WATER YEAR 2021 ANNUAL REPORT

White Wolf Subbasin

FINAL | March 2022
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Water Year 2021 Annual Report

White Wolf Subbasin

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White Wolf Groundwater Sustainability Agency

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Water Year 2021 Annual Report

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ABBREVIATIONS AND ACRONYMS

AEWSD	Arvin-Edison Water Storage District
AF	acre-feet
AFY	acre-feet per year
CCR	California Code of Regulation
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
COVID	Coronavirus Disease
CVP	Central Valley Project
DTW	Depth to Water
DWR	Department of Water Resources
EAR	Electronic Annual Report
ET	evapotranspiration
ft	feet
ft bgs	feet below ground surface
ft msl	feet above mean sea level
GDE	Groundwater Dependent Ecosystem
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWE	Groundwater Elevation
IM	Interim Milestone
ISW	Interconnected Surface Water
ITRC	Irrigation Training and Research Center

JPA	Joint Powers Agreement
KCWA	Kern County Water Agency
M&I	municipal and industrial
METRIC	Mapping of Evapotranspiration with Internal Calibration
MO	Measurable Objective
MT	Minimum Threshold
NA	Not Applicable
P/MAs	Projects and Management Actions
POD	Point of Diversion
PRISM	Parameter-elevation Regressions on Independent Slopes Model
RMW	Representative Monitoring Well
SGMA	Sustainable Groundwater Management Act
SMB	Soil Moisture Budget Accounting Model
SMC	Sustainable Management Criteria
SWP	State Water Project
TCWD	Tejon-Castac Water District
TRC	Tejon Ranch Company
TRCC	Tejon Ranch Commerce Center
USBR	United States Bureau of Reclamation
WRMWSD	Wheeler Ridge-Maricopa Water Storage District
WWB	White Wolf Basin
WWF	White Wolf Fault
WWGFM	White Wolf Groundwater Flow Model
WY	Water Year

EXECUTIVE SUMMARY

The San Joaquin Valley Groundwater Basin - White Wolf Subbasin (referred to herein as "the Basin"), California Department of Water Resources (DWR) Basin No. 5-022.18, is classified as a "medium priority" basin (DWR, 2019). To address the long-term reliability of groundwater within the Basin, the White Wolf Groundwater Sustainability Agency (GSA) developed a Groundwater Sustainability Plan (GSP), which was adopted by the White Wolf GSA Board on 25 January 2022 and submitted to DWR on 28 January 2022.

This Water Year (WY) 2021 Annual Report for the Basin has been prepared in compliance with California Code of Regulations (CCR) 23 § 356.2. WY 2021 includes the period from 1 October 2020 through 30 September 2021.

The White Wolf GSA is the exclusive GSA for the Basin, and was formed in 2017 upon adoption of a Joint Powers Agreement (JPA). The White Wolf GSA is governed by a seven-member Board of Directors which includes two (2) representatives of each member district: Arvin-Edison Water Storage District (AEWSD), Tejon-Castac Water District (TCWD), and Wheeler Ridge-Maricopa Water Storage District (WRMWSD). Kern County is represented as the seventh, non-voting member of the Board.

The Basin encompasses 107,532 acres in the southernmost region of the San Joaquin Valley Groundwater Basin within Kern County, California, as shown on **Figure 1**. The Basin contains one principal aquifer, inclusive of the Shallow Alluvium, Kern River Formation, and Chanac Formation.

Groundwater elevation contours are shown on **Figure 2** for Fall 2020 (seasonal low) and on **Figure 3** for Spring 2021 (seasonal high). Flow direction and magnitude indicated by the groundwater elevation contours did not vary greatly between the seasonal low to seasonal high periods in WY 2021. Both contour maps show that groundwater generally flows from the southeast to the northwest.

The Basin currently has 14 Representative Monitoring Wells (RMWs) for Chronic Lowering of Groundwater Levels (RMW-WL) and three (3) RMWs for Depletions of Interconnected Surface Water (RMW-ISW); Hydrographs showing groundwater elevations for the RMWs-WL or depth to groundwater for the RMWs-ISW and Sustainable Management Criteria (SMC) are shown on **Figure 4** and **Figure 5**, respectively. Groundwater levels in all RMWs continue to remain above their Minimum Thresholds (MTs). Among the RMW-WLs that had at least one groundwater level measurement collected during WY 2021, seven RMW-WLs have groundwater levels above their Measurable Objectives (MOs) for at least one seasonal (Spring or Fall) measurement. Two out of three RMW-ISWs have groundwater levels above their MOs.

Groundwater and imported surface water uses in the Basin during WY 2021 is summarized in **Table 1** and **Table 2,** respectively. Total groundwater extractions were determined through a combination of metered data where available and calculated using the Soil Moisture Budget (SMB) Accounting model developed for the Basin as described in **Section 3 Groundwater Extraction Data**. Total pumpage was approximately 68,300 acre-feet (AF), of which 99.5% (67,923 AF) was for the agricultural sector. General locations of groundwater extractions are shown on **Table 1** and **Figure 6**. Groundwater and imported surface water were the major sources of water in the Basin during WY 2021; the WY 2021 water supply consisted of 63% groundwater, 35% imported water, 1% stream diversions, and less than 1% recycled water.

Changes in groundwater storage were estimated using the White Wolf Groundwater Flow Model (WWGFM), a three-dimensional numerical groundwater flow model, which was prepared to analyze

water budget information for the Basin as part of the GSP. Modeled groundwater levels correlate well with measured water levels in Basin wells (**Figure 7**), thus the Basin model is sufficiently accurate for reporting purposes. A map of water level difference and groundwater storage change in the Basin between WY 2020 and WY 2021, as calculated by the WWGFM, is shown on **Figure 8**. Generally, most of the Basin experienced a decrease in groundwater storage over the WY due to critically dry hydrologic conditions and the lack of surface water from the State Water Project (SWP) and Central Valley Project (CVP). **Figure 9** shows water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater storage for the Basin from WY 1995 to WY 2021. WY 2021 was a critically dry year, and the change in groundwater storage for the Basin (-38,600 AF) is similar to other recent critically dry years.

Table 4 summarizes the water levels in RMW-WLs, and their various SMCs. **Table 5** summarizes the depths to water in RMW-ISWs, and their various SMC. As described above, groundwater levels in all of the RMWs remain above MTs.

The GSP outlined 24 potential Projects and Management Actions (P/MAs) for the Basin. Implementation of select P/MAs have been initiated during this reporting period. A brief description of each P/MA and their implementation status is listed in **Section 7.3 Implementation of Projects and Management Actions (P/MAs)**.

1 GENERAL INFORMATION

☑ *§ 356.2 (a)*

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.

On 16 September 2014, the California legislature enacted the Sustainable Groundwater Management Act (SGMA) - the primary purpose of which is to achieve and/or maintain sustainability within the state's high and medium priority groundwater basins. The San Joaquin Valley Groundwater Basin - White Wolf Subbasin (also referred to herein as "the Basin"), California Department of Water Resources (DWR) Basin No. 5-022.18, is classified as a "medium priority" basin (DWR, 2019). To address the long-term reliability of groundwater within the Basin, the White Wolf Groundwater Sustainability Agency (GSA) developed a Groundwater Sustainability Plan (GSP), which was adopted by the White Wolf GSA Board on 25 January 2022 and submitted to DWR on 28 January 2022 (White Wolf GSA, 2021).

This Water Year (WY) 2021 Annual Report for the Basin has been prepared in compliance with CCR 23 § 356.2. WY 2021 includes the period from 1 October 2020 through 30 September 2021. This Annual Report also contains available and appropriate historical information back to calendar year 2015, as required by CCR 23 §356.2 (b), in order to provide information and data related to Basin conditions through the current reporting year.

The White Wolf GSA is the exclusive GSA for the Basin. The White Wolf GSA was formed in 2017 upon adoption of a Joint Powers Agreement (JPA) and is governed by a seven-member Board of Directors which includes two (2) representatives of each member district: Arvin-Edison Water Storage District (AEWSD), Tejon-Castac Water District (TCWD), and Wheeler Ridge-Maricopa Water Storage District (WRMWSD). Kern County is represented as the seventh, non-voting member of the Board.

The Basin encompasses 107,532 acres at the southern end of the San Joaquin Valley Groundwater Basin (see **Figure 1**) within Kern County. The Basin is bordered on the north by the Kern County Subbasin, with no adjacent basins located to the south, east, or west.

Available hydrogeologic information indicates that the Basin is bounded on the north by the White Wolf Fault (WWF) system, on the east and south by a crystalline basement complex of the Tehachapi Mountains, and on the west by Tertiary-age sedimentary rocks of the San Emigdio Mountains. The Basin contains one Principal Aquifer, consisting of the deposits of Shallow Alluvium, Kern River Formation, and Chanac Formation. The thickness of the Principal Aquifer ranges from 25 to 7,518 feet (average of 2,200 feet) over the entire Basin. The Springs Fault lies subparallel to the WWF in the southeastern portion of the Basin and forms a distinct partial barrier to groundwater flow, effectively separating the Principal Aquifer from a shallow water-bearing zone that supports Groundwater Dependent Ecosystems (GDEs).

Sources of water to the Basin groundwater system include infiltration of applied water[1], precipitation, or infiltration from leaking distribution and conveyance channels, leakage from streams, and subsurface groundwater flow from the unpumped aquifer. Outflows from the Basin include groundwater pumping, evapotranspiration of shallow groundwater in the vicinity of GDEs, and subsurface outflow to the Kern County Subbasin across the WWF.

[1] Applied water includes groundwater and imported surface water. Imported surface water can be a combination of contracted State Water Project (SWP) water, contracted Central Valley Project (CVP) water, transfer water, exchanged water, and/or banked water managed through the individual district's service area and water supply portfolio.

2 GROUNDWATER ELEVATION DATA

☑ *§ 356.2 (b) (1)*

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:

(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.
(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.

2.1 Groundwater Elevation Contour Maps

Figure 2 and **Figure 3** map groundwater elevation contours in the Principal Aquifer for data collected in Fall 2020 and Spring 2021, respectively. The contours and posted groundwater elevations in Representative Monitoring Wells (RMWs) indicate seasonal high and low groundwater conditions for WY 2021. For the purposes of this Annual Report, Fall 2020 measurements were those collected between 1 October and 15 November 2020 and Spring 2021 measurements were those collected between 15 January and 15 April 2021.[2] **Figure 2** illustrates the WY 2021 seasonal low (Fall 2020) and **Figure 3** illustrates the WY 2021 seasonal high (Spring 2021) groundwater elevation contours in the Basin.

Figure 2 and **Figure 3** show that in WY 2021, groundwater elevations in the Basin generally are highest in the southeast in areas of higher topography and generally decrease to the northwest, and groundwater flow directions are generally to the northwest. Most of the groundwater elevation head change (the steepest groundwater gradient) is in the central area of the Basin, and does not vary greatly between the seasonal low and seasonal high periods in WY 2021.

2.2 Groundwater Hydrographs

Long-term hydrographs showing historical groundwater elevation data through WY 2021 for the RMW-WLs are shown on **Figure 4**.[3] RMW-WWB-006 has no prior historical data on record, nor a measurement obtained during WY 2021; the GSA will begin monitoring RMW-WWB-006 during WY 2022 as part of GSP implementation. Sustainable Management Criteria (SMC) including Measurable Objectives (MOs) and

[2] When more than one measurement was taken within the time period, the earliest measurement was used unless it was obtained during a period when water levels may have been influenced (e.g., pumping or prior to well development).
[3] Hydrographs show static water levels. Erroneous groundwater elevation data or groundwater elevation data marked as questionable are excluded from the hydrographs.

Minimum Thresholds (MTs) have been established for groundwater levels at the 14 RMW-WLs, based on a multi-step process that included evaluation of current and historical groundwater elevation data, projected trends, and analysis of potential impacts to existing wells.[4] The SMC are depicted graphically on the hydrographs, and are summarized in **Table 4**. Water levels in all RMW-WLs were above their MTs over the reporting period.

RMW-ISWs were installed in January 2021 to fill data gaps associated with the shallow water-bearing zone upgradient of the Springs Fault in areas supporting GDEs. Hydrographs showing depth to groundwater data collected through WY 2021 for the RMW-ISWs are shown on **Figure 5**. Based on limited availability of shallow depth to groundwater data, preliminary MOs and MTs were established at the three RMW-ISWs using groundwater levels as proxy.[5] These are depicted graphically on the hydrographs and are summarized in **Table 5**. Water levels in all RMW-ISWs were above their MTs over the reporting period.

[4] White Wolf GSA, 2021, Groundwater Sustainability Plan White Wolf Subbasin. Prepared by EKI Environment & Water Inc. for White Wolf Groundwater Sustainability Agency. December 2021.
[5] Ibid [4]

3 GROUNDWATER EXTRACTION DATA

☑ *§ 356.2 (b) (2)*

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:

(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:

(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.

Table 1 shows the WY 2021 groundwater extraction data by water use sector and measurement method. shows the general location and volume of groundwater extractions. Total pumpage was approximately 68,300 acre-feet (AF), of which 99% was for the agricultural sector.

Table 1. Summary of Groundwater Extraction Data by Sector

Water Year	Pumping, Agricultural (AF)		Pumping, Municipal & Industrial (AF)	Pumping, Total (AF)
	Metered [a]	Estimated [b]	Metered/Estimated [c]	
2021	21,386	46,537	377	68,300

Abbreviations:
AF = acre-feet

Notes:
(a) Metered data provided by WRMWSD and AEWSD. Values rounded to the nearest acre-foot.
(b) Agricultural pumping is estimated by the Basin's Soil Moisture Budget (SMB) Accounting model and input into the White Wolf Groundwater Flow Model (WWGFM) domain. Approximately 5% of the SMB-calculated private irrigation well pumping is not represented in the WWGFM due to either the proximity of the well locations to the White Wolf Fault and fault geometry or to assumptions on screened interval placement within model layers which may go dry during the model simulation period. Estimated agricultural pumping reported is after the approximately 5% reduction and is rounded to the nearest hundred acre-feet.
(c) Metered data compiled from the State Board Electronic Annual Report System. Pumping for January through September 2021 is estimated, as reported values were not yet available. Values rounded to the nearest acre-foot.

Groundwater for irrigation is extracted from both WRMWSD-owned and privately-owned wells. WRMWSD-owned wells and wells that pump into the WRMWSD water distribution system have metered monthly pumping data. Between WY 2019 and WY 2020, AEWSD installed meters on five privately-owned wells. Metered data was reported in AF; reported data are assumed to have a high level of accuracy, with

a precision of 0.01 AF for WRMWSD meters and 0.001 AF for AEWSD meters. Other privately-owned agricultural pumping has been estimated by the Soil Moisture Budget (SMB) Accounting model developed for the Basin. The SMB estimates groundwater pumping by satisfying any unmet agricultural demand, as estimated by METRIC ET data, after precipitation and applied surface water, and with consideration for irrigation efficiency.[6] Groundwater extractions estimated by the SMB have a lesser degree of accuracy, with a precision of 100 AF to 1,000 AF, as they are estimated from other data inputs and calibrated model parameters.

Groundwater for municipal and industrial (M&I) use in developed areas is extracted from public water systems wells and domestic wells. Three public water systems were identified within the Basin: TCWD (CA1503341), Tut Brothers Farm #96 (CA1500516), and Cuyama Orchards (CA1503679). Public water system pumping was extracted from the State Board Electronic Annual Report (EAR) System[7]. Data was reported in either gallons or AF, with a precision of 10 gallons or 0.001 AF. Data were only available through calendar year 2020. January through September 2021 extractions were estimated based on a repeat of calendar year 2020 values. Therefore, public water system pumping for WY 2021 are estimates and will be updated as additional data becomes available.

Although other domestic wells exist within the Basin, these are assumed to be de minimis users (i.e., less than 2 acre-feet per year; AFY) and therefore are not estimated herein.

[6] Details about the SMB can be found in the GSP and associated Appendix L. White Wolf GSA, 2021, Groundwater Sustainability Plan White Wolf Subbasin. Prepared by EKI Environment & Water Inc. for White Wolf Groundwater Sustainability Agency. December 2021.
[7] https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/eardata.html

4 SURFACE WATER SUPPLY

☑ *§ 356.2 (b) (3)*

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:

(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:

(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.

Surface water inflows to the Basin include imported surface water[8] and natural stream inflows. In WY 2021, imported surface water was provided by WRMWSD, AEWSD, and TCWD, as shown in **Table 2**.

The Basin contains 57,600 (38%) of the total 150,000 acres of service area covered by WRMWSD. WRMWSD imports State Water Project (SWP) water pursuant to its contractual agreement with the Kern County Water Agency (KCWA) for 197,088 AFY of Table A Allocation. WRMWSD delivers a combination of imported surface water and groundwater to the Basin. In WY 2021, WRMWSD delivered 35,984 AF of water to the Basin for agricultural use, based on metered deliveries by turnout. A portion of this water was groundwater (20,073 AF, see **Table 1**), therefore imported surface water deliveries for agricultural use are assumed to be total delivered water minus groundwater pumped into the WRMWSD distribution system. Similarly, in WY 2021, WRMWSD delivered 3,251 AF of water for M&I use, based on metered deliveries by turnout.[9] All metered data was reported in AF; reported data are assumed to have a high level of accuracy, with a precision of 0.01 AF.

The Basin contains 23,400 (17%) of the total 131,660 acres of service area covered by AEWSD. AEWSD contracts with the United States Bureau of Reclamation (USBR) for water service from the Central Valley Project (CVP). AEWSD's USBR contract provides for 40,000 AFY of Class 1 water and up to 311,675 AFY of Class 2 water from the Friant Division of the CVP. In WY 2021, AEWSD delivered 18,391 AF of water to the Basin, based on metered deliveries by turnout. Metered data was reported in AF; reported data are assumed to have a high level of accuracy, with a precision of 1 AF.

The Basin contains 20,800 (34%) of the total 61,400 acres of service area covered by TCWD. The TCWD provides water and wastewater service to the Tejon Ranch Commerce Center (TRCC), the only significant commercial development in the Basin. The TCWD has rights to receive up to 5,278 AFY of SWP surface water supplies (62% designated for agricultural uses and 38% designated for M&I uses) under contracts

[8] Imported surface water is a combination of contracted SWP water, contracted CVP water, transfer water, exchanged water, and/or banked water managed through the individual district's service area and water supply portfolio.

[9] Imported surface water delivered by WRMWSD to M&I users are not included in the Soil Moisture Balance Accounting model (SMB). 96% of the M&I water was delivered to Pastoria Energy Facility. It is assumed that these M&I deliveries contributions to the groundwater system are negligible.

with KCWA. For WY 2021, TCWD provided a total of 526 AF in-District and/or transfer deliveries of SWP water. Data was reported in AF; reported data are assumed to have a high level of accuracy, with a precision of 1 AF.

Finally, there are stream diversions at points of diversion (PODs) on El Paso, Grapevine, Tunis, Tejon, and Pastoria Creeks that are utilized for irrigation by the overlying landowner. Applied diversions are based on monthly reported stream diversion data, as uploaded to the Electronic Water Rights Information Management System (eWRIMs). Monthly diversion amounts are reported in AF based on flowmeters that record in either AF or cubic feet per second (cfs), and therefore have a high level of accuracy, estimated at 0.01 to 0.1 AF. However, diversion data were unavailable for POD10 (Grapevine Creek) from 15 January 2021 onward as the unit was stollen. POD9 (Grapevine Creek) recorded negative diversions for January and May 2021, signifying the diversion was less than the recorded overflow; therefore, a diversion value of zero was assumed. In WY 2021, stream diversions totaled 1,128 AF, as shown in **Table 2**.

Table 2. Summary of Surface Water Supply by Source and Sector

Water Year	WRMWSD Imports [a] (AF)		AEWSD Imports [a] (AF)	TCWD Imports (AF)	Total Imports (AF)		Stream Diversions[c] (AF)
	Agricultural [b]	M&I	Agricultural	M&I	Agricultural	M&I	Agricultural
2021	15,911	3,251	18,391	526	34,302	3,777	1,128

Abbreviations:

AEWSD = Arvin-Edison Water Storage District
AF = acre-feet
M&I = municipal and industrial
TCWD = Tejon-Castac Water Storage District
WRMWSD = Wheeler Ridge-Maricopa Water Storage District

Notes:

(a) Surface water imports are based on surface water deliveries to customers. Actual imports may be greater due to conveyance system losses.
(b) Agricultural deliveries are calculated based on the total water delivered by turnout, minus the total volume of metered groundwater pumped into the WRMWSD distribution system by both District-owned and privately-owned wells (see **Table 1**).
(c) Stream diversions from Grapevine Creek POD10 were unavailable from 15 January 2021 onward. January and May 2021 diversions from Grapevine Creek POD9 were assumed zero as diversions were less than recorded overflow.

5 TOTAL WATER SUPPLY

☑ *§ 356.2 (b) (4)*

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:

(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:

(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.

As described above, surface water and groundwater extraction comprise the majority of water use in the Basin. Additionally, small amounts of recycled water are used for irrigation at the TRCC. Therefore, the total water use is equal to the sum of total estimated groundwater extraction (**Table 1**)**,** the total surface water supplies (**Table 2**), and total applied recycled water. **Table 3** summarizes the total water use by water use sector and water use type. Approximately 96% of water was used for agriculture and 63% is from groundwater extractions.

Methods of measurement and accuracy of measurements for groundwater extraction and surface water data are summarized in **Section 4** and **Section 5** respectively. Recycled non-potable water used for landscape irrigation on the eastside of TRCC is recorded by TCWD based on consumer water meters that record in hundred cubic feet (ccf), and therefore have a high level of accuracy at 1 ccf.

Table 3. Summary of Total Water Use by Sector and Source

Water Year	Agriculture (AF)					M&I (AF)				Total Water Use
	Pumping		Imported Water[c]	Stream Diversions[e]	Total	Pumping	Imported Water[c]	Recycled Water[g]	Total	
	Metered[a]	Estimated[b]	Metered[d]	Metered		Metered/ Estimated[f]	Metered	Metered		
2021	21,386	46,437	34,302	1,128	103,353	377	3,777	123	4,277	107,630

Abbreviations:

AF = acre-feet

M&I = municipal and industrial

Notes:

(a) Metered data provided by WRMWSD and AEWSD. Values rounded to the nearest acre-foot.

(b) Agricultural pumping is estimated by the Basin's Soil Moisture Budget (SMB) Accounting model and input into the White Wolf Groundwater Flow Model (WWGFM) domain. Approximately 5% of the SMB-calculated private irrigation well pumping is not represented in the WWGFM due to either the proximity of the well locations to the White Wolf Fault and fault geometry or to assumptions on screened interval placement within model layers which may go dry during the model simulation period. Estimated agricultural pumping reported is after the approximately 5% reduction and is rounded to the nearest hundred acre-feet.

(c) Surface water imports are based on surface water deliveries to customers. Actual imports may be greater due to conveyance system losses.

(d) See **Table 2** notes regarding calculation for agricultural deliveries.

(e) Stream diversions from Grapevine Creek Point of Diversion (POD) 10 were unavailable from 15 January 2021 onward. January and May 2021 diversions from Grapevine Creek POD 9 were assumed zero as diversions were less than recorded overflow.

(f) Metered data compiled from the State Board Electronic Annual Report System. M&I pumping for January through September 2021 is estimated, as reported values were not yet available. Values rounded to the nearest acre-foot.

(g) Metered recycled water data provided by Tejon-Castac Water District. Value is rounded to the nearest AF.

6 CHANGE IN GROUNDWATER STORAGE

☑ *§ 356.2 (b) (4)*

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:

(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:

(4) Change in groundwater in storage shall include the following:

(A) Change in groundwater in storage maps for each principal aquifer in the basin.

(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.

Changes in groundwater storage were estimated using the White Wolf Groundwater Flow Model (WWGFM), a three-dimensional numerical groundwater flow model based on the U.S. Geological Survey public-domain software package MODFLOW. The Basin-specific model was developed as part of the GSP to analyze water budget information and quantify the historical and current change in groundwater storage over WY 1995-2019. The WWGFM was extended through WY 2021 to support change in groundwater storage calculations for this Annual Report by extending:

- Daily precipitation data from Parameter-elevation Regressions on Independent Slopes Model (PRISM);
- Monthly satellite evapotranspiration (ET) data from the Cal Poly Irrigation Training and Research Center's Mapping of EvapoTranspiration with Internal Calibration (ITRC-METRIC);
- Daily reference ET Data from California Irrigation Management Information System (CIMIS) Arvin-Edison station #125;
- Monthly surface water imports/delivery records from AEWSD, WRMWSD, and TCWD internal operations records;
- Monthly recycled water usage from TCWD internal operations records;
- Monthly pumping records including (1) WRMWSD "pump in" records of privately pumped groundwater that has been added to the WRMWSD water distribution system from the District's internal operations records; (2) WRMWSD pumping volumes from District-owned wells from the District's internal operations records; (3) Public Water System pumping[10]; and (4) private agricultural pumping calculated by the SMB;

[10] Available online at: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/eardata.html

- Monthly stream diversions at PODs on El Paso, Grapevine, Tunis, Tejon, and Pastoria Creeks and Reservoirs 1 and 2 from Tejon Ranch Company (TRC) internal records and as uploaded to eWRIMs; and
- Boundary conditions, including (1) monthly water level time series from wells located in Kern County Subbasin for simulating flow across the WWF and (2) monthly stream inflows based on a watershed analysis.

As a check on model output, groundwater elevations in wells predicted by the WWGFM during WY 2021 were compared to groundwater elevations measured in wells during WY 2021. **Figure 7** shows a scatterplot of model-calculated vs. observed water levels. The coefficient of determination (R^2) of 0.99 indicates that there is a good match between model-calculated and observed water levels and that the model can be used to simulate water levels in the Basin, and thus changes in Basin groundwater storage.

Figure 8 is a map of model-calculated water level difference and model-estimated changes in groundwater storage within the Basin between WY 2020 and WY 2021. The WWGFM calculates the change in groundwater storage based on the change in water level and the calibrated storage properties of each model cell. **Figure 8** shows that water levels primarily decreased in the central portions of the Basin and slightly increased in the foothills portions of the Basin. Furthermore, groundwater storage also decreased in most areas of the Basin, with increases seen in the same areas of water level increases. The southeastern fringe areas also experienced groundwater storage declines due to drainage from lack of precipitation.

Figure 9 shows water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater storage for the Basin from WY 1995 to WY 2021. WY 2021 was a critically dry year[11]; the Basin experienced a decrease in groundwater storage of 38,600 AF, which is comparable to other recent critically dry years (e.g., 2013 and 2014).

[11] DWR-published Water Year (WY) type for the Basin's Hydrologic Unit Code (HUC) 8 watershed was not available at the time of drafting the WY 2021 Annual Report. As such, WY type for 2021 was calculated using the same methodology presented in DWR, 2021.

7 PLAN IMPLEMENTATION

☑ *§ 356.2 (b) (4)*

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:

(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.

7.1 Progress Towards Interim Milestones for Chronic Lowering of Groundwater Levels

Table 4 compares WY 2021 groundwater elevations to interim milestones set at RMW-WLs established for the Chronic Lowering of Groundwater Levels Sustainability Indicator in the White Wolf Basin GSP. All of the wells have water levels above their respective MTs, so none indicate the presence of Undesirable Results with respect to groundwater levels in the Basin. Furthermore, among the RMW-WLs that have at least one groundwater level measurement collected during WY 2021, seven RMW-WLs have groundwater levels above their MOs for at least one seasonal (Spring or Fall) groundwater level measurement.

Table 4. Groundwater Elevations and Relevant Sustainable Management Criteria for Chronic Lowering of Groundwater Levels Sustainability Criteria

Well Name	Fall 2020 GWE (ft msl)	Spring 2021 GWE (ft msl)	MO (ft msl)	MT (ft msl)	IM-5 (ft msl)	IM-10 (ft msl)	IM-15 (ft msl)
RMW-WWB-001	NA[(a)]	802.5	800	680	800	800	800
RMW-WWB-002	239.1	NA[(a)]	273	177	273	273	273
RMW-WWB-003	223.4	NA[(a)]	252	196	224	210	231
RMW-WWB-004	154.1	159.1	151	103	127	115	133
RMW-WWB-005	159.2	160.9	162	93	128	110	136
RMW-WWB-006	NA[(a)]	NA[(a)]	171	152	162	157	164
RMW-WWB-007	168.4	NA[(b)]	180	123	151	137	159
RMW-WWB-008	154.4	150.1	149	104	127	115	132
RMW-WWB-009	168.1	152.3	160	130	145	137	148
RMW-WWB-010	183.7	177.4	181	159	181	181	181
RMW-WWB-011	448.2	446.1	433	380	433	433	433
RMW-WWB-012	143.8	142.8	161	123	142	133	147
RMW-WWB-013	132.9	NA[(a)]	181	92	136	114	147
RMW-WWB-014	143.7	151.7	151	96	124	110	130

Abbreviations:

ft msl = feet above mean sea level
GWE = groundwater elevation
IM = interim milestone
MO = measurable objective
MT = minimum threshold

Notes:

(a) No measurement available; well was temporarily inaccessible.
(b) No measurement as well was actively pumping during site visit.

7.2 Progress Towards Interim Milestones for Depletions of Interconnected Surface Water

Water levels in RMW-ISWs are used as proxy to monitor the health of the GDEs identified south of the Springs Fault. **Table 5** compares WY 2021 depth to water to the preliminary MOs and MTs set at the RMW-ISWs established for the Depletions of Interconnected Surface Water Sustainability Indicator in the White Wolf Basin GSP. A clerical error in the GSP switched the MO values for RMW-WWB-019 and RMW-WWB-020; **Table 5** below presents corrected MO values. In all three wells, depth to water is shallower than the preliminary MTs, so per the definition of Undesirable Results as outlined in the GSP, none indicate the presence of Undesirable Results. Furthermore, two out of three RMW-ISWs have groundwater levels above their MOs.

Table 5. Depth to Groundwater and Relevant Sustainable Management Criteria for Depletions of Interconnected Surface Water Sustainability Criteria

Well Name	Fall 2020 DTW [(a)] (ft bgs)	Spring 2021 DTW [(b)] (ft bgs)	MO [(c)] (ft bgs)	MT (ft bgs)	IM-5 [(d)] (ft bgs)	IM-10 [(d)] (ft bgs)	IM-15 [(d)] (ft bgs)
RMW-WWB-019	NA	18.81	19	30	n/a	n/a	n/a
RMW-WWB-020	NA	15.72	15	30	n/a	n/a	n/a
RMW-WWB-021	NA	32.88	36	36	n/a	n/a	n/a

Abbreviations:

ft bgs = feet below ground surface
IM = interim milestone
MO = measurable objective
MT = minimum threshold

Notes:

(a) Fall 2020 measurement was not available, as monitoring wells were installed in January 2021.
(b) Spring 2021 measurement was recorded on 4/2/2021.
(c) MOs have been corrected from those reported in the GSP.
(d) Given the preliminary nature of the data in which MOs and MTs were set, IMs were not established in the GSP.

7.3 Implementation of Projects and Management Actions (P/MAs)

The White Wolf Basin GSP outlined 24 potential P/MAs. A brief description and progress towards implementation of these is provided below.

- P/MA #1 - Recharge from Grapevine Development: The Grapevine Development will be annexed into and receive water and wastewater treatment service from TCWD. P/MA #1 has not yet been initiated.
- P/MA #2 - Oilfield Reclaimed Water from the Tejon Oil Field: This project consists of reclaiming water from oil production facilities in the TCWD area. Tejon Oil Field has a yield of approximately

20,000 barrels per day of produced water, or approximately 940 AFY (1.3 cfs), that it is available year-round irrespective of climatic conditions. Negotiations with oil producer are ongoing.

- P/MA #3 - Oilfield Reclaimed Water in AEWSD: This project involves reclaiming water from oil production facilities for irrigation purposes in AEWSD. After treatment and cooling, water could be pumped into AEWSD facilities to serve irrigation demands in-lieu of groundwater pumping. P/MA #3 has not yet been initiated.
- P/MA #4 - Purchase Additional Surface Water Supplies: All White Wolf GSA member districts continually seek to purchase additional surface water supplies, as available, including unused allocations of wet year CVP water, SWP water, or high flow Kern River supplies or transfer/exchange agreements with out-of-basin entities. P/MA #4 has been initiated and work is ongoing. For example, during WY 2021 WRMWSD purchased an additional 11,695 acre-feet for surface delivery in WRMWSD (including both the Kern County Subbasin and White Wolf Subbasin). In addition, WRMWSD recovered approximately 66,000 acre-feet of banked water from its out of District banking projects for delivery in the District.
- P/MA #5 - WRMWSD "Thru Delta" Facility: WRMWSD is actively participating in planning efforts surrounding a "Thru Delta" Facility. This is a State-led effort to increase SWP water reliability with a projected supply benefit for WRMWSD of up to 25,000 AFY upon Cal WaterFix Project completion (anticipated 2035). In 2020, The WRMWSD Board of Directors elected to participate at 32% of its State Water Project entitlement (63,100 acre-feet) in the planning phase of the Delta Conveyance Project. P/MA #5 has been initiated and work is ongoing with the District continuing to fund the planning phase in WY 2021.
- P/MA #6 - WRMWSD Desalination Facility: WRMWSD is planning to develop a facility whereby poor-quality groundwater (i.e., high in total dissolved solids) that is encountered in areas of poor water quality for beneficial use will be treated to a point where it is usable for agricultural use and can be used to supplement irrigation supply. P/MA #6 has not yet been initiated.
- P/MA #7 - Recapture of Basin Groundwater: To recapture the surface water imported into the Basin, the GSA will consider either installing a line of pumping wells along the WWF or increasing the use of existing private pumping wells along the WWF. P/MA #7 has not yet been initiated.
- P/MA #8 - WRMWSD Mettler Recharge Project: This project entails the operation and maintenance of a 60-acre groundwater recharge facility for the artificial recharge of available surface water to groundwater for later use by WRMWSD. The Metter recharge facility was constructed in 2019 and is connected to the 850 Canal near the existing PA-1 pumping plant. The facility did not receive water during WY 2021.
- P/MA #9 - WRMWSD El Paso Creek Recharge Project: This project is an artificial recharge project along El Paso Creek in which water would be gravity fed through mostly existing conveyance pipelines to conduct in-stream and off-stream recharge on adjacent native vegetation lands. P/MA #9 has not yet been initiated.
- P/MA #10 - AEWSD In-Lieu Banking Program: AEWSD will supply surface water when available through new facilities to the Groundwater Service Area within AEWSD with the intent of reducing AEWSD-wide groundwater use. However, when surface water is in short supply and under

agreement, the landowners could recover and return groundwater from their own wells to the AEWSD canal system through new pipelines once they have satisfied their own water needs. AEWSD submitted a USDA Regional Conservation Partnership Program grant application to support expansion of its gravity pipeline distribution network in the Tejon Unit of its surface water service area which was not awarded. AEWSD has completed preliminary design for two (2) additional In-Lieu units on the north side of the District (Frick and Panama Units). Development of a potential hybrid In-lieu and temporary water service contract is underway in order to begin landowner outreach for the two areas. On a related matter, AEWSD approved the CEQA Negative Declaration for its groundwater service area distribution pipeline expansion project and has completed 30% design of such pipeline expansions.

- P/MA #11 - AEWSD Private & Caltrans Basin Connections: This Project involves connecting multiple on-farm private basins and some Caltrans sumps near AEWSD facilities by gravity pipeline and utilizing for groundwater recharge and floodwater capture. P/MA #11 has not yet been initiated.
- P/MA #12 - AEWSD South Canal WRMWSD 850 Canal Intertie: This project involves either improving existing interties and/or construct new interties between AEWSD's South Canal or distribution system and WRMWSD's 850 Canal to facilitate water exchanges between AEWSD and WRMWSD. Discussion regarding interconnections were initiated during the reporting period with infrastructure delivery tests planned to begin in October 2021.
- P/MA #13 - AEWSD South Canal Balancing Reservoir Project: AEWSD is in need of additional infrastructure to allow water storage and regulation of flow mismatches in its canal system during operation or emergencies. P/MA #13 has not yet been initiated.
- P/MA #14 - AEWSD Groundwater Subsidies for Land Conversion: AEWSD may adopt a management action to provide subsidies to incentivize groundwater users to convert land to alternative land uses and reduce groundwater extractions. P/MA #14 has not yet been initiated.
- P/MA #15 - WRMWSD Land Retirement and/or Conversion: WRMWSD may purchase and permanently fallow previously irrigated acreage within the WRMWSD service area to reduce overall water demand and groundwater extractions. P/MA #15 has not yet been initiated.
- P/MA #16 - AEWSD Groundwater Allocation per Acre: AEWSD may adopt a program which provides a finite groundwater allocation on a per acre basis. P/MA #16 has not yet been initiated.
- P/MA #17 - AEWSD Groundwater Fee Increase: AEWSD may adopt a management action to increase Groundwater Service Area costs to incentivize groundwater users to reduce groundwater extractions and take surface water when available. P/MA #17 has not yet been initiated.
- P/MA #18 - AEWSD Groundwater Marketing & Trading: AEWSD would pursue a groundwater market and trading program once P/MA #16 and P/MA #17 have been adopted to provide users and beneficial users more flexibility in utilizing their allocation. Trading may be executed through short-and long-term leases, permanent transfers, inter-annual water exchanges, or dry-year option contracts. P/MA #18 has not yet been initiated.

- P/MA #19 - WRMWSD Groundwater Allocation and Market: WRMWSD may develop a groundwater pumping allocation methodology, including a market system for trading and/or transferring of allocations between water users. P/MA #19 has not yet been initiated.
- P/MA #20 - WRMWSD Voluntary Pumping Limitations: WRMWSD may set non-binding pumping limitations in conjunction with a fee for pumping above limits. P/MA #20 has not yet been initiated.
- P/MA #21 - WRMWSD Mandatory Pumping Limitations: WRMWSD may set binding pumping limitations in conjunction with a fee for pumping above limits. P/MA #21 has not yet been initiated.
- P/MA #22 - Improved Stormwater Management and Flood Control in AEWSD: AEWSD's canal system requires modifications/improvements to comply with storm runoff pollution prevention. Additionally, there is a need to modify old and build new facilities for flood protection from intermittent creeks (e.g., Tejon Creek, El Paso Creek, their tributaries and others). P/MA #22 has not yet been initiated.
- P/MA #23 - AEWSD Groundwater Extraction Quantification Method: AEWSD may adopt a policy to specify the approved method or methods to quantify the individual and aggregate groundwater extractions for the required SGMA annual reporting. AEWSD completed installation of groundwater pumping meters at 50 sites under its existing Groundwater Metering grant program, with five meters located in the Basin.
- P/MA #24 - WRMWSD Acreage Assessment WRMWSD may set a policy to implement an acreage assessment to fund purchases of additional supplies, purchase of land for fallowing, and other investments to support SGMA compliance. The funds generated from could be used to finance other P/MAs. WRMWSD initiated a study to analyze possible acreage assessments or groundwater pumping charges that could both fund future P/MAs and provide financial incentives to limit pumping from the groundwater basin. It is anticipated that these analyses will be completed by mid-2022.

7.4 Stakeholder Engagement

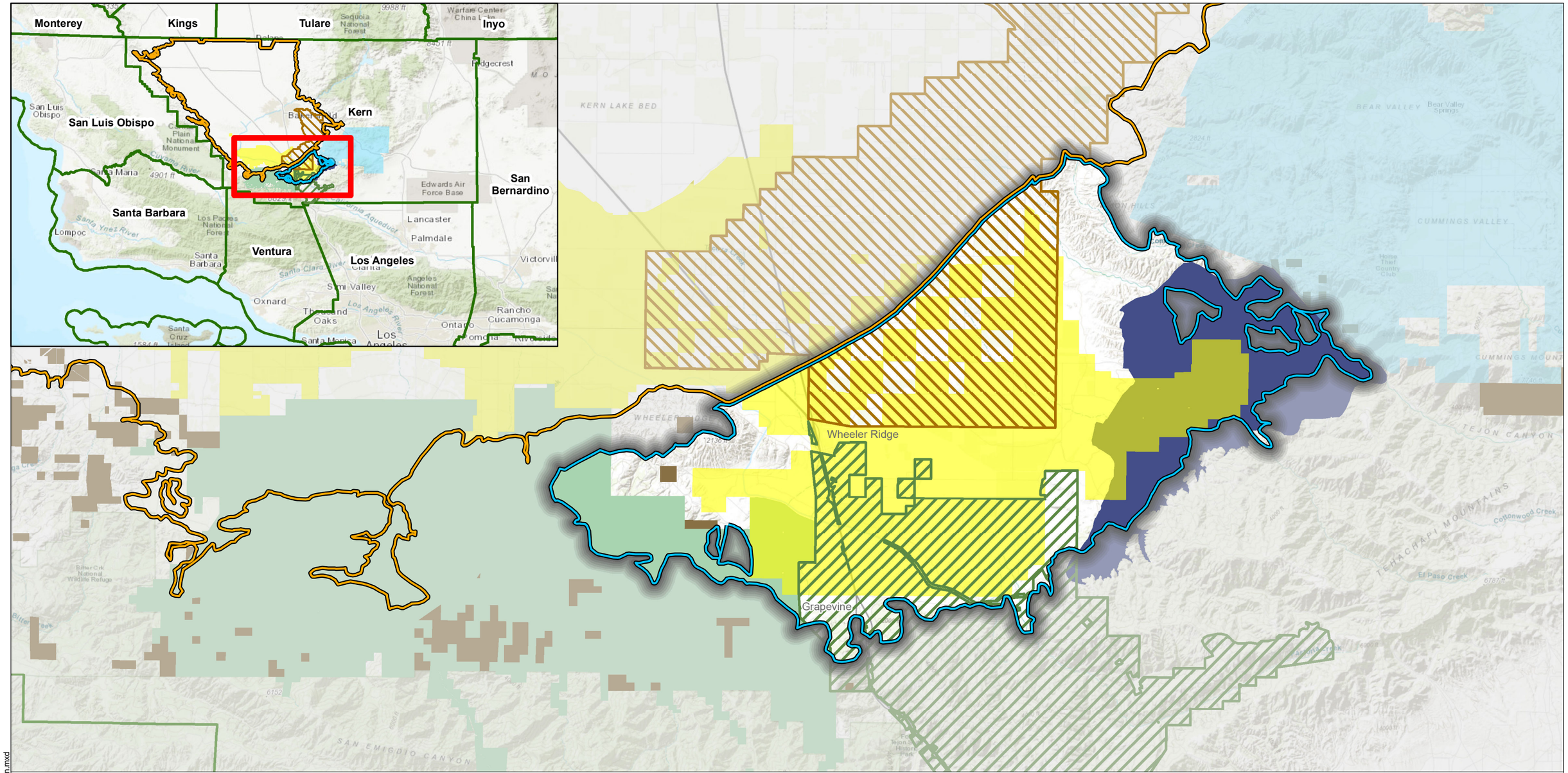
The White Wolf GSA practices stakeholder engagement through the GSA website (http://whitewolfgsa.org/), public meetings and workshops presented in person prior to the current global COVID-19 pandemic, and presented online while health-protective restrictions are in force. During the reporting period, White Wolf GSA held public meetings on 1 December 2020, 2 March 2021, 1 June 2021, 12 August 2021, and 7 September 2021 and stakeholder workshops 8 October 2020 and 26 July 2021. The GSA will continue to meet regularly in 2022.

8 REFERENCES

DWR, 2019, Sustainable Groundwater Management Act 2019, Basin Prioritization Process and Results. April 2019, 64 pp.

DWR, 2021. Sustainable Groundwater Management Act Water Year Type Data Set Development Report, January 2021, 17pp. https://data.cnra.ca.gov/dataset/sgma-water-year-type-dataset/resource/79c7b9c1-1203-4203-b956-844554fcec79

White Wolf GSA, 2021, Groundwater Sustainability Plan White Wolf Subbasin. Prepared by EKI Environment & Water Inc. for White Wolf Groundwater Sustainability Agency. December 2021.



Legend

Groundwater Subbasin

- White Wolf (DWR 5-022.18)
- Kern County (DWR 5-022.14)
- County Boundary
- Arvin-Edison Water Storage District
- Tejon-Castac Water District
- Wheeler Ridge-Maricopa Water Storage District
- Tehachapi - Cummings County Water District
- Federal Lands
- Conservation Easement Area
- Private Conservation

Abbreviations

CCED = California Conservation Easement Database
CPAD = California Protected Areas Database
DWR = California Department of Water Resources
GSA = Groundwater Sustainability Agency

Notes

1. All locations are approximate.
2. The enitre displayed area within Kern County is covered by the Kern County General Plan
3. The White Wolf GSA covers the entire White Wolf Subbasin and is the exclusive GSA for the Subbasin.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 17 February 2022.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater Bulletin 118 - Final Prioritization, dated February 2019.
3. District boundaries acquired from respective District staff.
4. Federal Lands from CPAD 2017 - www.calands.org.
5. Private Conservation Lands from CPAD 2018 - www.calands.org.
6. Conservation Easement Area Lands from CCED -www.calands.org/CCED.
7. Kern County General Plan information obtained on 16 August 2018 from http://esps.kerndsa.com/gis/gis-download-data.

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0 3 6

(Scale in Miles)

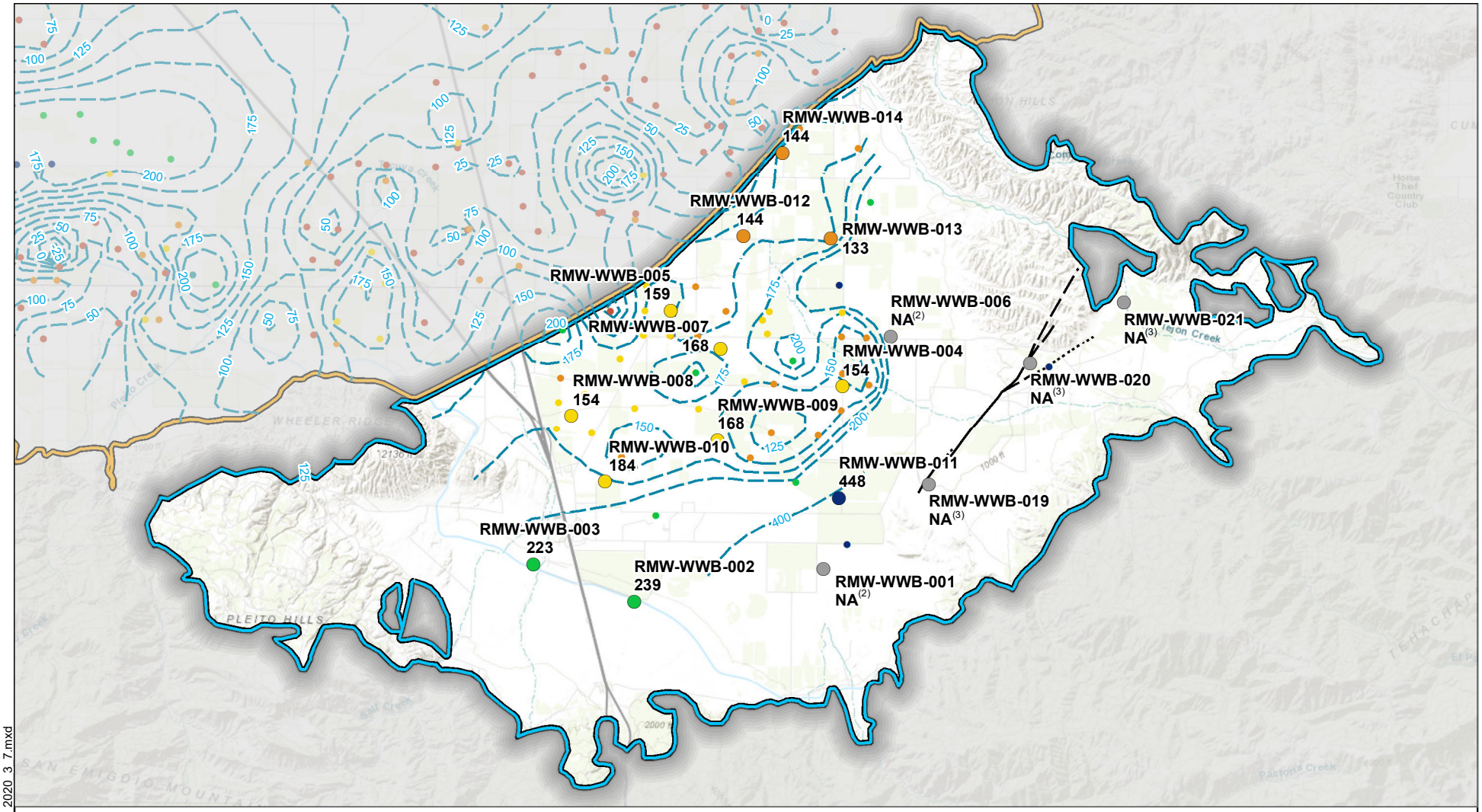
White Wolf Subbasin and Relevant Boundaries

White Wolf GSA
Kern County, California
Feburary 2022
C20014.00

Figure 1

eki environment & water

Path: X:\C20014.00\Maps\2022\02\Figure 1. White Wolf Subbasin.mxd



Legend

Groundwater Subbasin

- White Wolf (DWR 5-022.18)
- Kern County (DWR 5-022.14)
- Springs Fault
- Fall 2020 Groundwater Elevation contour (ft msl)

Fall 2020 Groundwater Elevation (ft msl)

- NA
- <100
- 100-150
- 150-200
- 200-250
- 250-300
- >300

Abbreviations

DTW	= Depth to groundwater
DWR	= California Department of Water Resources
ft msl	= feet above mean sea level
GSA	= Groundwater Sustainability Agency
NA	= not available

Notes

1. All locations are approximate.
2. No measurement available; well was temporarily inaccessible.
3. Measurement was not available, as monitoring wells were installed in January 2021.
4. Wells with questionable measurements were excluded from the contours.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 7 March 2022.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater Bulletin 118 - Final Prioritization, dated February 2019.
3. Springs Fault trace from Bartow, 1984, Geological Map and Cross Sections of the Southeastern Margin of the San Joaquin Valley, California: U.S. Geological Survey Map I-1496.
4. Groundwater elevation data provided by the White Wolf GSA member Districts.

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(Scale in Miles)

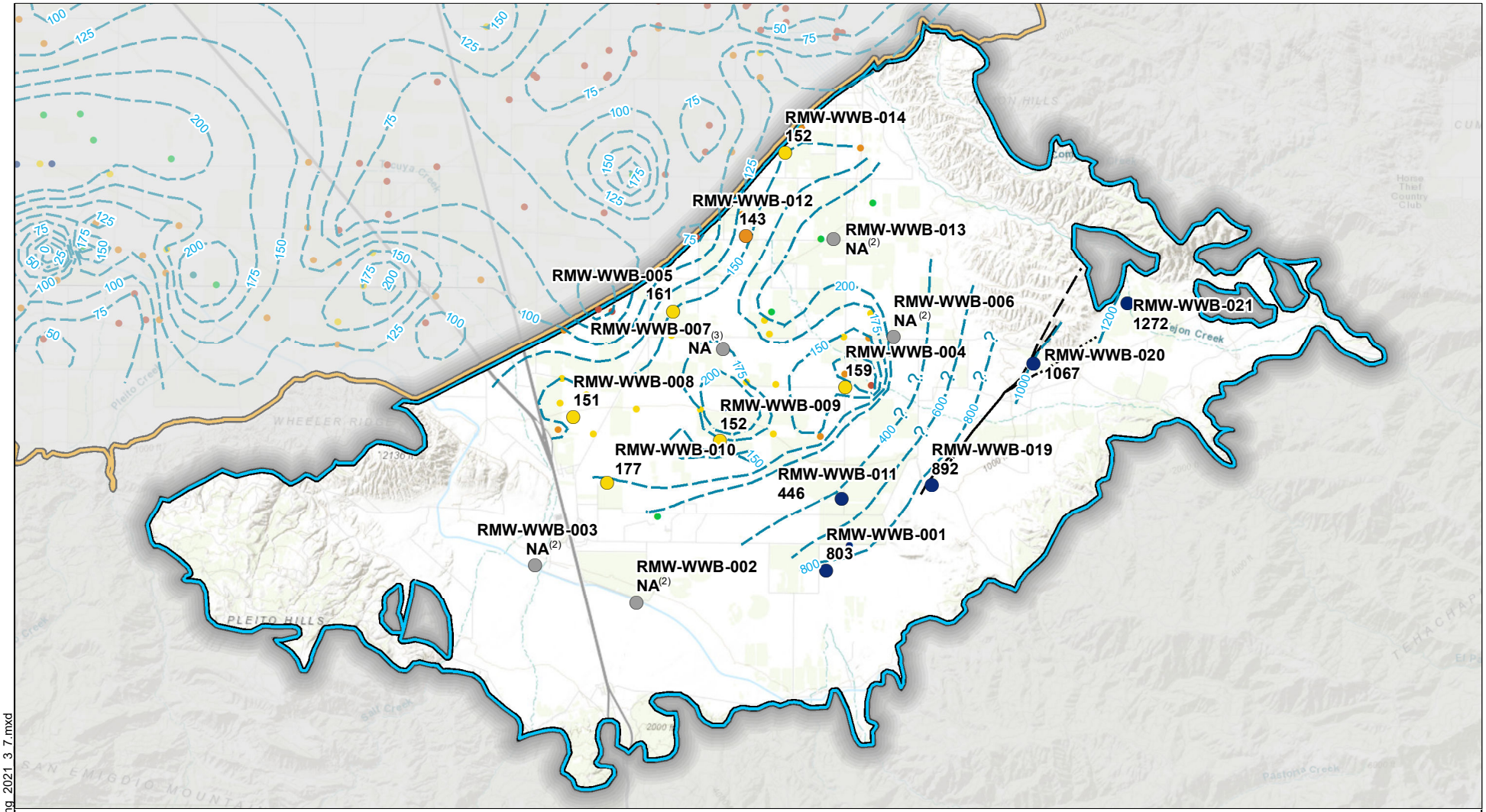
Groundwater Elevation Contours, Fall 2020

White Wolf GSA
Kern County, California
March 2020
C20014.00

Figure 2

eki environment & water

Path: X:\C20014.00\Maps\2022\02\Figure 2. WL Fall 2020 3_7.mxd



Legend

Groundwater Subbasin

- White Wolf (DWR 5-022.18)
- Kern County (DWR 5-022.14)
- Springs Fault
- Spring 2021 Groundwater Elevation contour (ft msl)

Spring 2021 Groundwater Elevation (ft msl)

- NA
- <100
- 100-150
- 150-200
- 200-250
- 250-300
- >300

Abbreviations

DTW	= Depth to groundwater
DWR	= California Department of Water Resources
ft msl	= feet above mean sea level
GSA	= Groundwater Sustainability Agency
NA	= not available

Notes

1. All locations are approximate.
2. No measurement available; well was temporarily inaccessible.
3. No measurement as well was actively pumping during site visit.
4. Contours are queried when uncertain.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 7 March 2022.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater Bulletin 118 - Final Prioritization, dated February 2019.
3. Springs Fault trace from Bartow, 1984, Geological Map and Cross Sections of the Southeastern Margin of the San Joaquin Valley, California: U.S. Geological Survey Map I-1496.
4. Groundwater elevation data provided by the White Wolf GSA member Districts.

N

0 3 6

(Scale in Miles)

Groundwater Elevation Countors, Spring 2021

White Wolf GSA
Kern County, California
March 2022
C20014.00
Figure 3

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Path: X:\C20014.00\Maps\2022\02Figure 3. WL_Spring_2021_3_7.mxd

Path: X:\C20014.00\Maps\2022\02Figure 4. RMW WL Hydrographs.mxd

Legend

Groundwater Subbasin

- White Wolf (DWR 5-022.18)
- Kern County (DWR 5-022.14)
- RMW-WL
- Springs Fault
- California Aqueduct
- 850 Canal
- Measurable Objective
- Minimum Threshold
- Groundwater Elevation
- Ground Surface Elevation

Land Use

- Agricultural Land
- Developed
- Grazing
- Mining
- Oil Field
- Conservation Easement
- California Protected Areas
- Proposed Grapevine Development

Abbreviations

DWR = California Department of Water Resources
ft msl = feet above mean sea level
MO = Measurable Objective
MT = Minimum Threshold
RMW-WL= Representative Monitoring Well for Water Level

Notes

1. All locations are approximate.
2. RMW-WWB-006 has no prior historical data on record, nor a measurement obtained during WY 2021.
3. Hydrographs show static water levels. Erraneous datapoints have been excluded.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 8 March 2022.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater Bulletin 118 - Final Prioritization, dated February 2019.
3. Land Use simplified from Figure PA-3 and Figure PA-8.
4. Surface water features, watersheds, and springs from NHD (https://viewer.nationalmap.gov/basic/).
5. Springs Fault trace from Bartow, 1984, Geological Map and Cross Sections of the Southeastern Margin of the San Joaquin Valley, California: U.S. Geological Survey Map I-1496.

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(Scale in Miles)

Hydrographs of Representative Monitoring Wells for Chronic Lowering of Groundwater Levels Sustainability Indicator

White Wolf GSA
Kern County, California
March 2022
C20014.00
Figure 4

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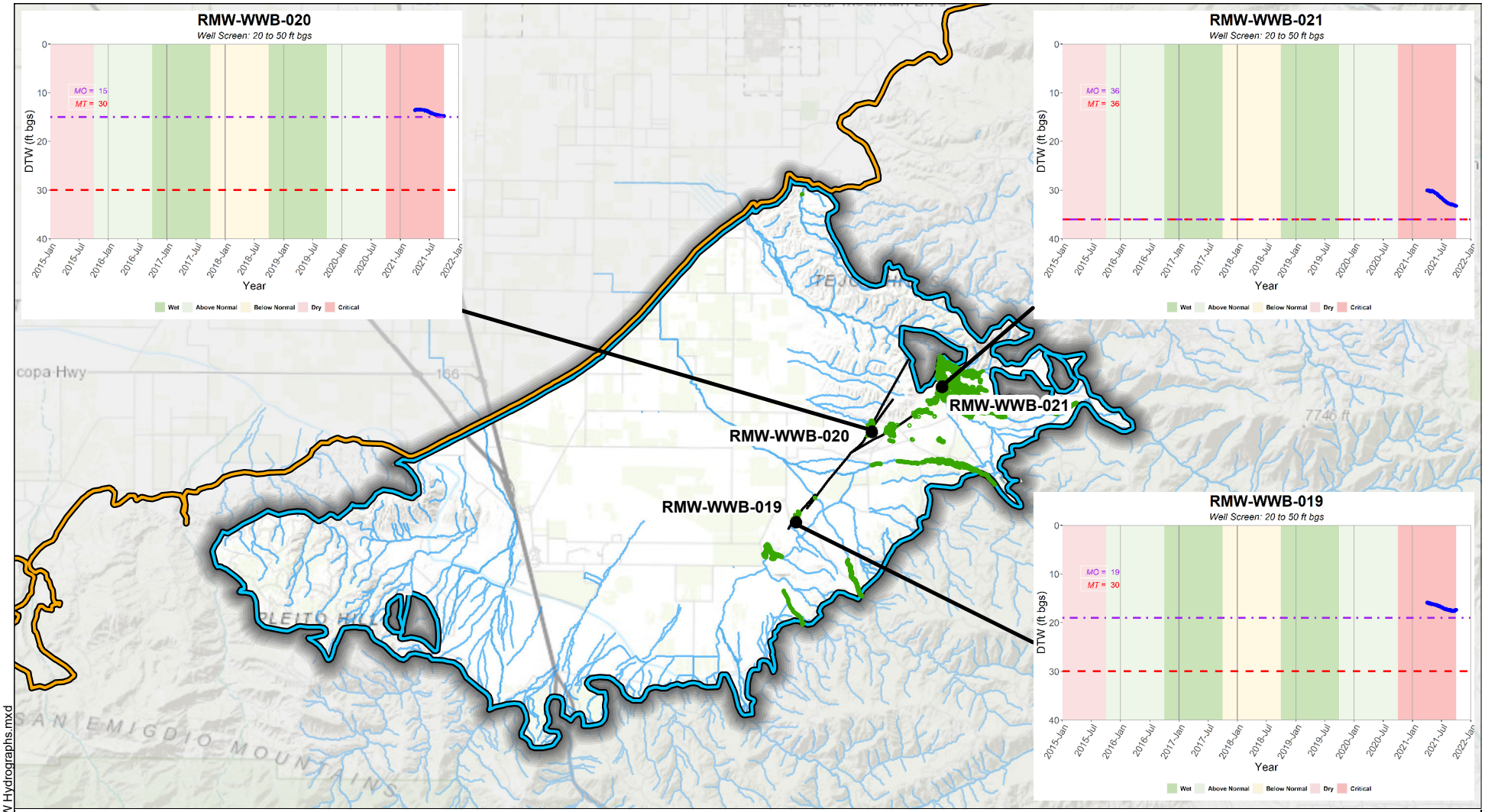

Legend

Groundwater Subbasin

- White Wolf (DWR 5-022.18)
- Kern County (DWR 5-022.14)
- GDEs of Interest
- Stream
- Springs Fault
- Representative Monitoring Well
- Measurable Objective
- Minimum Threshold
- Depth to Water (ft bgs)

Abbreviations

DTW	= depth to water
DWR	= California Department of Water Resources
ft bgs	= feet below ground surface
GDE	= Groundwater Dependent Ecosystem
MO	= Measurable Objective
MT	= Minimum Threshold

Notes

1. All locations are approximate.
2. MO values for RMW-WWB-019 and RMW-WWB-020 have been corrected.
3. GDEs of interest are those supported by the shallow water-bearing zone upgradient of the Springs Fault ("B") or the Regional Aquifer ("R").

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 4 March 2022.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater Bulletin 118 - Final Prioritization, dated February 2019.
3. Surface water features from National Hydrography Dataset (https://viewer.nationalmap.gov/basic/).
4. GDEs of interest shapefile provided by GeoSystems Analysis, Inc., 7 October 2020.
6. Springs Fault trace from Bartow, 1984, Geological Map and Cross Sections of the Southeastern Margin of the San Joaquin Valley, California: U.S. Geological Survey Map I-1496.

N

0 4 8

(Scale in Miles)

Hydrographs of Representative Monitoring for Depletions of Interconnected Surface Water Sustainability Indicator

White Wolf GSA
Kern County, California
March 2022
C20014.00

Figure 5

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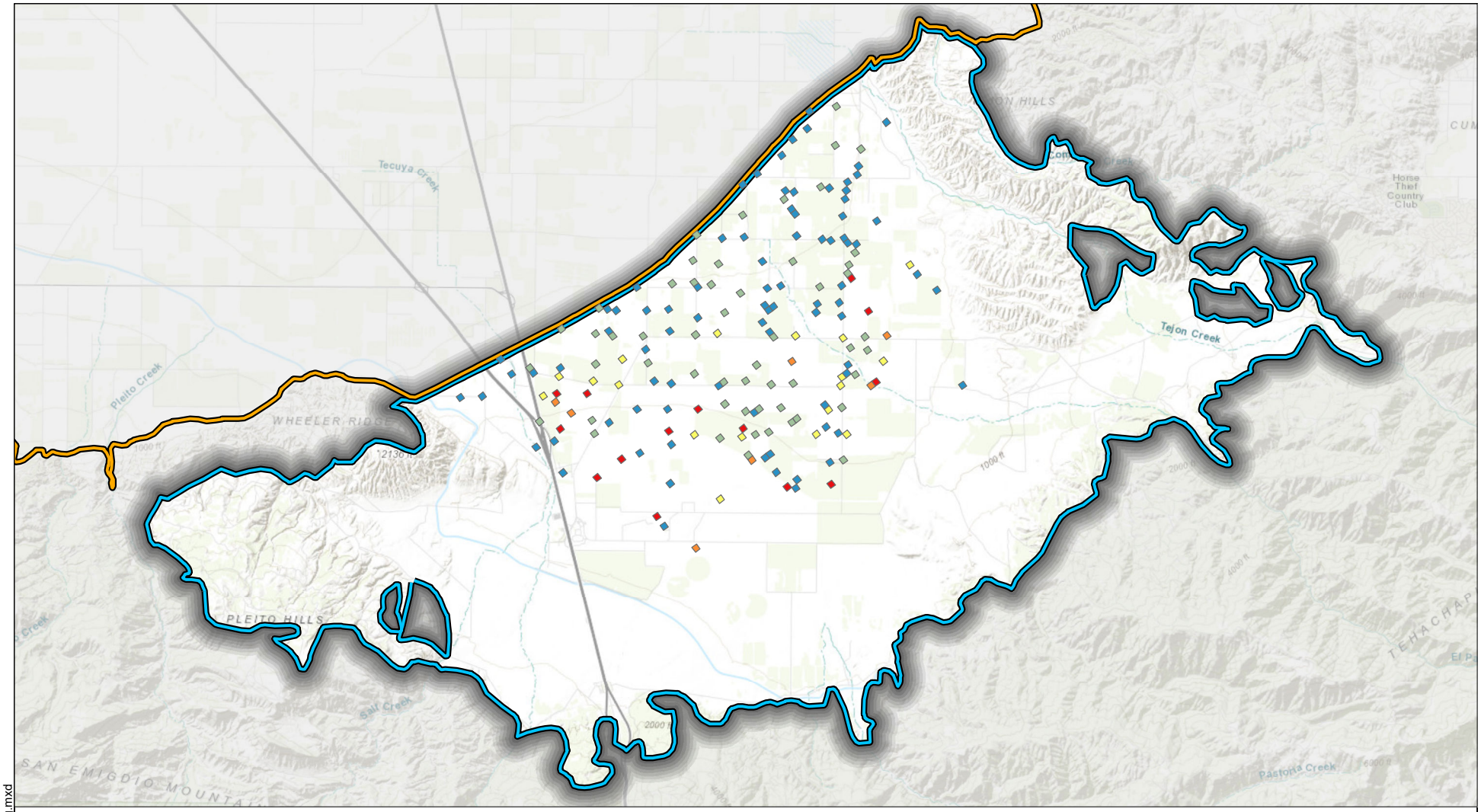
Path: X:\C20014.00\Maps\2022\02\Figure 5. RMW ISW Hydrographs.mxd



Legend

Groundwater Subbasin

- White Wolf (DWR 5-022.18)
- Kern County (DWR 5-022.14)

WY 2021 Groundwater Pumping (AF)

- < 250
- 250 - 500
- 500 - 750
- 750 - 1,000
- 1,000 - 3,383

Abbreviations

AF = acre-feet
DWR = California Department of Water Resources
WY = Water Year

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 31 March 2022.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater Bulletin 118 - Final Prioritization, dated February 2019.
3. Groundwater pumping in the White Wolf Groundwater Flow Model is a combination of metered data where available and estimated using the Soil Moisture Budget where unavailable.

N

0 3 6

(Scale in Miles)

General Location of Groundwater Extractions, WY 2021

White Wolf GSA
Kern County, California
February 2022
C20014.00

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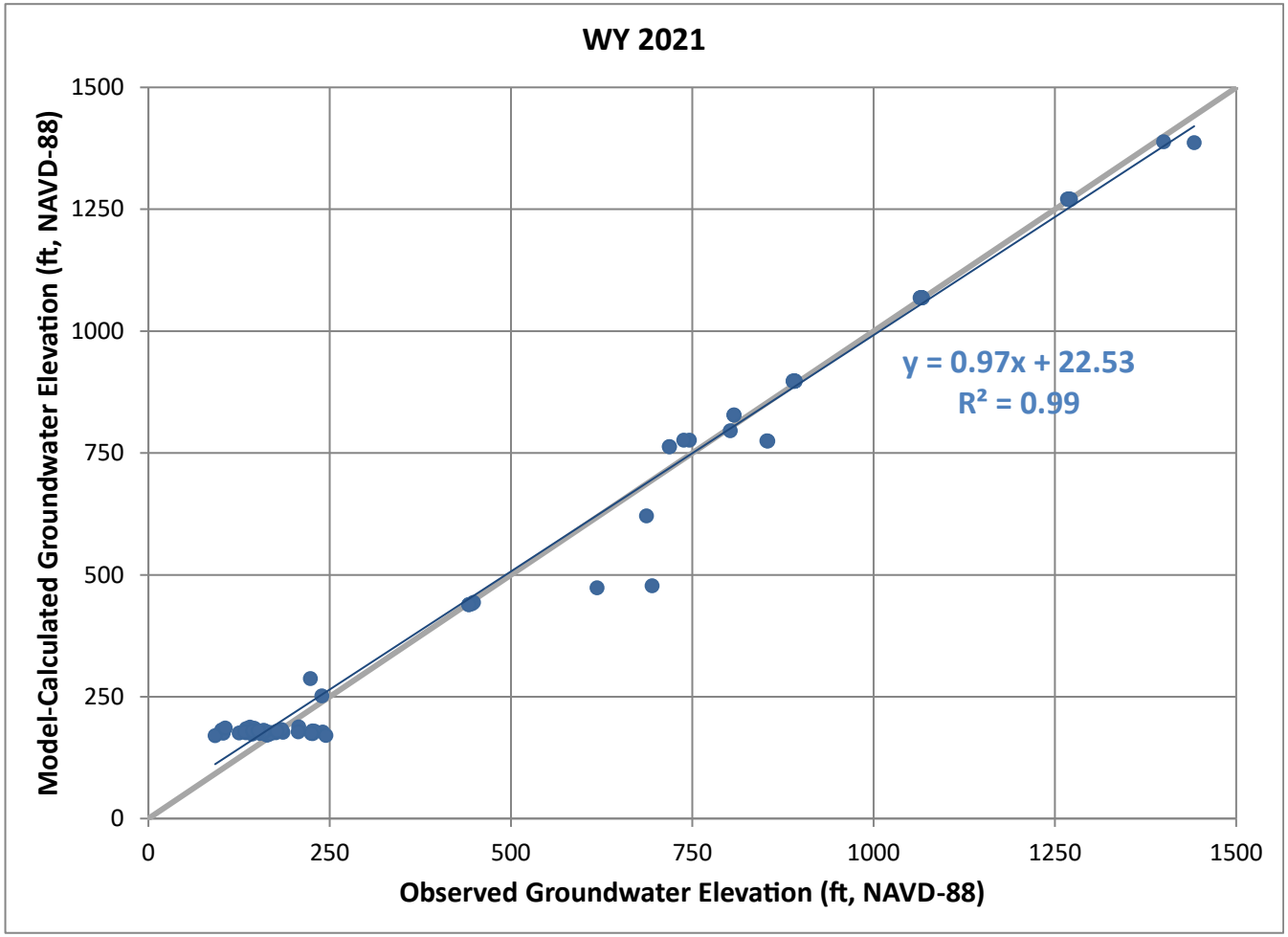
Figure 6

Path: X:\C20014.00\Maps\2022\02\Figure 6. Pumping.mxd



Legend

= Observed Groundwater Elevation

= 1 : 1

= Linear (Observed)

Abbreviations

ft	= acre-feet
NAVD-88	= North American Vertical Datum of 1988
WY	= water year

Notes

1. Wells plotted include calibration, verification, and representative monitoring wells with available water level data collected between 1 October 2020 and 30 September 2021.

Sources

1. White Wolf Groundwater Flow Model

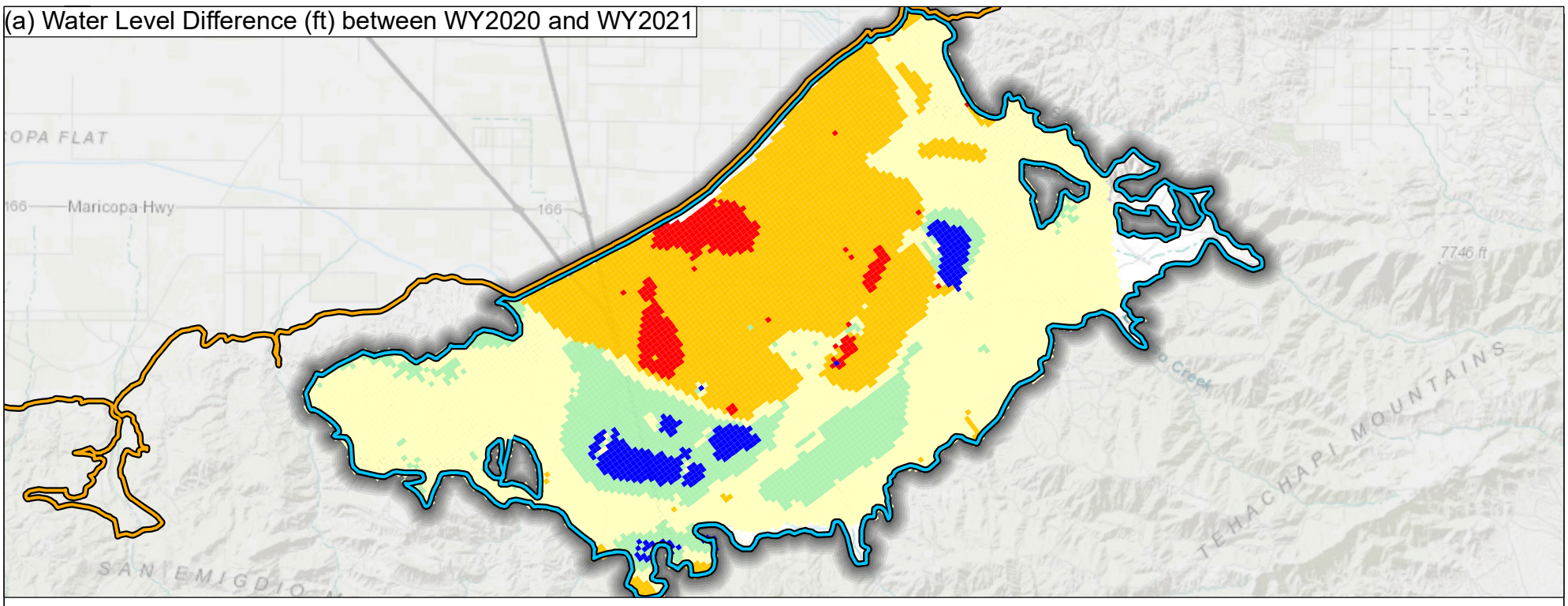
Model-Calculated versus Observed Water Level Elevations in Wells, WY 2021

White Wolf GSA
Kern County, California
February 2022
C20014.00

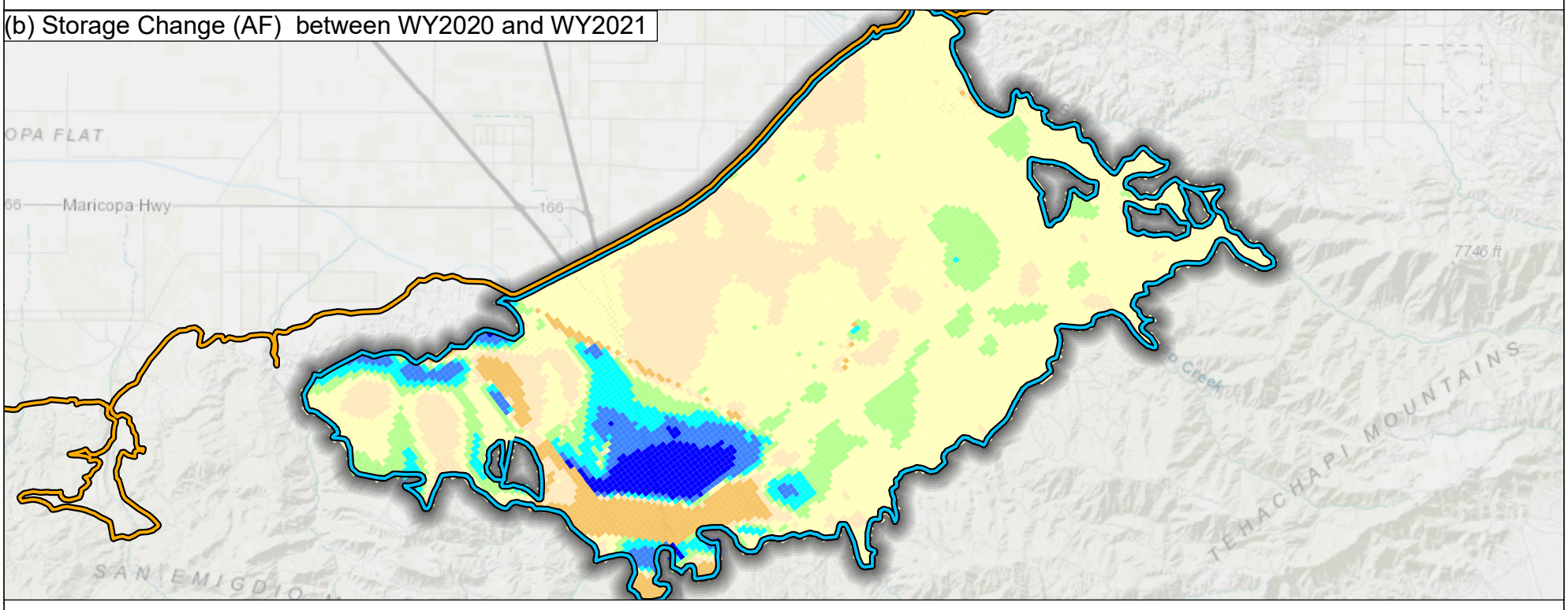
eki environment & water

Figure 7

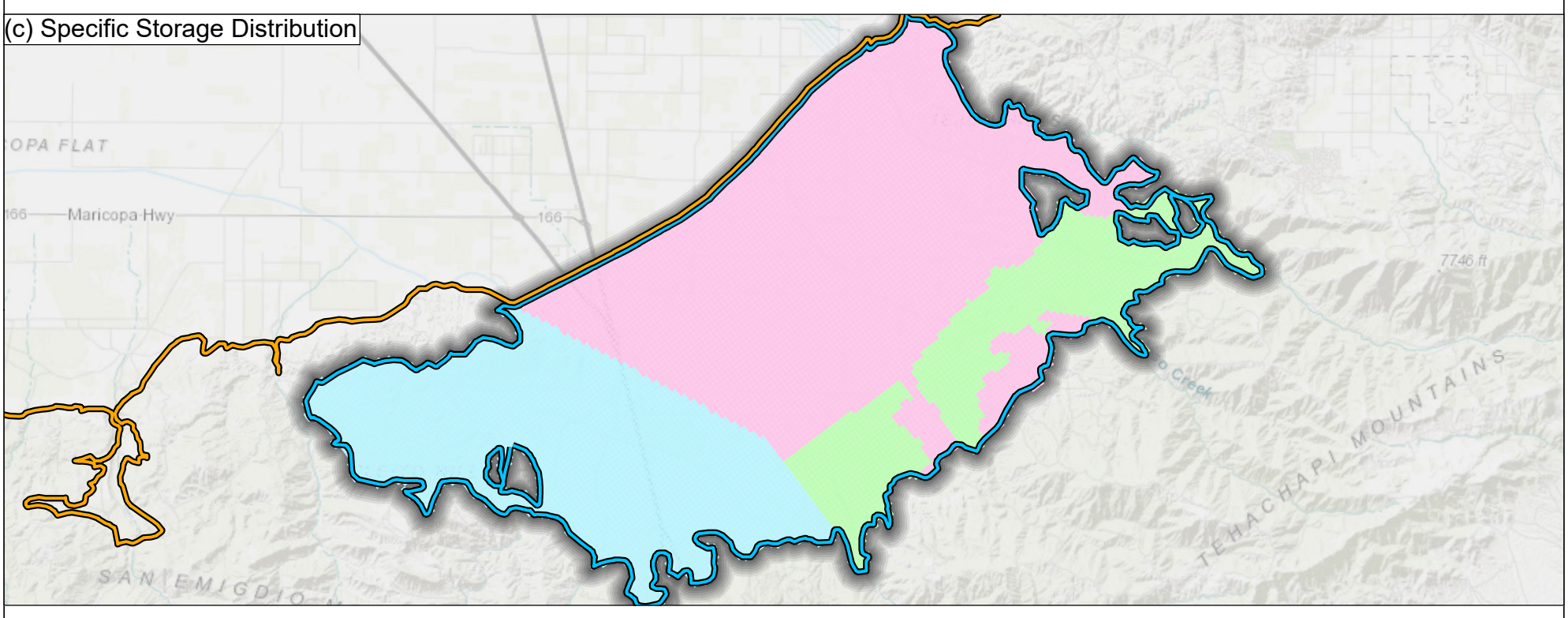
(a) Water Level Difference (ft) between WY2020 and WY2021



(b) Storage Change (AF) between WY2020 and WY2021



(c) Specific Storage Distribution



Legend

Water Level Difference (ft)
- <-10
- -9 - -2
- -1 - 0
- 1 - 2
- >3

Specific Storage
- 0.000002
- 0.0015
- 0.002

Storage Change (AF)
- < -25
- -25 - -10
- -10 - 0
- 0 - 10
- 10 - 25
- 25 - 50
- > 50

Groundwater Subbasin
- White Wolf
- Kern County

Abbreviations

DWR = California Department of Water Resources
WY = Water Year
AF = Acre Feet

Notes

1. All locations are approximate.
2. Water level difference and storage change are calculated as the difference between September 2021 and September 2020

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 3 March 2022.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater Bulletin 118 - Final Prioritization, dated February 2019. (https://dwr.maps.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37).
3. White Wolf Groundwater Flow Model

N

0 4 8

(Scale in Miles)

Model Estimated Groundwater Storage Change between WY 2020 and WY 2021

White Wolf GSA
Kern County, California
March 2022
B50001.05

Figure 8

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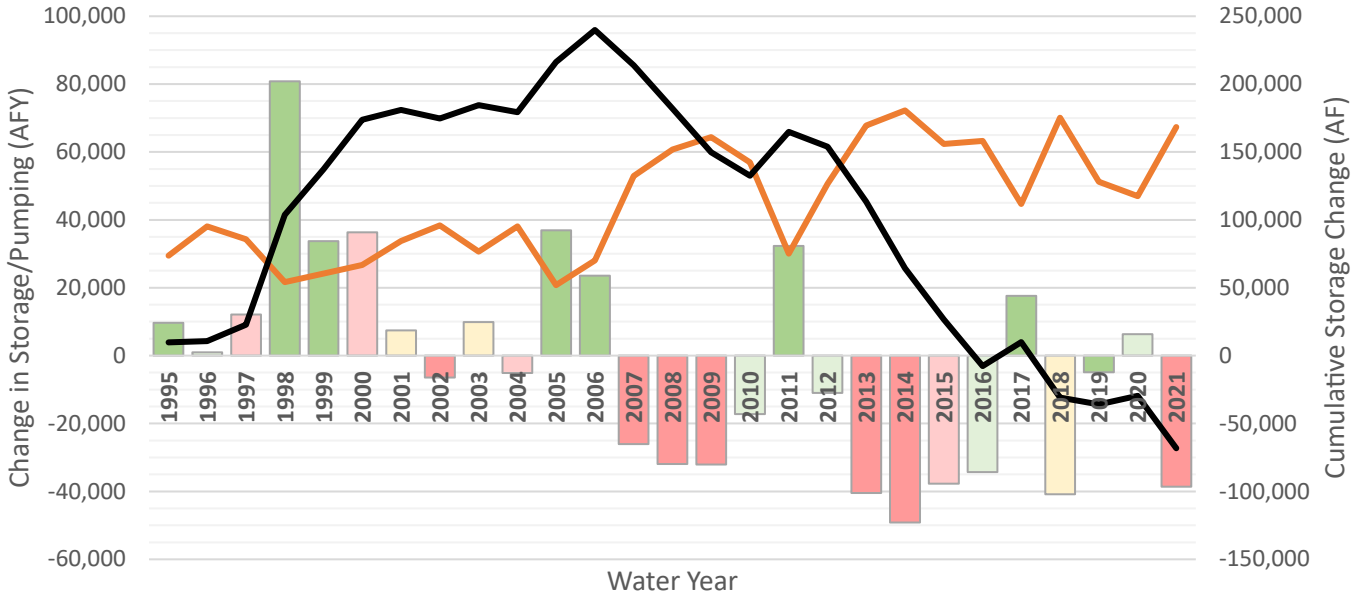
Path: X:\B50001.05\Maps\2022\03\Panel_StorageChange_WLDifference.mxd



Legend

Change in Groundwater Storage

DWR Water Year Type

- Wet
- Above Normal
- Below Normal
- Dry
- Critical

- Groundwater Use
- Cumulative Storage Change

Abbreviations

AF	= acre-feet
AFY	= acre-feet per year
DWR	= California Department of Water Resources
WY	= Water Year

Notes

1. Water Year is defined as the October of the previous year through September of the current year.
2. Water Year type for WY 2019, 2020, and 2021 calculated using same methodology as DWR, 2021.

Sources

1. DWR Water Year type for WY 1995-2018 from (DWR, 2021).

Annual Change in Groundwater Storage and DWR Water Year Type

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White Wolf GSA
Kern County, California
March 2021
C20014.00

Figure 9

APPENDIX A

Annual Report Submittal Checklist

Groundwater Sustainability Plan Annual Report Elements Guide

Basin Name	White Wolf Subbasin		
GSP Local ID			
California Code of Regulations - GSP Regulation Sections	***Groundwater Sustainability Plan Elements***	**Document *page number(s) that address the applicable GSP element.***	***Notes: Briefly describe the GSP element does not apply.***
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.	12, 15, 17, 21:22	
	Note: Authority cited: Section 10733.2, Water Code. Reference: Sections 10728, 10728.2, 10733.2 and 10733.8, Water Code.		
Article 7	**Annual Reports and Periodic Evaluations by the 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.	6:9, 27	
	(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.	28:29	
	(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.	30:31	
	(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.	12:13, 32	
	(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.	14:15	

California Code of Regulations - GSP Regulation Sections	*Groundwater Sustainability Plan Elements*	Document *page number(s) that address the applicable GSP element.*	*Notes: Briefly describe the GSP element does not apply.*
	(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.	16:17	
	(5) Change in groundwater in storage shall include the following:		
	(A) Change in groundwater in storage maps for each principal aquifer in the basin.	34	
	(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.	35	
	(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.	20:25	