interconnected surface water and subsidence monitoring, GSP revisions, and outreach and engagement. All grant-funded activities will be complete by March 31, 2025. In December 2022, the Delta-Mendota Subbasin submitted an application totaling $20 million in grant funding under DWR's SGM Program SGMA Implementation – Round 2, which includes proposed activities to fill interconnected surface water monitoring and groundwater dependent ecosystem data gaps, canal lining projects, groundwater recharge projects, and water use efficiency and reclamation projects. Draft awards are anticipated in June 2023.

As previously noted, representatives of the six Delta-Mendota GSP groups met bi-weekly as part of the Delta-Mendota Subbasin Technical Group and Coordination Committee between January and June 2022 to address revisions to the GSPs and Common Chapter and monthly thereafter. Meetings of the Technical Working Group and Coordination Committee were noticed according to the Brown Act.