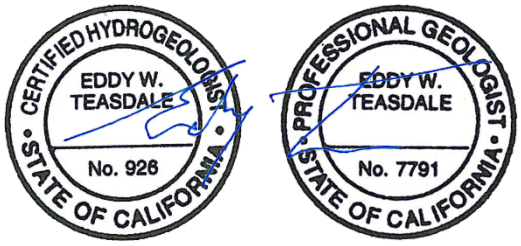
BOWMAN SUBBASIN GROUNDWATER SUSTAINABILITY PLAN ANNUAL REPORT - 2021

PREPARED FOR

TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION GSA

TEHAMA COUNTY GSA-BOWMAN

PREPARED BY



EDDY TEASDALE, PG, CHG
SUPERVISING HYDROGEOLOGIST
LUHDORFF AND SCALMANINI, CONSULTING ENGINEERS
500 1ST STREET
WOODLAND, CA 95695

Luhdorff & Scalmanini
Consulting Engineers

TABLE OF CONTENTS

Executive Summary ES-1
ES 1. Introduction ES-1
ES 2. Groundwater Elevations ES-3
ES 3. Water Supply and Use ES-3
ES 4. Groundwater Storage ES-4
ES 5. GSP Implementation Progress ES-4

1. General Information 1
1.1. Subbasin Setting 1
1.2. Report Contents 3
2. Groundwater Elevations §356.2(B)(1) 3
2.1. Groundwater Elevation Contours - §356.2(b)(1)(A) 3
2.2. Groundwater Elevation Hydrographs - §356.2(b)(1)(B) 13
3. Water Supply and Use 15
3.1. Groundwater Extraction - §356.2(b)(2) 15
3.2. Surface Water Supply - §356.2(b)(3) 16
3.3. Total Water Use by Sector - §356.2(b)(4) 16
4. Groundwater Storage 21
4.1. Groundwater Storage Maps - §356.2(b)(5)(A) 23
4.2. Subbasin Water Budget - §356.2(b)(5)(B) 23
5. GSP Implementation Progress - §356.2(B) 29
6. Conclusions 29
7. References 30

LIST OF TABLES

Table ES-1. Groundwater Use in Each Water Year by Water Use Sector and Source ES-3
Table ES-2. Surface Water Use in Each Water Year by Water Use Sector and Source ES-3
Table ES-3. Change in Groundwater Storage Based on Seasonal High Groundwater Levels ES-4
Table 3-1. Groundwater Use in Each Water Year by Water Use Sector 15
Table 3-2. Surface Water Use in Each Water Year by Water Use Sector and Source 16

TABLE OF CONTENTS

Table 3-3. Total Water Use in Each Water Year by Water Use Sector 16
Table 4-1. Change in Groundwater Storage Based on Seasonal High Groundwater Levels 21
Table 4-2. Change in Groundwater Storage Based on Tehama IHM Model 22

LIST OF FIGURES

Figure ES-1. Subbasin Location Map ES-2
Figure 1-1. Subbasin Location Map 2
Figure 2-1. Contours of Equal Groundwater Elevation Upper Aquifer - Fall 2020 5
Figure 2-2. Contours of Equal Groundwater Elevation Upper Aquifer - Fall 2021 6
Figure 2-3. Contours of Equal Groundwater Elevation Upper Aquifer - Spring 2020 7
Figure 2-4. Contours of Equal Groundwater Elevation Upper Aquifer - Spring 2021 8
Figure 2-5. Contours of Equal Groundwater Elevation Lower Aquifer - Fall 2020 9
Figure 2-6. Contours of Equal Groundwater Elevation Lower Aquifer - Fall 2021 10
Figure 2-7. Contours of Equal Groundwater Elevation Lower Aquifer - Spring 2020 11
Figure 2-8. Contours of Equal Groundwater Elevation Lower Aquifer - Spring 2021 12
Figure 2-9. RMS Network 14
Figure 3-1. Groundwater Extraction in the Upper Aquifer – Water Year 2020 17
Figure 3-2. Groundwater Extraction in the Upper Aquifer – Water Year 2021 18
Figure 3-3. Groundwater Extraction in Lower Aquifer – Water Year 2020 19
Figure 3-4. Groundwater Extraction in Lower Aquifer – Water Year 2021 20
Figure 4-1. Groundwater Change in Storage, Upper Aquifer – 2019-2020 24
Figure 4-2. Groundwater Change in Storage, Upper Aquifer – 2020-2021 25
Figure 4-3. Groundwater Change in Storage, Lower Aquifer – 2019-2020 26
Figure 4-4. Groundwater Change in Storage, Lower Aquifer – 2020-2021 27
Figure 4-5. Groundwater Extraction and Change in Groundwater Storage 28

APPENDICES

Appendix A Water Level Hydrographs of Representative Monitoring Wells for Groundwater Level

Appendix B Annual Report Water Level Data

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
af	Acre-Feet
amsl	Above mean sea level
CASGEM	California Statewide Groundwater Elevation Monitoring Online System
CVP	Central Valley Project
District	Tehama County Flood Control and Water Conservation District
DMS	Data Management System
DWR	Department of Water Resources
ft	feet
GAMA	Groundwater Ambient Monitoring and Assessment Program
GSP	Groundwater Sustainability Plan
GSA	Groundwater Sustainability Agency
MO	Measurable Objective
MT	Minimum Threshold
NAVD 88	North American Vertical Datum of 1988
PMAs	Projects and Management Actions
RMS	Representative Monitoring Sites
SGMA	Sustainable Groundwater Management Act
SMC	Sustainable Management Criteria
Subbasin	Bowman Groundwater Subbasin
SVSim	Sacramento Valley Groundwater-Surface Water Simulation Model
TNC	The Nature Conservancy
TSS	Technical Support Services
USGS	United States Geological Survey

EXECUTIVE SUMMARY

ES 1. Introduction

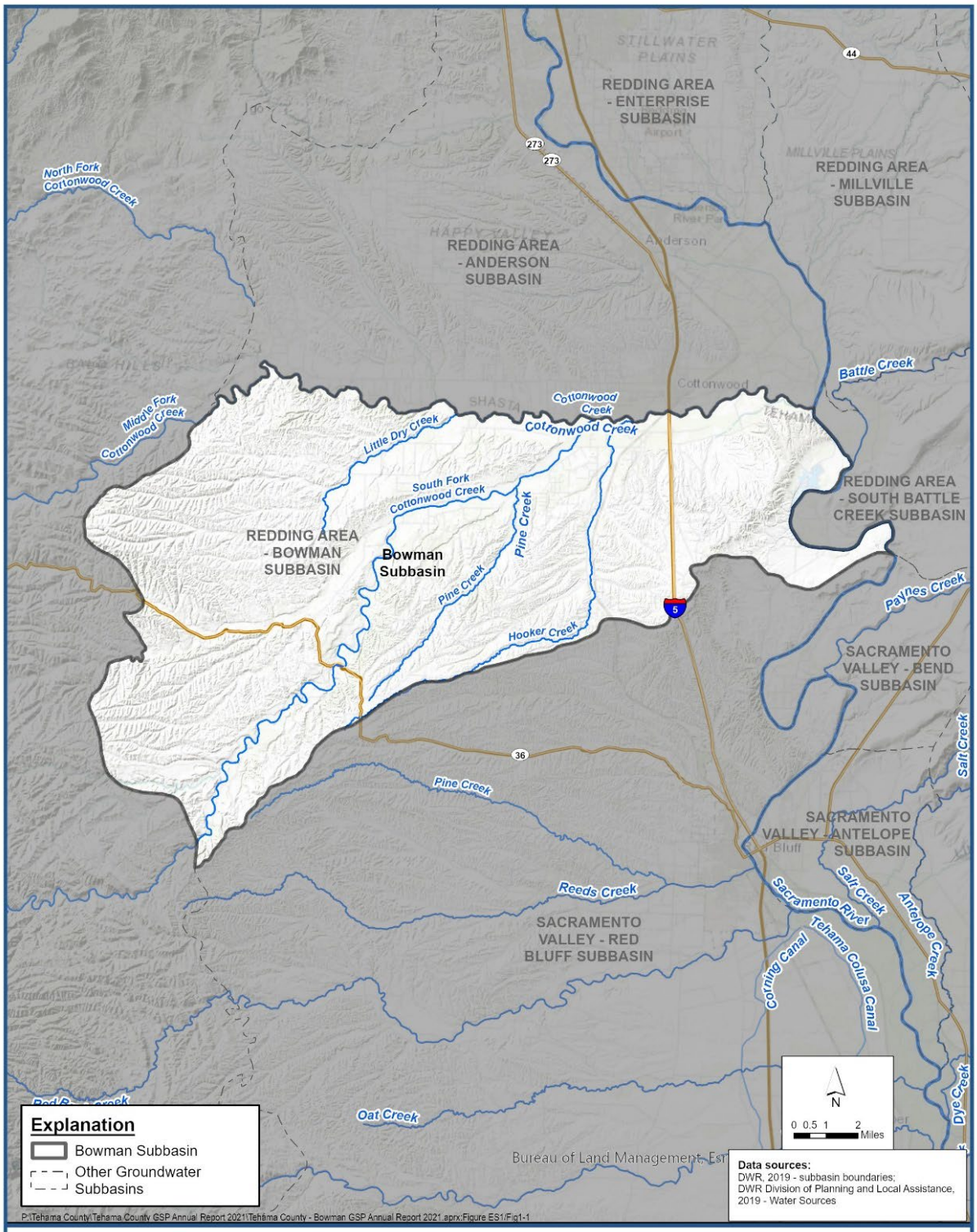
The annual report for the Bowman Subbasin (Subbasin) (5-006.01) was prepared on behalf of the Tehama County Flood Control and Water Conservation District (Tehama County FCWCD) Groundwater Sustainability Agency (GSA) to fulfill the statutory requirements of the Sustainable Groundwater Management Act (SGMA) legislation (§10728) and regulatory requirements developed by the California Department of Water Resources (DWR) included in the Groundwater Sustainability Plan (GSP) Regulations (§354.40 and §356.2). The Regulations require the GSA to submit an Annual Report to DWR by April 1st following the reporting year (October through September).

The Bowman Subbasin covers 122,500 acres and is located in the Redding Area Groundwater Basin (Figure ES-1). Bowman is one of seven (7) groundwater subbasins within Tehama County. The Tehama County FCWCD is the exclusive GSA for six (6) of those subbasins: Antelope, Bend, Bowman, Los Molinos, Red Bluff, and South Battle Creek. The seventh, the Corning Subbasin, extends into Glenn County, and the GSP for that subbasin is being developed in a coordinated effort between the Tehama County FCWCD and the Corning Sub-basin GSA.

This report is the first Annual Report prepared to support the adopted Bowman Subbasin GSP submitted in January 2022. This Annual Report includes data elements for the current and previous reporting water years (2020-2021). Pursuant to GSP Regulations, the Annual Report includes:

1. Groundwater Elevation Data
2. Water Supply and Use
3. Change in Groundwater Storage
4. GSP Implementation Progress

All data and information in the annual report are for the Bowman Subbasin. This Annual Report coincides with one of the most severe and extensive droughts that has ever gripped the western United States. In December 2021, as the final GSP was being assembled, drought conditions throughout most of California, including in this subbasin were classified as “exceptional,” the most extreme classification defined by the U.S. Drought Monitor. Historically, observed impacts during exceptional drought generally include: widespread water supply shortages, depleted surface water supplies, extremely low federal and state surface water deliveries, curtailment of water rights, extremely high surface water prices, increased groundwater pumping to satisfy water demands, dry groundwater wells, increased well drilling and deepening, increased pumping costs, wildfire, decreased recreational opportunities, and poor water quality, among other potential impacts reported by the U.S. Drought Monitor. All of these conditions were experienced to some degree across California in 2021 and, at least in part, within the Subbasin.



TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Subbasin Area Map

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure ES-1

ES 2. Groundwater Elevations

Groundwater elevation data in the Upper and Lower Aquifers for the 2020-2021 water years were analyzed. The water year is defined as October through September. Groundwater elevation contour maps for seasonal low and seasonal high-water levels were prepared for the 2020-2021 water years. Four Representative Monitoring Site (RMS) wells exist that monitor groundwater levels in the Upper Aquifer while three RMS wells are screened in the Lower Aquifer. Seasonal high groundwater elevations were all above the measurable objectives during the 2020-2021 water years.

ES 3. Water Supply and Use

Table ES-1 includes groundwater use data by sector for the 2020 and 2021 water years. The agricultural sector had the greatest increase in use going from 6,200 af in 2020 to 6,800 af in 2021 whereas native vegetation decreased from 1,800 to 1,500 af. Urban water use remained largely unchanged increasing slightly from 1,200 to 1,300 af.

Table ES-1. Groundwater Use in Each Water Year by Water Use Sector and Source

Sector	2020 (D) (af)	2021 (C) (af)
Agricultural	6,200	6,800
Urban	1,200	1,300
Native Vegetation	1,800	1,500
Total	**9,200**	**9,600**

D: Dry Sacramento Valley Water Year as defined by DWR.

C: Critical Sacramento Valley Water Year as defined by DWR.

Surface water use by sector for the 2020 and 2021 water years is presented in **Table ES-2**. Both urban and native vegetation sectors contributed to no surface water use in either 2020 or 2021. Agricultural surface water use remained the same between years staying at 14,000 during both years.

Table ES-2. Surface Water Use in Each Water Year by Water Use Sector and Source

Sector	2020 (D) (af)		2021 (C) (af)	
	Supply Source			
	CVP	Local	CVP	Local
Agricultural	18,000	-4,000	18,000	-4,000
Urban	0	0	0	0
Native Vegetation	0	0	0	0
Total	**14,000**		**14,000**	

D: Dry Sacramento Valley Water Year as defined by DWR.

C: Critical Sacramento Valley Water Year as defined by DWR.

ES 4. Groundwater Storage

Changes in groundwater storage values were calculated based on water years for the Upper and Lower Aquifers. Groundwater storage change was estimated for the 2020 water year based on the change in seasonal high groundwater levels between the 2019 and 2020 water years. Likewise, 2021 storage change was calculated based on the change in seasonal high groundwater levels between 2020 and 2021 water years. Change in storage calculations are described further in Sections 2.1. **Table ES-3** presents the annual storage change values for each principal aquifer.

Table ES-3. Change in Groundwater Storage Based on Seasonal High Groundwater Levels

Aquifer	2020 (D) (af)	2021 (C) (af)
Upper Aquifer	-6,000	-15,000
Lower Aquifer	8,000	-17,000
Total	**2,000**	**-31,000**

D: Dry Sacramento Valley Water Year as defined by DWR.

C: Critical Sacramento Valley Water Year as defined by DWR.

ES 5. GSP Implementation Progress

Implementation of the GSP focused primarily on enactment of projects and management actions (PMAs). PMAs were developed to manage groundwater conditions in the Subbasin and achieve groundwater sustainability objectives described in the GSP. Due to the recent adoption of the GSP, no progress towards the implementation of PMAs has occurred. In coordination with DWR the subbasin is scheduled for an Airborne Electromagnetic (AEM) Survey. Additionally, the GSA has scheduled a survey to better establish the vertical datum of one RMS well.

1. GENERAL INFORMATION

The annual report for the Bowman Subbasin (Subbasin) (5-006.01) was prepared on behalf of the Tehama County Flood Control and Water Conservation District (Tehama County FCWCD), Groundwater Sustainability Agency (GSA) to fulfill the statutory requirements of the Sustainable Groundwater Management Act (SGMA) legislation (§10728) and regulatory requirements developed by the California Department of Water Resources (DWR) included in the Groundwater Sustainability Plan (GSP) Regulations (§354.40 and §356.2). The Regulations require the GSA to submit an Annual Report to DWR by April 1 following the reporting year (Oct. through Sept.).

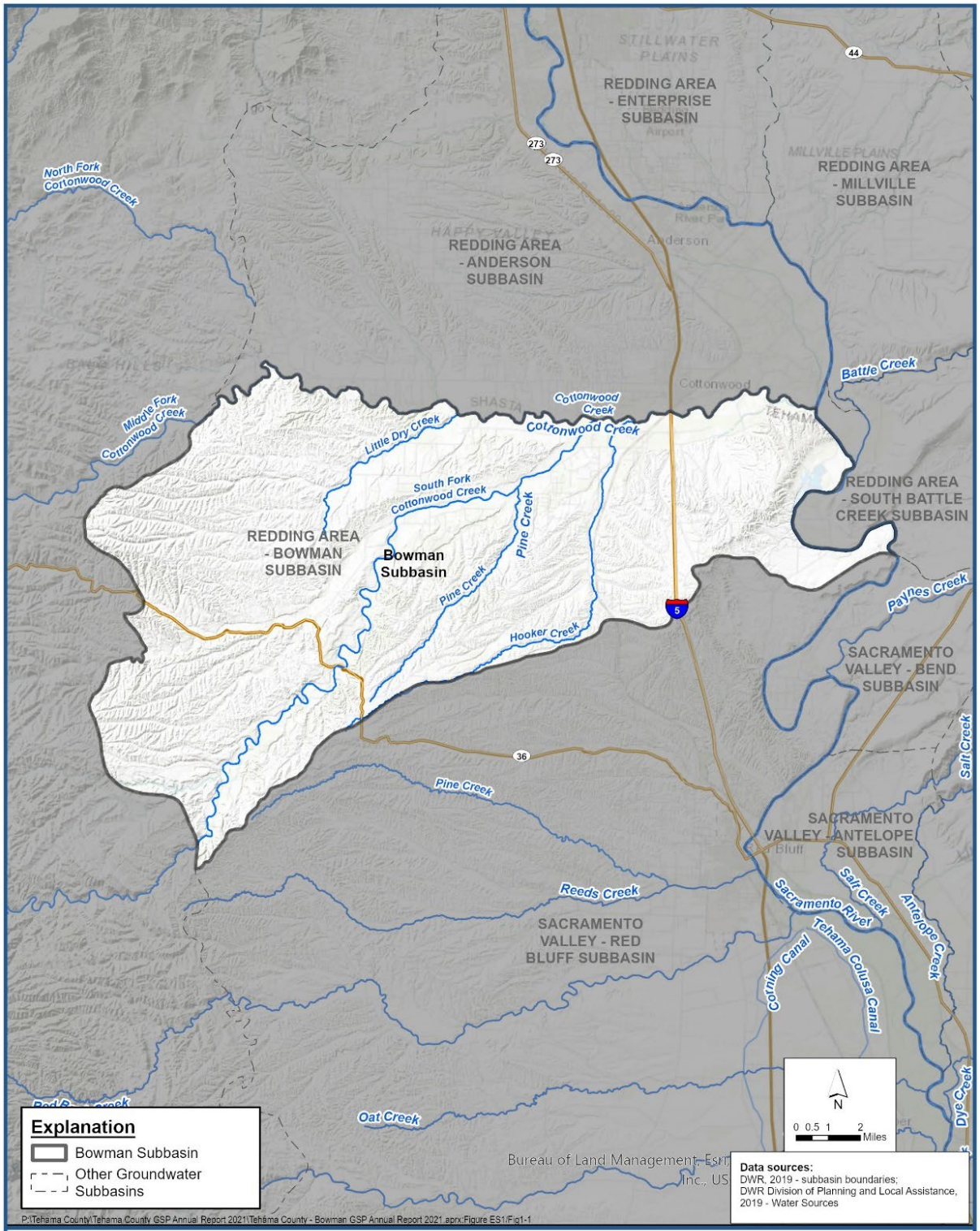
1.1. Subbasin Setting

The Bowman Subbasin (DWR Subbasin No. 5-006.01) covers 122,500 acres and is located in the Redding Area Groundwater Basin. The lateral extent of the Subbasin is defined by the Subbasin boundaries provided in Bulletin 118 (DWR, 2018 It is bounded on the north by the Anderson Subbasin (DWR Subbasin No. 5-006.03), on the south by the Red Bluff Subbasin (DWR Subbasin No. 5-021.50), on the east by the South Battle Creek Subbasin (DWR Subbasin No. 5-006.06), and on the west by the Northern Coast Mountain Ranges. The northern and eastern boundaries of the Subbasin generally follow Cottonwood Creek and the Sacramento River, respectively, and the western boundary generally aligns with the Northern Coast Mountain Range (**Figure 1-1**).

native and riparian vegetation (94%) is the leading source of land use within the Subbasin with approximately 5% and 1% dedicated to agriculture and urban use, respectively. The Subbasin's agricultural water users rely on both surface water and groundwater to irrigate their crops.

Fresh groundwater bearing geologic deposits in the Subbasin are subdivided from previous studies into two units: The Upper Aquifer and the Lower Aquifer (DWR, 2003; DWR, 2004). The two-aquifer designation is based on an examination of time-series groundwater elevation hydrographs, electric resistivity data from geophysical logs, lithologic logs, well construction details, and review of previous studies in the Subbasin. Generally, semi-confined, and confined aquifer conditions are encountered at depth and unconfined conditions are seen in the shallower porous media. The complexity of the geologic materials and the formations makes it difficult to define a singular widespread aquitard or distinctive change in geologic materials separating an Upper and Lower aquifer. To delineate between areas with a higher likelihood of confined conditions, well construction data throughout the Subbasin were examined. Water bearing geologic units in the Upper Aquifer include the Quaternary formations and the upper portions of the Tehama and Tuscan Formations. Wells screened in the Upper Aquifer are largely for domestic purposes. The depth to the bottom of the Upper Aquifer is approximately 350-450 ft bgs.

The Lower Aquifer is defined as the freshwater bearing geologic units throughout the Subbasin from the bottom of model layer 5 at approximately 350-450 ft bgs, to the bottom of the Subbasin. The aquifer has confined to semi-confined conditions. Water bearing geologic units include the lower portions of the Tehama and Tuscan Formations. Wells screened in the Lower Aquifer are largely for non-domestic purposes.



TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Subbasin Area Map

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 1-1

1.2. Report Contents

This report is the first Annual Report prepared to support the adopted Bowman Subbasin GSP submitted in January 2022. As a result, the Annual Report includes data elements for the current reporting water year (WY), 2021, as well as a "bridge year", 2020. The historical water budget period of the GSP was 1990-2018, and 2019 was considered as a current water budget period. The bridge year closes the gap between the water budget period presented in the GSP and current reporting water year. Data elements presented in this report refer to water years (12-month periods of October through September) unless otherwise noted. Pursuant to of the GSP Regulations, the Annual Report includes:

1. Groundwater Elevation Data
2. Water Supply and Use
3. Change in Groundwater Storage
4. GSP Implementation Progress

2. GROUNDWATER ELEVATIONS §356.2(B)(1)

Currently 32 wells are monitored as part of a broad network for groundwater levels and 7 are RMS wells assigned Sustainability Management Criteria. The wells are measured at least in the spring and fall each year. Groundwater elevation data in each of the principal aquifers for the 2020 and 2021 water years were analyzed. Hydrographs for these wells are included in Appendix A. Appendix B includes a copy of the monitoring data used to generate this Annual Report pursuant to GSP regulations (§354.40). Groundwater elevation contour maps for seasonal low and seasonal highwater levels were prepared for the 2020 and 2021 water years. Groundwater level data collected at RMS and other wells used to develop groundwater contours and RMS well hydrographs are collected by DWR, USGS, TNC and the District and records are maintained by GAMA and CASGEM. Records of groundwater elevations are also maintained in the GSA's DMS.

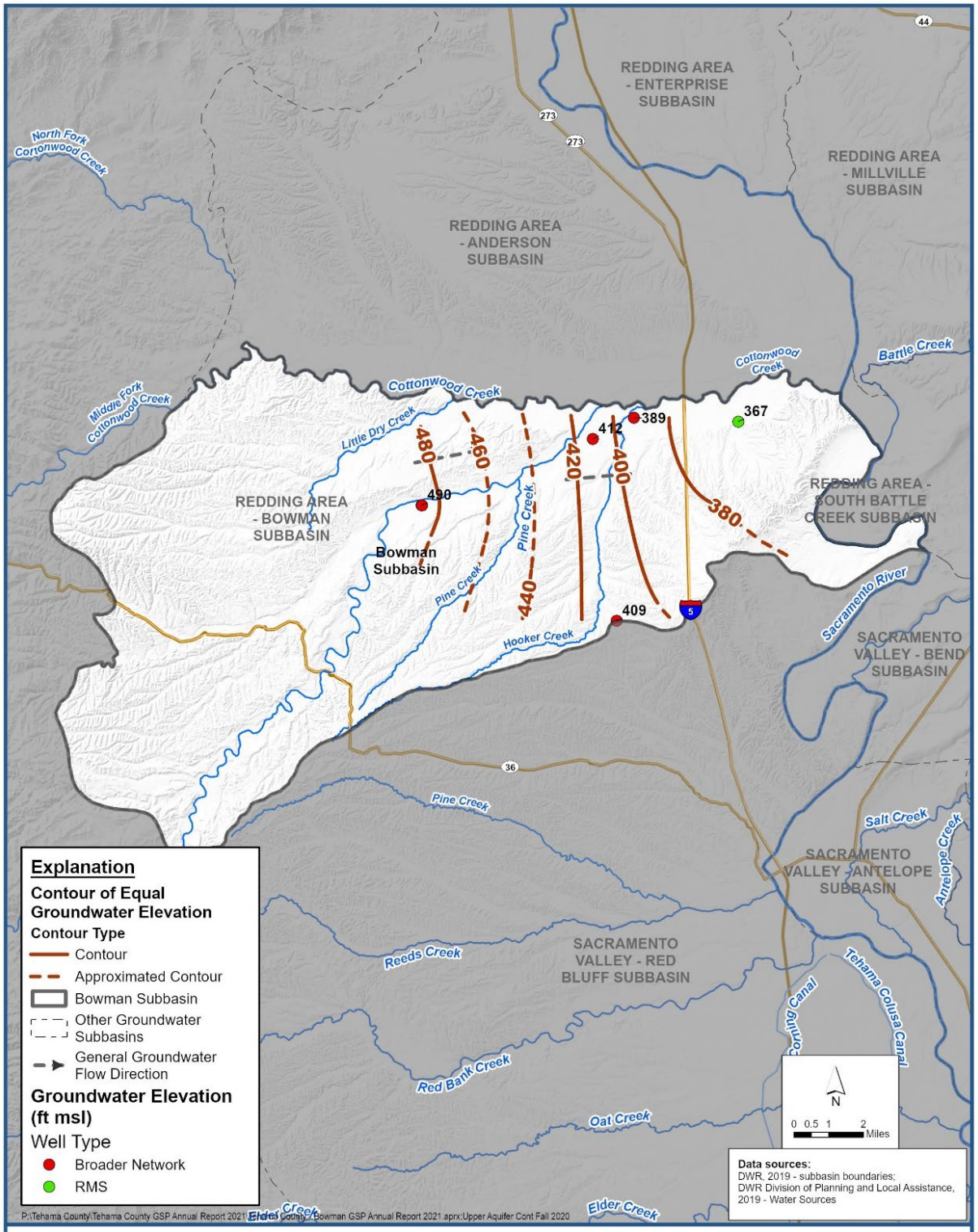
2.1. Groundwater Elevation Contours - §356.2(b)(1)(A)

Seasonal high and seasonal low groundwater elevation contour maps for the 2020-2021 water years are presented for the Upper Aquifer on **Figures 2-1** through **2-4** and in the Lower Aquifer in **Figures 2-5** through **2-8**. The seasonal high contours were prepared based on observed maximum springtime (February-May) water levels, while the seasonal low contours were prepared based on minimum water levels measured in July-October. Due to the limited number of wells in the subbasin and to resolve data gaps near the edge of the subbasin wells neighboring the Bowman subbasin were included in the contouring process. Wells were not displayed in contour maps if data did not exist at that well during the mapping period. Contours are shown solid if there is good confidence in the contour placement whereas contours are shown dashed

if their position is inferred from data yet generally representative of the contour's true location. Contours are not drawn if confidence in contours in is poor. Most notably this occurs on the far east side of the subbasin near RMS well Bow-5L. Contours were not extended to this well due to the great distance to other monitoring wells, and the fact that this wells vertical datum has not been properly survey at this time. For these reasons this well was previously excluded when creating contours for the GSP and is excluded from contours in this Annual Report as well. Once the vertical datum of this well is properly surveyed this well will become more important for contouring. Groundwater elevations on the contour maps are shown as feet above mean sea level (ft amsl) based on the North American Vertical Datum of 1988 (NAVD 88).

The contour maps illustrate several general features of the groundwater flow system in the Bowman Subbasin, including:

- Strong gradients indicating groundwater flow moving west to east except for spring 2020 in the Lower Aquifer where strong gradients show groundwater moving north around Hooker Creek.
- High water levels along Cottonwood Creek near the Sacramento River in the Upper Aquifer except during Fall 2020.



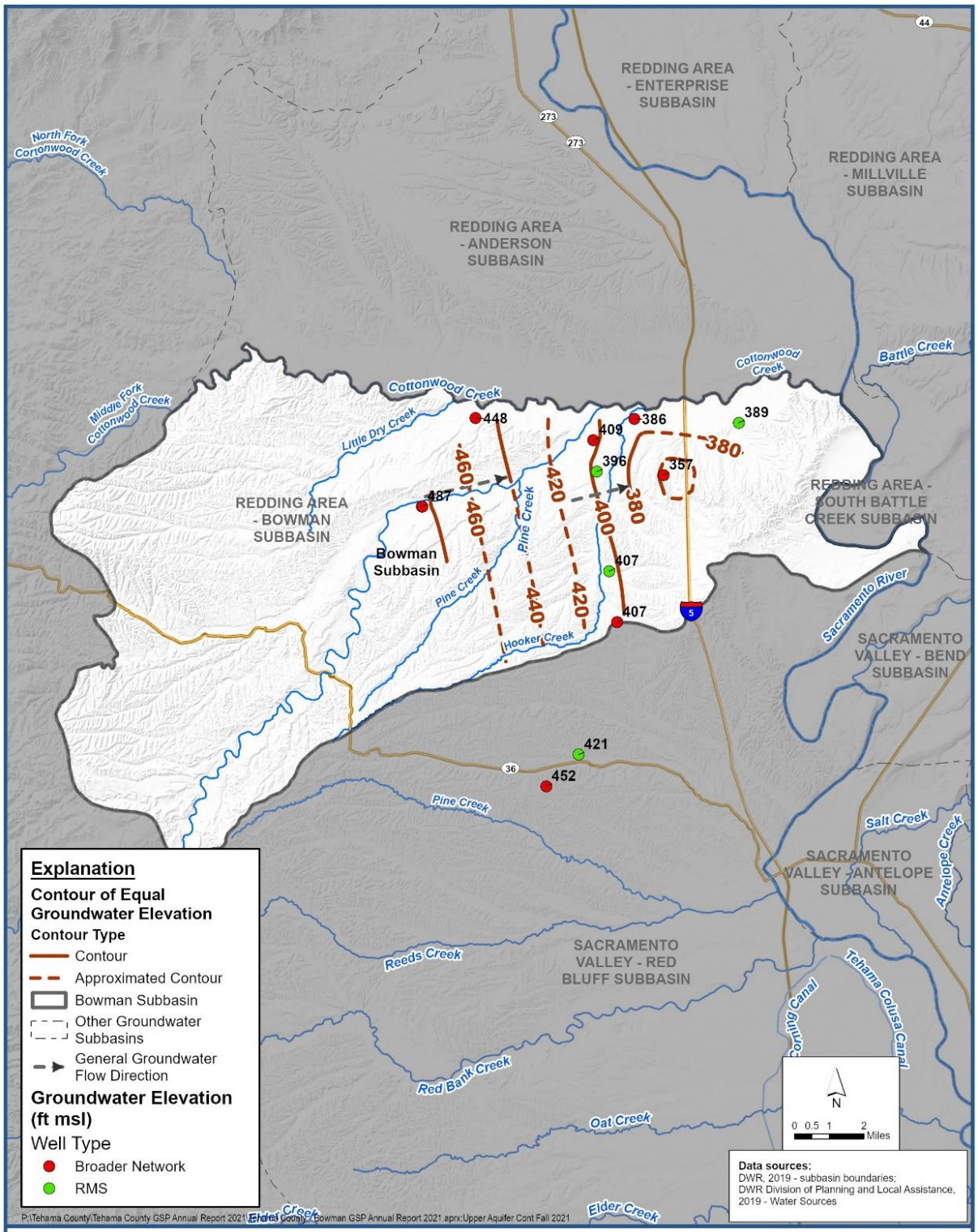
TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Contours of Equal Groundwater Elevation, Upper Aquifer - Fall 2020

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 2-1



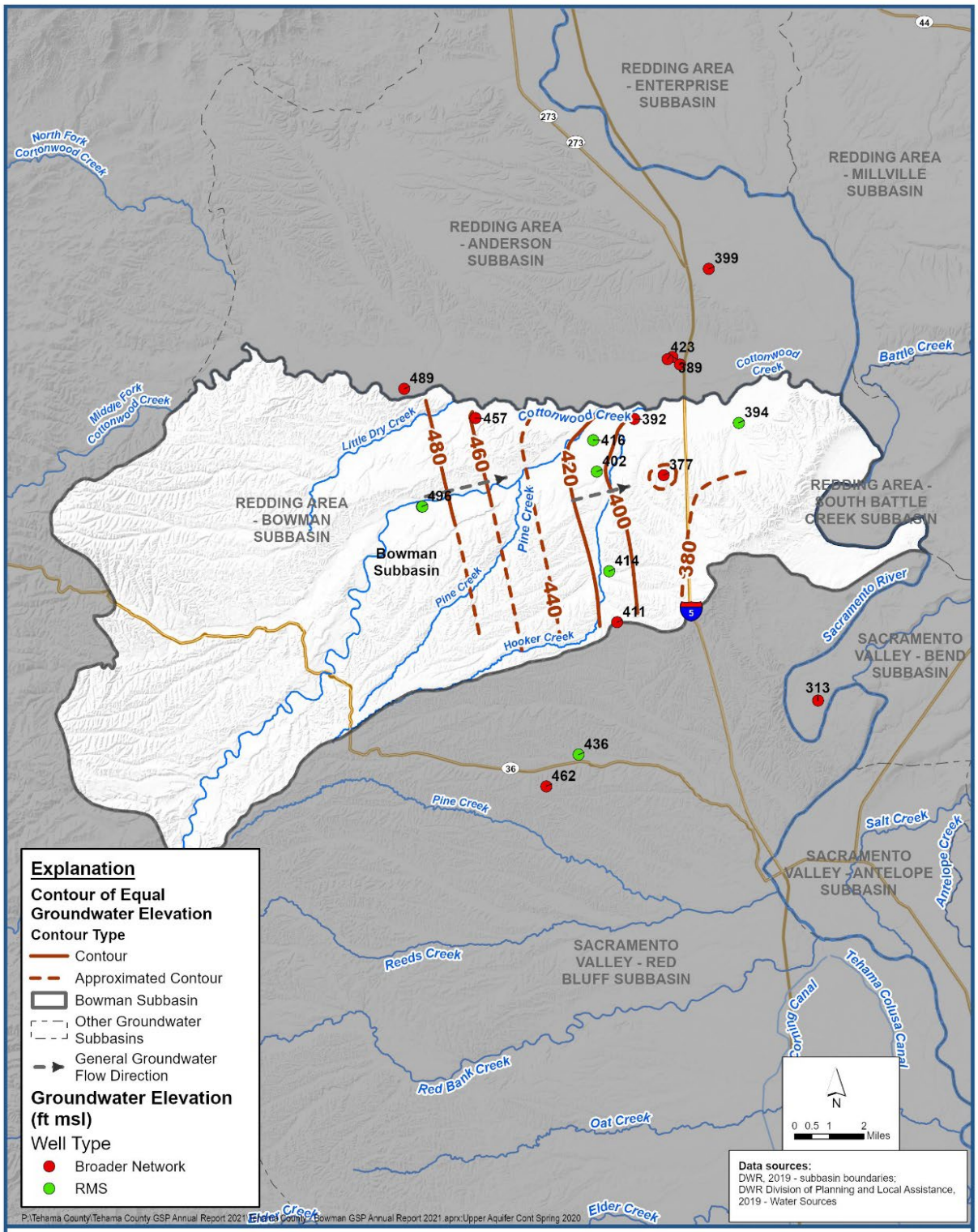
TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Contours of Equal Groundwater Elevation, Upper Aquifer - Fall 2021

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 2-2



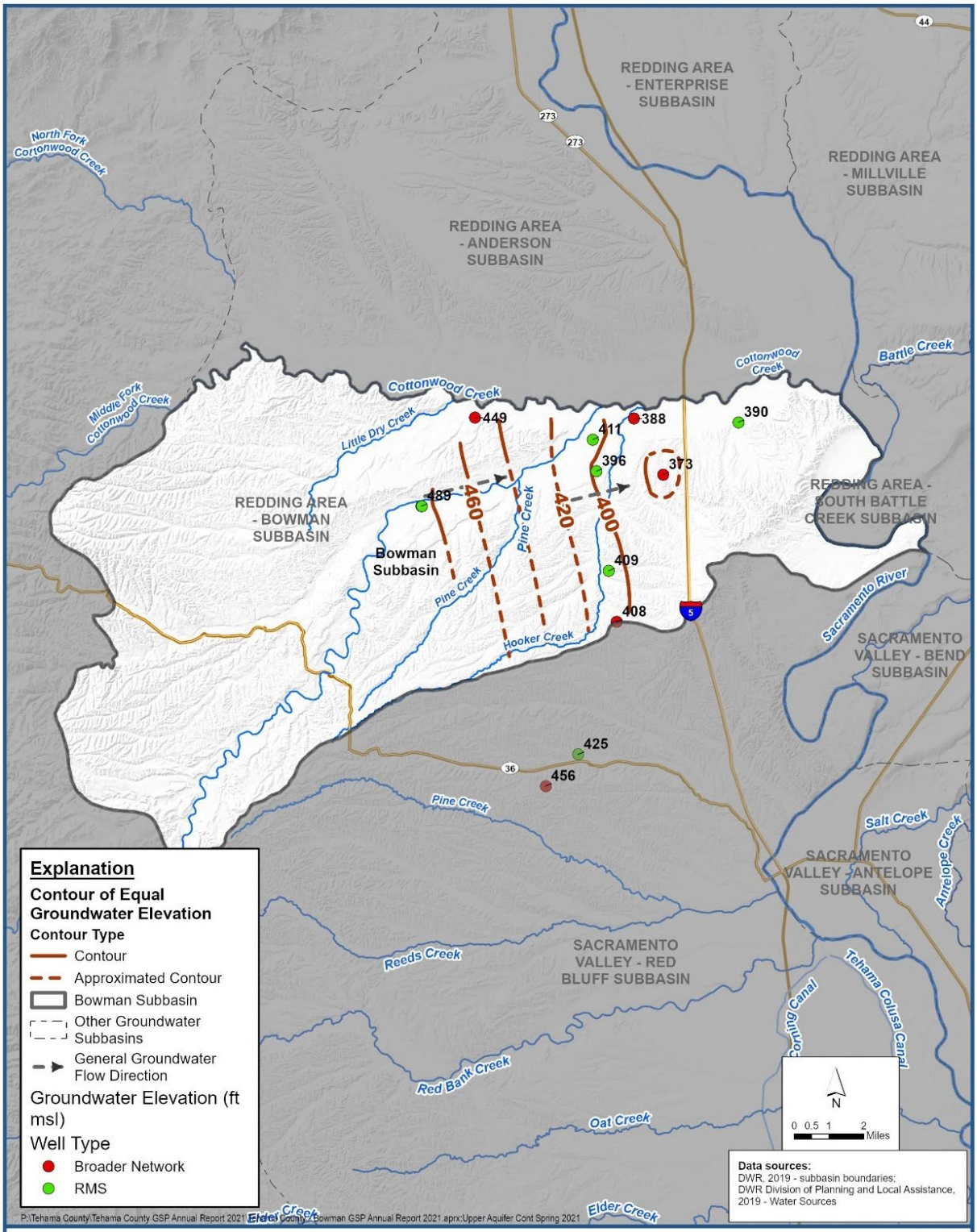
TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Contours of Equal Groundwater Elevation, Upper Aquifer - Spring 2020

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 2-3



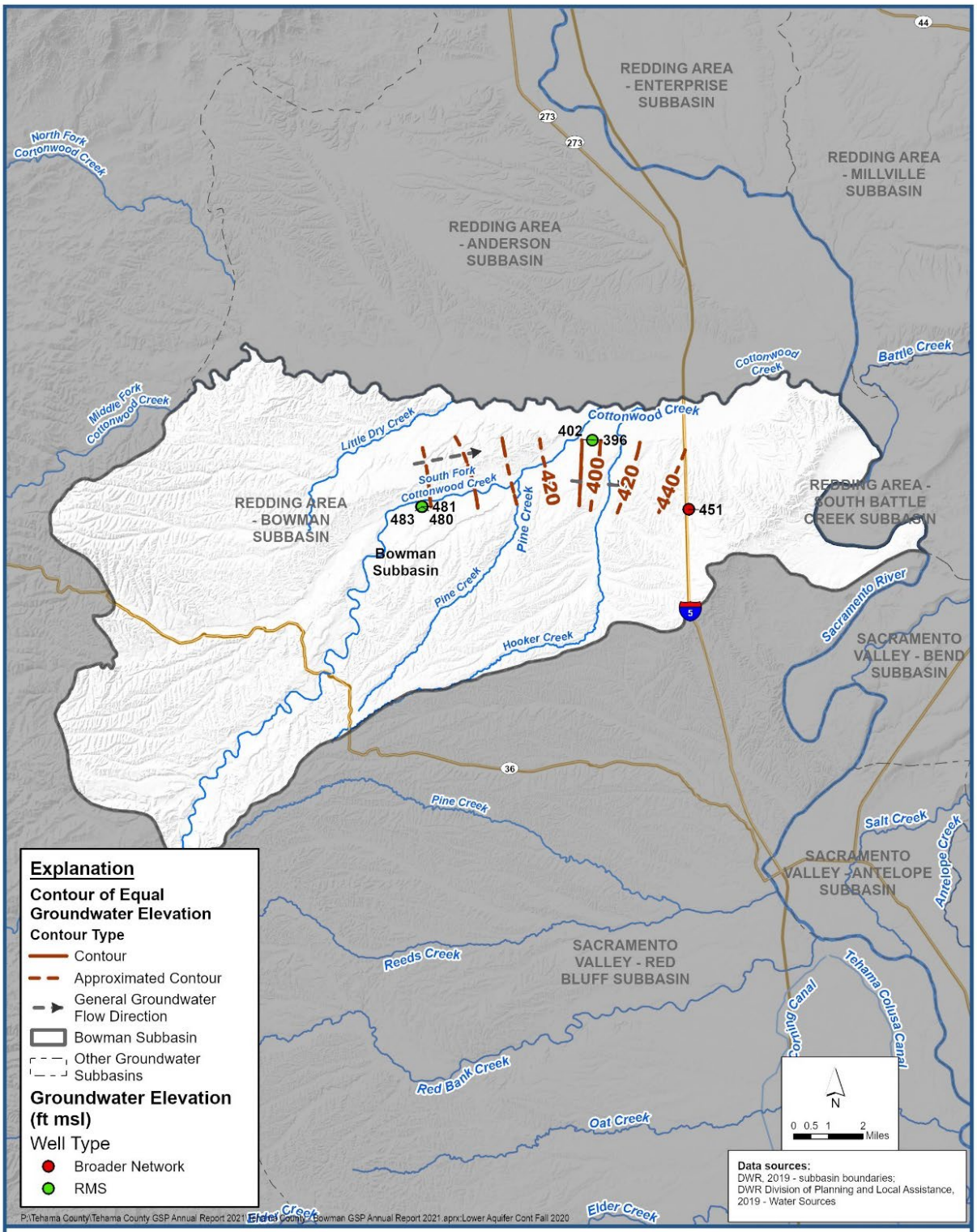
TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Contours of Equal Groundwater Elevation, Upper Aquifer - Spring 2021

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 2-4



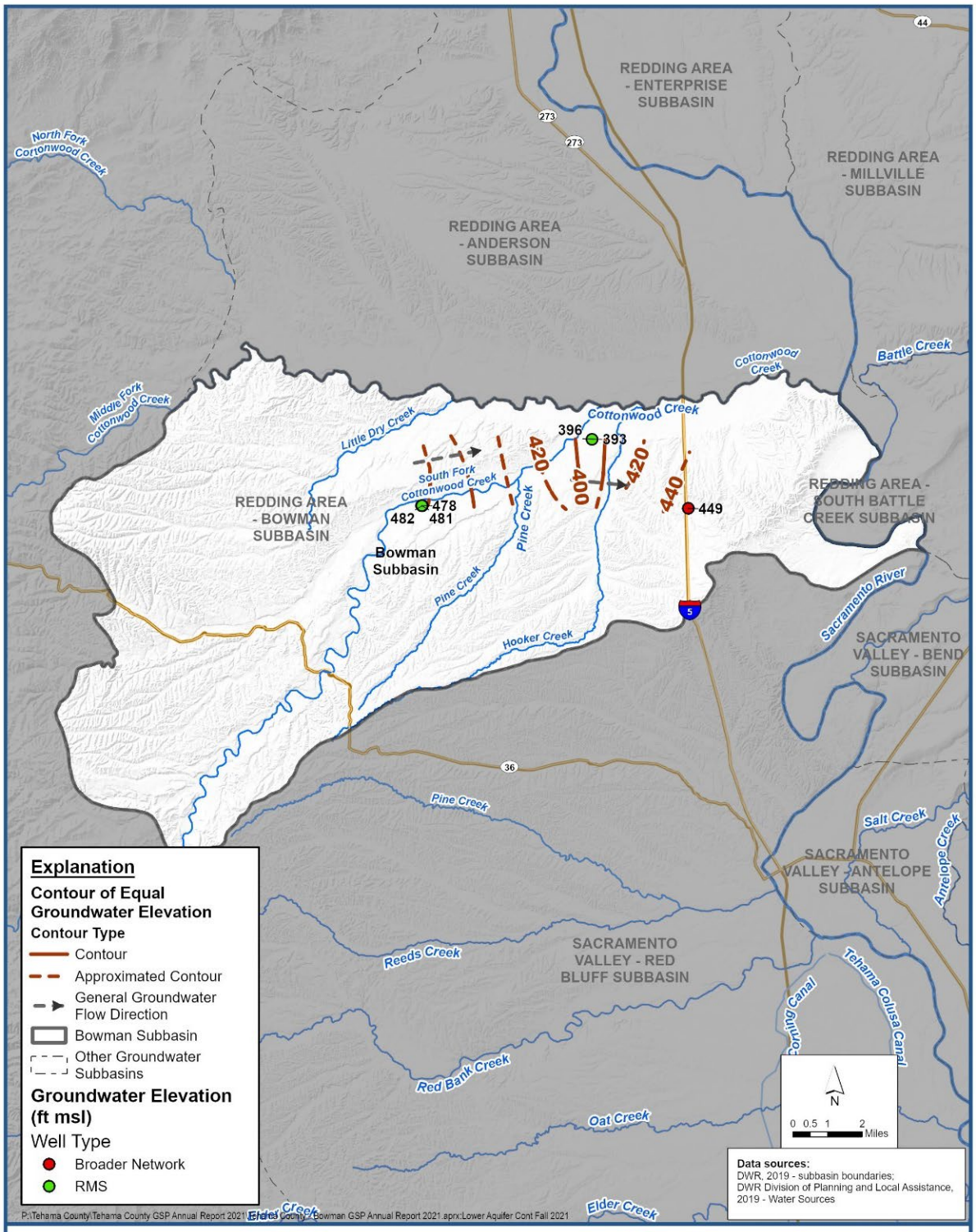
TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Contours of Equal Groundwater Elevation, Lower Aquifer - Fall 2020

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 2-5



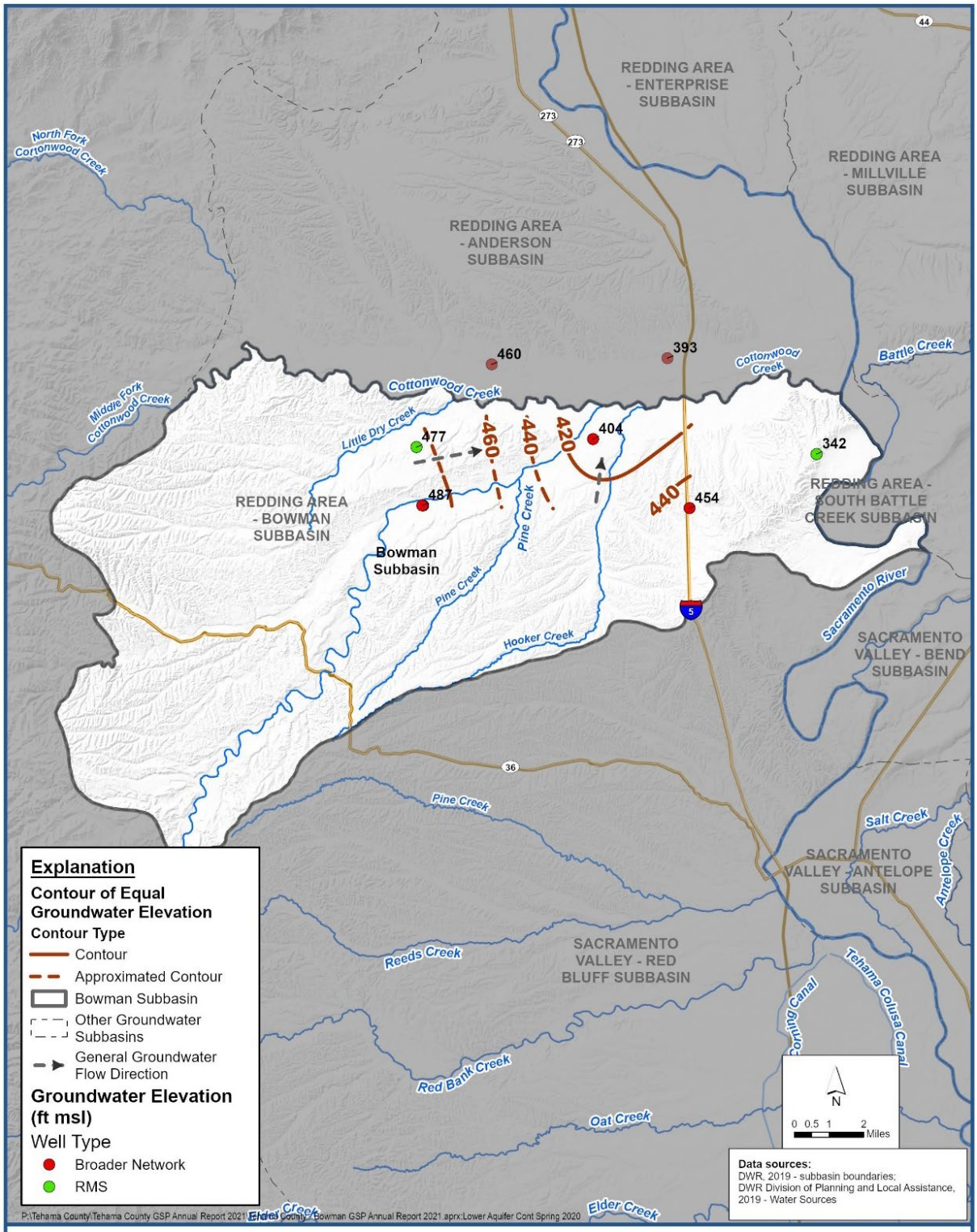
TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Contours of Equal Groundwater Elevation, Lower Aquifer - Fall 2021

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 2-6



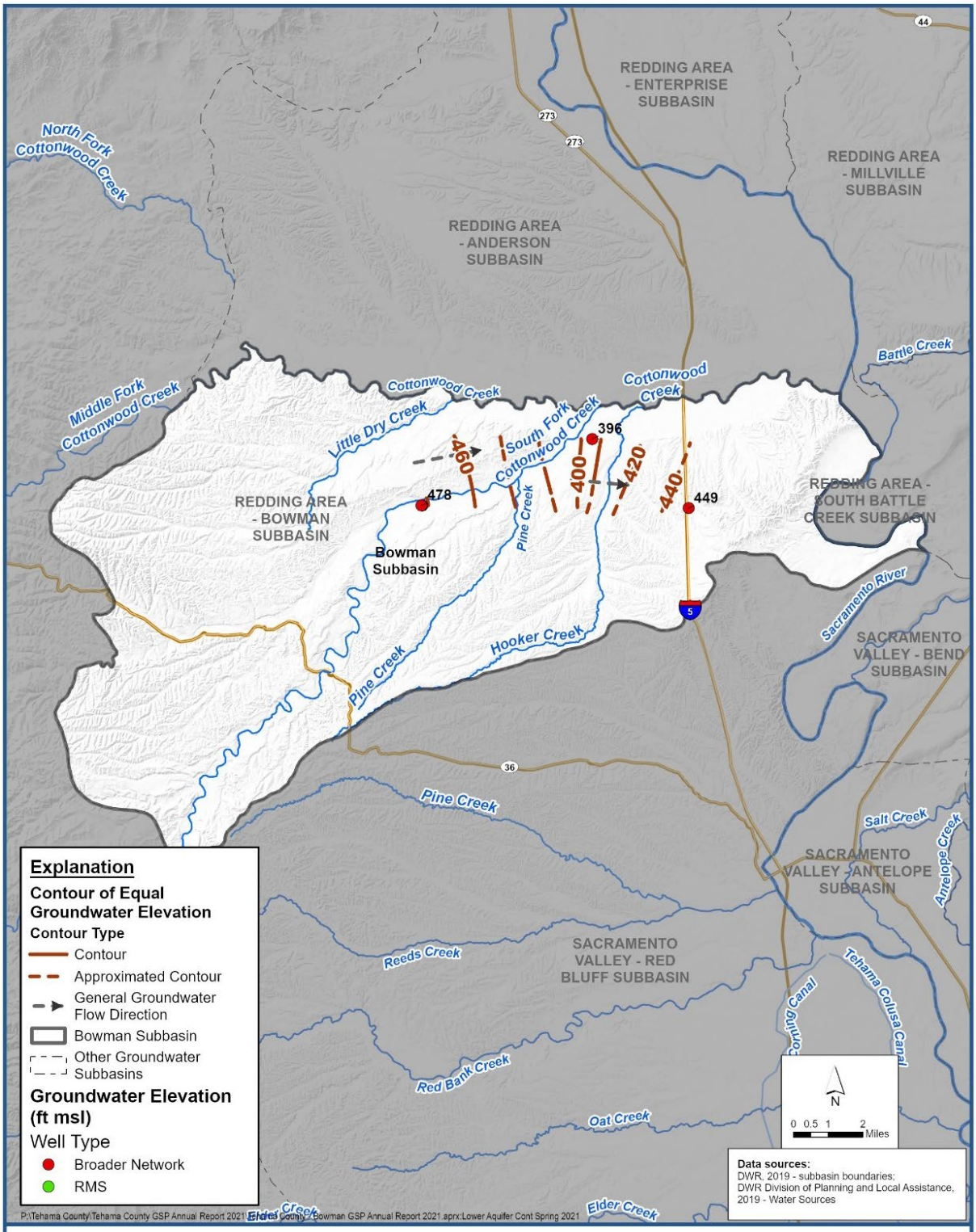
TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Contours of Equal Groundwater Elevation, Lower Aquifer - Spring 2020

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 2-7



TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Contours of Equal Groundwater Elevation, Lower Aquifer - Spring 2021

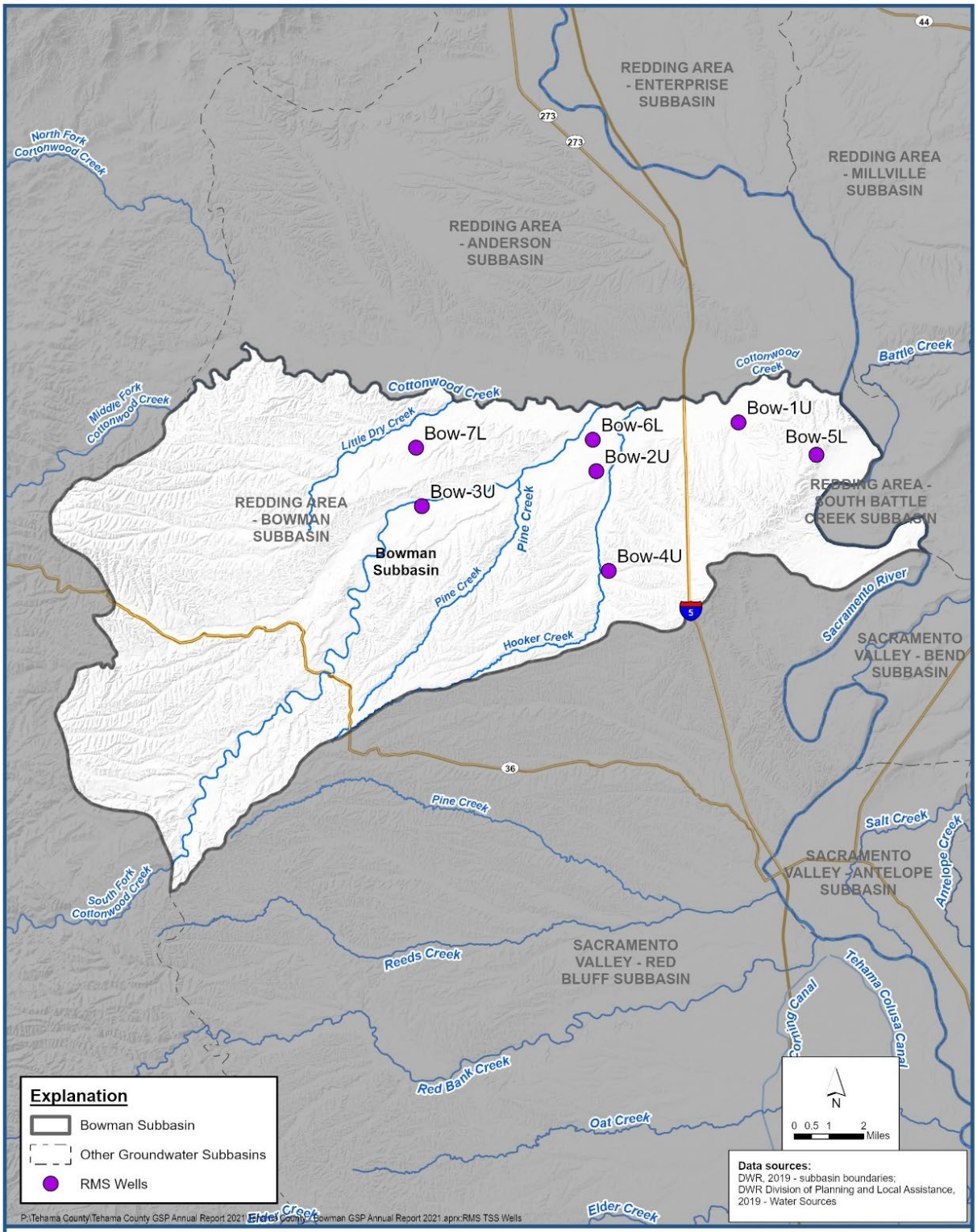
Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 2-8

2.2. Groundwater Elevation Hydrographs - §356.2(b)(1)(B)

Hydrographs of groundwater elevations were prepared for all seven RMS wells in both the Upper and Lower Aquifers. RMS wells are distributed throughout the Subbasin to provide broad spatial coverage of the Subbasin. **Figure 2-9** shows the distribution of the current RMS wells. The process for selecting these sites is documented in the Bowman Subbasin GSP. Long-term fluctuations in groundwater levels (and groundwater in storage) occur when there is an imbalance between the volume of water recharged into the aquifer and the volume of water removed from the aquifer, either by extraction or natural discharge to surface water bodies. If, over a period of years, the amount of water recharged to the aquifer exceeds the amount of water removed from the aquifer, then groundwater levels will increase and groundwater storage increases (i.e., positive change in storage). Conversely, if, over time, the amount of water removed from the aquifer exceeds the amount of water recharged then groundwater levels decline. These long-term changes can be linked to various factors including increased or decreased groundwater extraction or variations in recharge associated with wet or dry hydrologic cycles.

The seven RMS wells in the Upper and Lower Aquifers, all had seasonal high groundwater elevations above the minimum thresholds (MT) during the 2020 and 2021 water year. Wells rarely show seasonal low water levels that fall below the measurable objectives (MO) and have always maintained seasonal highs above this level.



TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

RMS Network

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 2-9

3. WATER SUPPLY AND USE

Water supply and use information are presented below. Water use data by sector (required per §356.2) is summarized in Section 3 and categorized by groundwater extraction, surface water supply and total supply using the best data available. Water use sectors are broadly identified as agricultural, urban, and native vegetation land uses.

3.1. Groundwater Extraction - §356.2(b)(2)

Groundwater extraction by water use sector is reported for the 2020 and 2021 water years. Groundwater extraction data was estimated from modeled results using the Tehama IHM model. The model estimates groundwater extraction based on available land use information, climate data and access to surface water. The Tehama IHM model was developed to support GSP development through adaptation of the Sacramento Valley Groundwater-Surface Water Simulation Model (SVSim, version BETA 3-19-2020). Direct measurements of groundwater extraction data could not be used in the model calibration to determine accuracy due to the limited number of observations. Instead, water levels and stream flows were used to calibrate the model resulting in a normalized root mean of squared residual error of 5%. Additional information about the Tehama IHM development process is described in the GSP (Appendix 2-J). Groundwater extraction in the Bowman Subbasin for water years 2020 and 2021 in both the Upper and Lower Aquifers was estimated on an element-basis by simulating groundwater pumping. The general location and volume of groundwater extractions are presented in **Figures 3-1** through **3-4**. **Table 3-1** includes groundwater use data by sector for each year. In all annual report tables numbers are rounded to two significant digits consistent with the uncertainty associated with the methods and sources used in the analysis. The exception to this rule applies to totals of other numbers presented in the tables. The 2020 water year is denoted as “D” (Dry) and the 2021 year as “C” (Critical). The agricultural sector had the greatest increase in use from 6,200 af to 6,800 af whereas native vegetation decreased from 1,80 to 1,500 af. Urban groundwater use remained largely unchanged increasing slightly from 1,200 to 1,300 af. The increase in agricultural sector use is likely due to the increased water demand of crops during dryer conditions as well as the need for growers to offset decreased surface water delivers during droughts.

Table 3-1. Groundwater Use in Each Water Year by Water Use Sector

Sector	2020 (D) (af)	2021 (C) (af)
Agricultural	6,200	6,800
Urban	1,200	1,300
Native Vegetation	1,800	1,500
Total	**9,200**	**9,600**

D: Dry Sacramento Valley Water Year as defined by DWR.

C: Critical Sacramento Valley Water Year as defined by DWR.

3.2. Surface Water Supply - §356.2(b)(3)

Surface water use by sector and source for the 2020 and 2021 water years is presented in **Table 3-2**. Surface water data was obtained from real world observations when available and was otherwise estimated from model results. Both urban and native vegetation sectors utilized no surface water in either 2020 or 2021. Agricultural surface water use remained the same staying at 14,000 during both years. CVP supplied 18,000 af however the full diversion was not used which is represented by a -4,000 af flux from local supplies.

Table 3-2. Surface Water Use in Each Water Year by Water Use Sector and Source

Sector	2020 (D) (af)		2021 (C) (af)	
	Supply Source			
	CVP	Local	CVP	Local
Agricultural	18,000	-4,000	18,000	-4,000
Urban	0	0	0	0
Native Vegetation	0	0	0	0
Total	**14,000**		**14,000**	

D: Dry Sacramento Valley Water Year as defined by DWR.

C: Critical Sacramento Valley Water Year as defined by DWR.

3.3. Total Water Use by Sector - §356.2(b)(4)

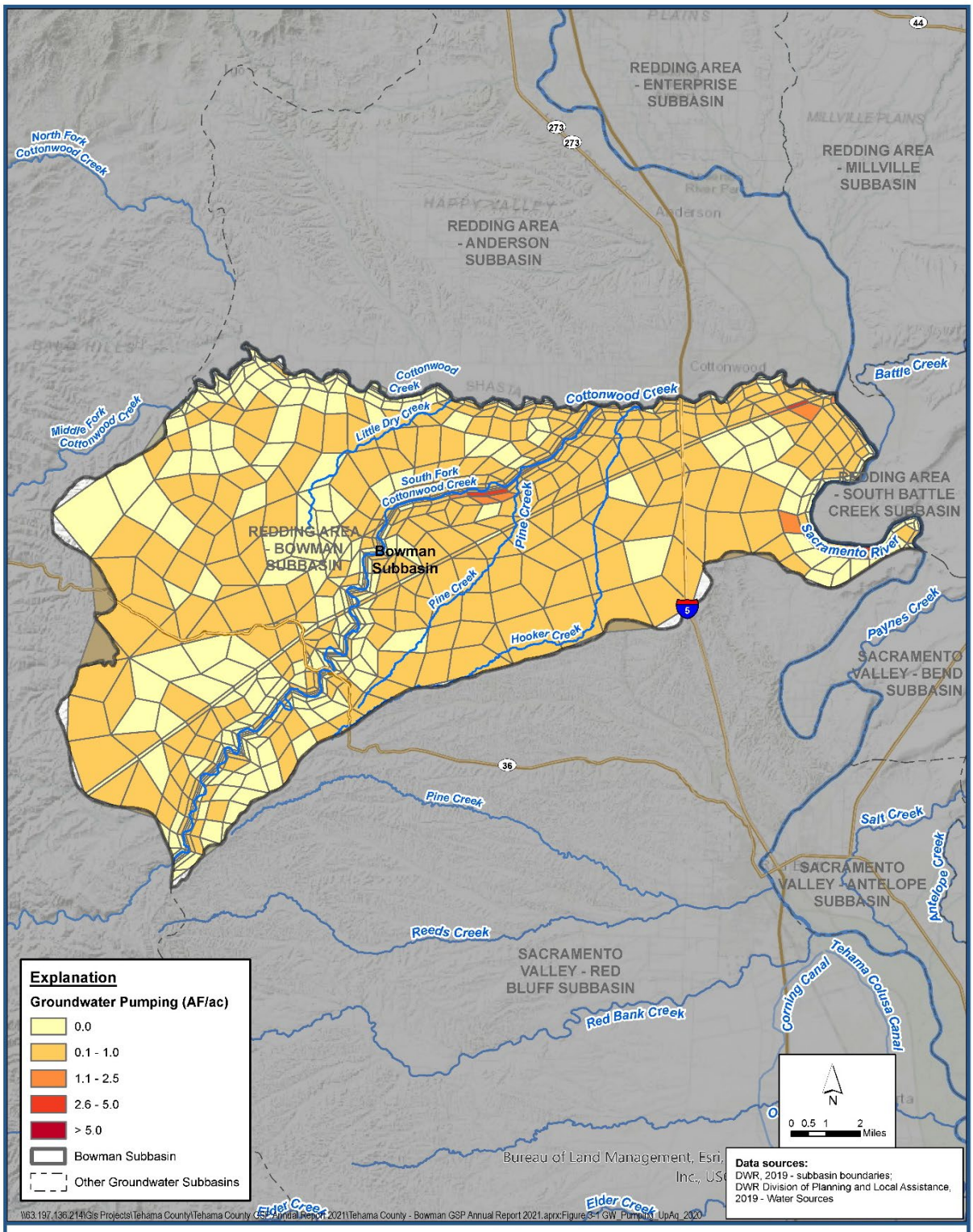
Total water use by sector for the 2020 and 2021 water years is included in **Table 3-3**. Total water use is summarized from results presented in Section 3.1 and 3.2. Total agricultural water use remained nearly the same between years starting at 20,200 af in 2020 and ending at 20,800 af in 2021. Urban water use saw a similar change going from 1,200 af in 2020 to 1,300 in 2021 and native vegetation water use declined from 1,800 af to 1,500 af. Overall water use slightly increased going from 23,200 af in 2020 to 23,600 af in 2021.

Table 3-3. Total Water Use in Each Water Year by Water Use Sector

Sector	2020 (D) (af)	2021 (C) (af)
Agricultural	20,200	20,800
Urban	1,200	1,300
Native Vegetation	1,800	1,500
Total	**23,200**	**23,600**

D: Dry Sacramento Valley Water Year as defined by DWR.

C: Critical Sacramento Valley Water Year as defined by DWR.



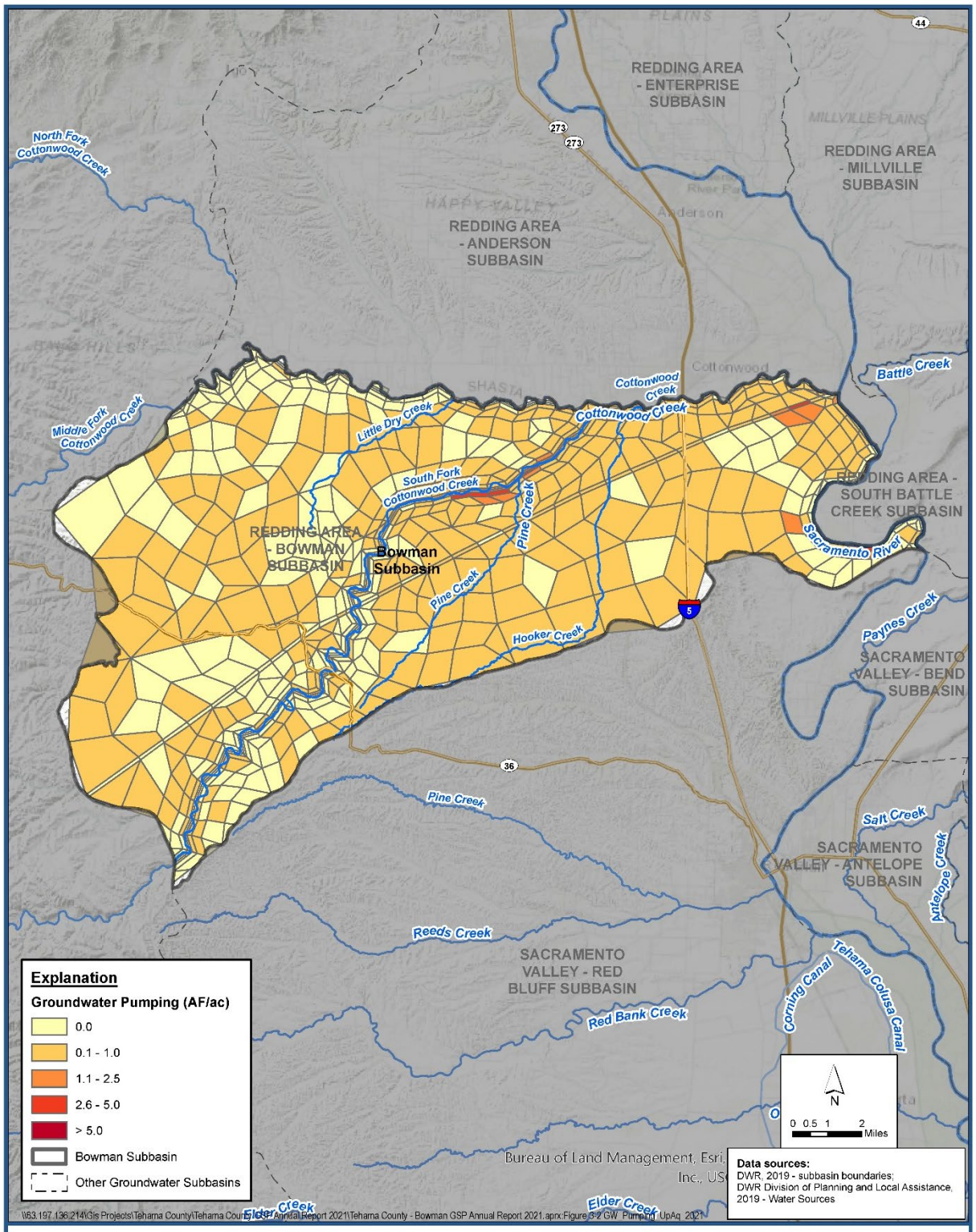
TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Groundwater Extraction in the Upper Aquifer - Water Year 2020

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 3-1



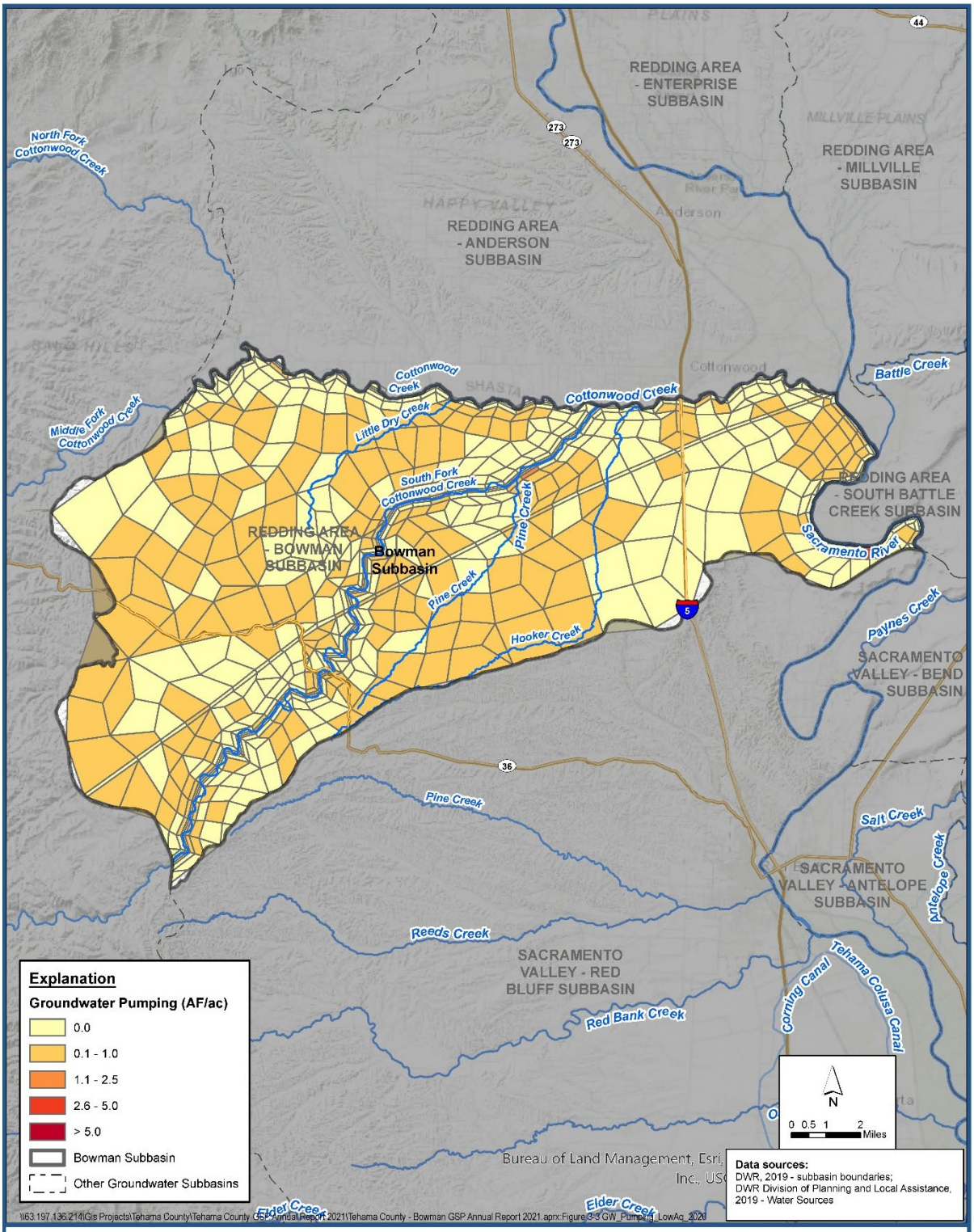
TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Groundwater Extraction in the Upper Aquifer - Water Year 2021

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 3-2



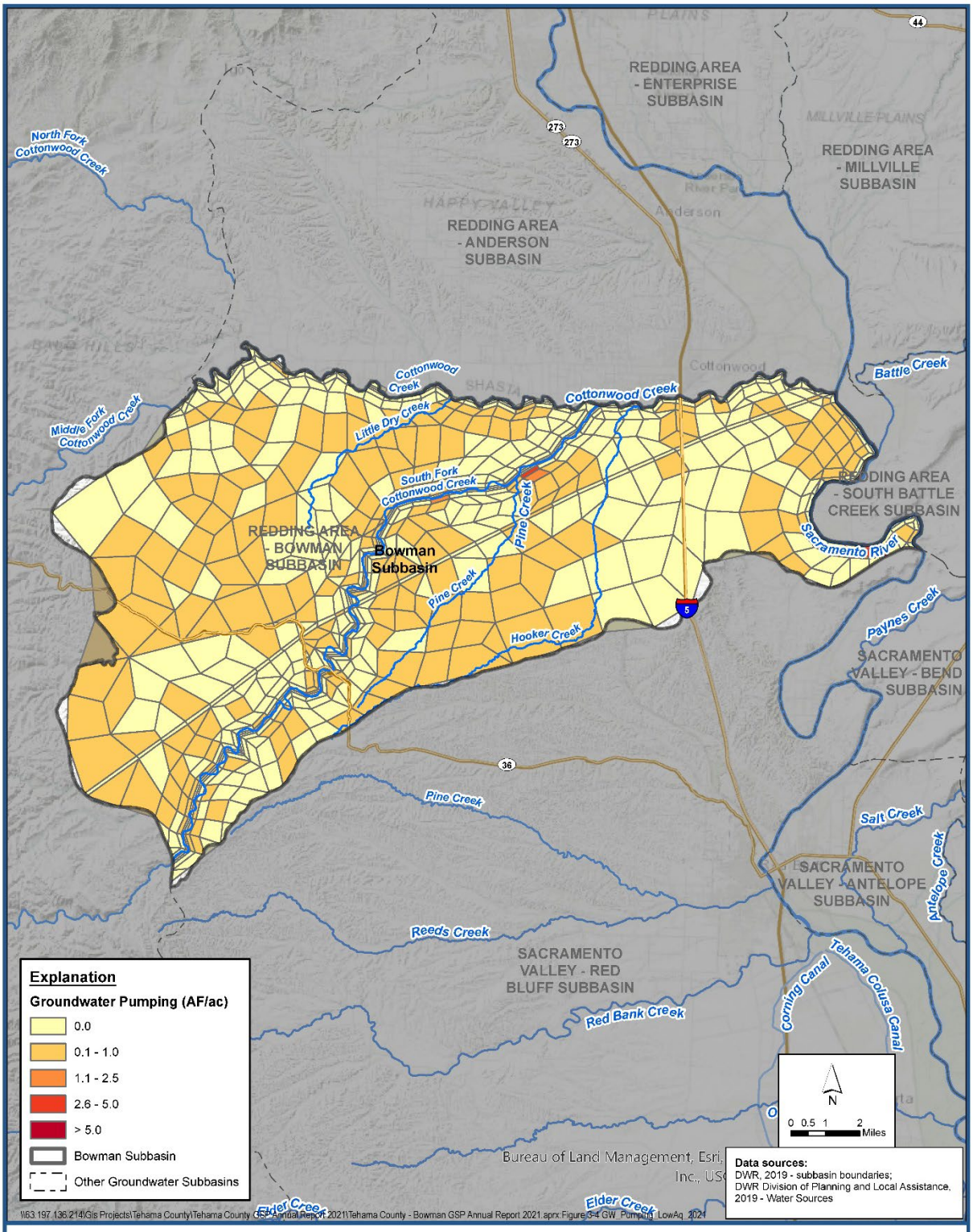
TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Groundwater Extraction in the Lower Aquifer - Water Year 2020

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 3-3



TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Groundwater Extraction in the Lower Aquifer - Water Year 2021

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 3-4

4. GROUNDWATER STORAGE

Changes in groundwater storage values were calculated for the 2020 and 2021 water years for the Upper and Lower Aquifers. Groundwater storage change was estimated based on the change in seasonal high groundwater levels (spring to spring). Seasonal high measurements made in the winter and spring provide a more reliable method to calculate change in groundwater storage than measurements made from seasonal low measurements that may be influenced by residual groundwater pumping. Storage change in the 2020 water year was estimated based on the change in seasonal high groundwater levels between the 2019 and 2020 water years. Likewise, 2021 storage change was calculated based on the change in seasonal high groundwater levels between 2020 and 2021 water years. While contour maps show wells over a large area of the subbasin water level change was calculated within a smaller monitoring area to exclude areas of poor data density. As the groundwater level monitoring network improves this area will expand to include more of the subbasin. A groundwater elevation surface was generated using either natural neighbor or kriging interpolation methods. The average groundwater level change over the monitored area was applied to the subbasin extent. Lastly, groundwater model average aquifer properties (storage coefficients) for each Aquifer (Upper, Lower) were used to calculate change in storage. This represents a departure from change in storage calculations made in the GSP where the groundwater model was utilized to calculate groundwater storage changes. **Table 4-1** presents the annual storage change values for both the Upper and Lower Aquifers.

It should be noted that although fundamentally the approach is similar to that used to estimate groundwater storage change in the GSP, the groundwater model was not used to estimate storage changes for 2020 and 2021. Therefore, future updates to the model may result in different estimates for 2020 and 2021 groundwater storage changes. The approach of using spring groundwater elevation contours is considered reasonable and cost effective for the purposes of the annual report. **Table 4-2** includes estimates of annual groundwater pumping, groundwater uptake, storage change and cumulative storage change for water years 1990-2021. Change in storage and cumulative change in storage for water years 2020-2021 was estimated based on the above method. The Tehama IHM Model was used to estimate groundwater pumping and groundwater uptake for all water years. Change in storage and cumulative change in storage were Model estimated for water years 1990-2019.

Table 4-1. Change in Groundwater Storage Based on Seasonal High Groundwater Levels

Aquifer	2020 (D) (af)	2021 (C) (af)
Upper Aquifer	-6,000	-15,000
Lower Aquifer	8,000	-17,000
Total	**2,000**	**-31,000**

D: Dry Sacramento Valley Water Year as defined by DWR.

C: Critical Sacramento Valley Water Year as defined by DWR.

Table 4-2. Change in Groundwater Storage Based on Tehama IHM Model				
Water Year & Type[1]	Groundwater Pumping (af)	Groundwater Uptake (af)	Annual Groundwater Storage Change (af)	Cumulative Groundwater Storage Change (af)
1990 (C)	-5,600	-3,000	-27,000	-27,000
1991 (C)	-5,100	-2,300	-28,000	-55,000
1992 (C)	-4,900	-2,200	-6,000	-61,000
1993 (AN)	-4,100	-3,100	41,000	-20,000
1994 (C)	-5,300	-2,300	-28,000	-48,000
1995 (W)	-3,300	-3,300	49,000	1,000
1996 (W)	-4,500	-3,600	16,000	17,000
1997 (W)	-7,000	-3,500	-11,000	6,000
1998 (W)	-3,600	-4,400	54,000	60,000
1999 (W)	-3,400	-4,300	-14,000	46,000
2000 (AN)	-3,800	-4,000	-10,000	36,000
2001 (D)	-5,900	-3,300	-30,000	6,000
2002 (D)	-7,200	-3,400	-7,600	-1,600
2003 (AN)	-5,500	-3,500	20,000	18,000
2004 (BN)	-8,500	-3,700	-3,500	15,000
2005 (AN)	-6,300	-3,600	13,000	28,000
2006 (W)	-5,700	-4,000	15,000	43,000
2007 (D)	-8,000	-3,100	-47,000	-4,100
2008 (C)	-8,900	-2,900	-19,000	-23,000
2009 (D)	-6,900	-2,400	-18,000	-41,000
2010 (BN)	-7,700	-2,700	21,000	-20,000
2011 (W)	-6,200	-3,200	17,000	-3,100
2012 (BN)	-6,000	-2,300	-30,000	-33,000
2013 (D)	-7,700	-2,300	-13,000	-46,000
2014 (C)	-6,900	-1,700	-29,000	-75,000
2015 (C)	-8,800	-1,700	-3,800	-79,000
2016 (BN)	-6,700	-2,300	23,000	-56,000
2017 (W)	-5,400	-2,800	43,000	-13,000
2018 (BN)	-7,800	-1,900	-37,000	-50,000
2019 (W)	-6,000	-2,900	36,000	-14,000
2020 (D)	-7,400	-1,800	2,000	-12,000
2021 (C)	-8,100	-1,500	-31,000	-43,000
Average	**-6,200**	**-2,900**	**-1,300**	

All volumes are rounded to two significant figures

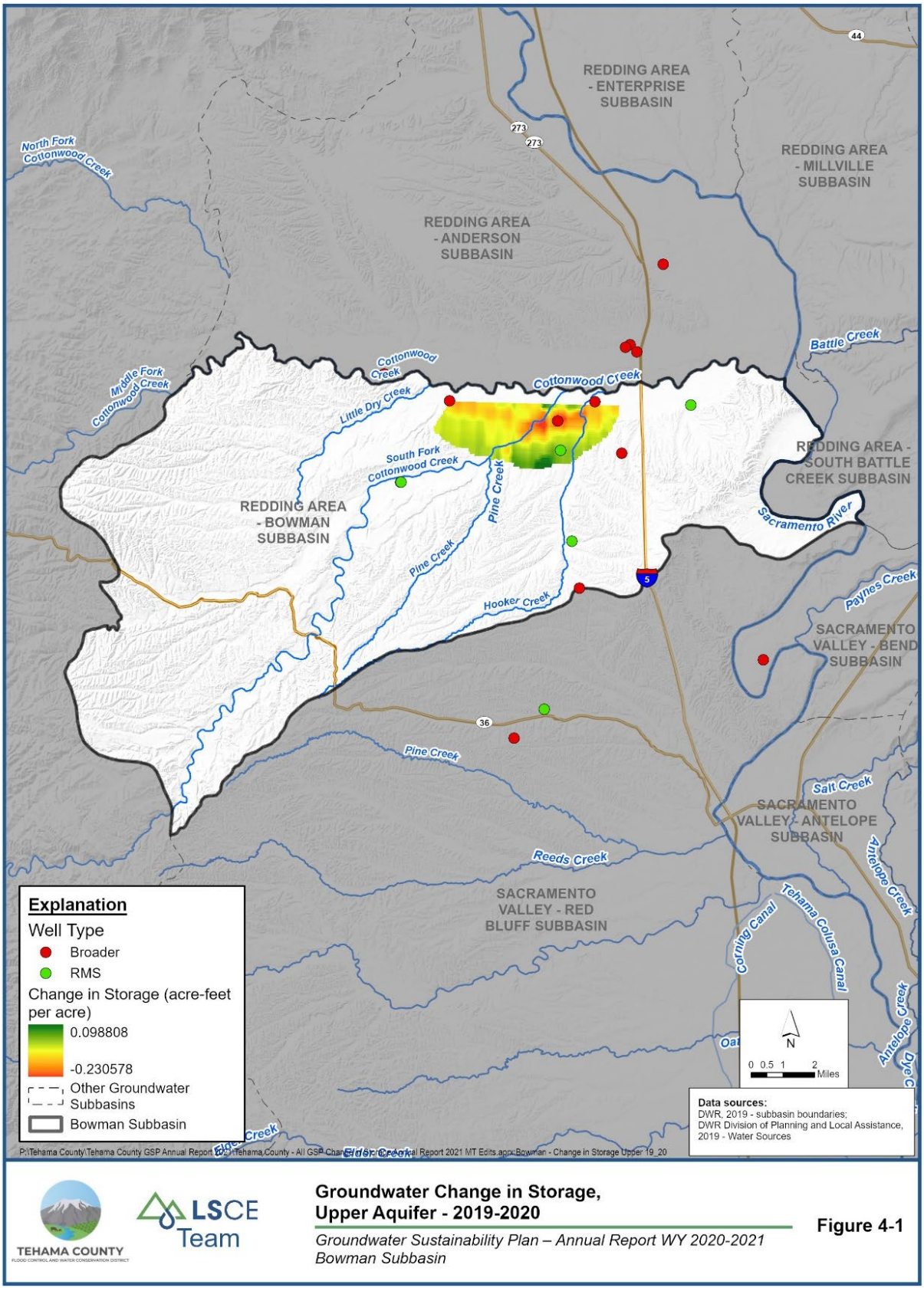
1. Sacramento Valley Water Year Type is provided by DWR for years 1990-2020. Water year 2021 meets the criteria to be considered a critical water, as shown in CDEC resources, but has not officially been assigned that designation by DWR. Wet (W), Above Normal (AN, Below Normal (BN), Dry (D), Critical (C)
2. Storage change in water years 2020-2021 was estimated using seasonal high spring to spring water levels and in all other years was estimated using the Tehama IHM Model.

4.1. Groundwater Storage Maps - §356.2(b)(5)(A)

Figures 4-1 and **4-2** present the distribution of storage change in the Upper Aquifer for the 2020 and 2021 water years, respectively. **Figures 4-3** and **4-4** display maps for the Lower Aquifer for the same periods. Maps include the groundwater wells used to calculate change in storage. Groundwater storage change is not shown on **Figures 4-1** through **4-4** outside the established monitoring area to avoid extrapolating beyond the control points (i.e., reliable monitoring well data).

4.2. Subbasin Water Budget - §356.2(b)(5)(B)

A graph depicting water year type, groundwater pumping, groundwater uptake, the annual change in groundwater storage, and the cumulative change in groundwater storage is presented on **Figure 4-5**.



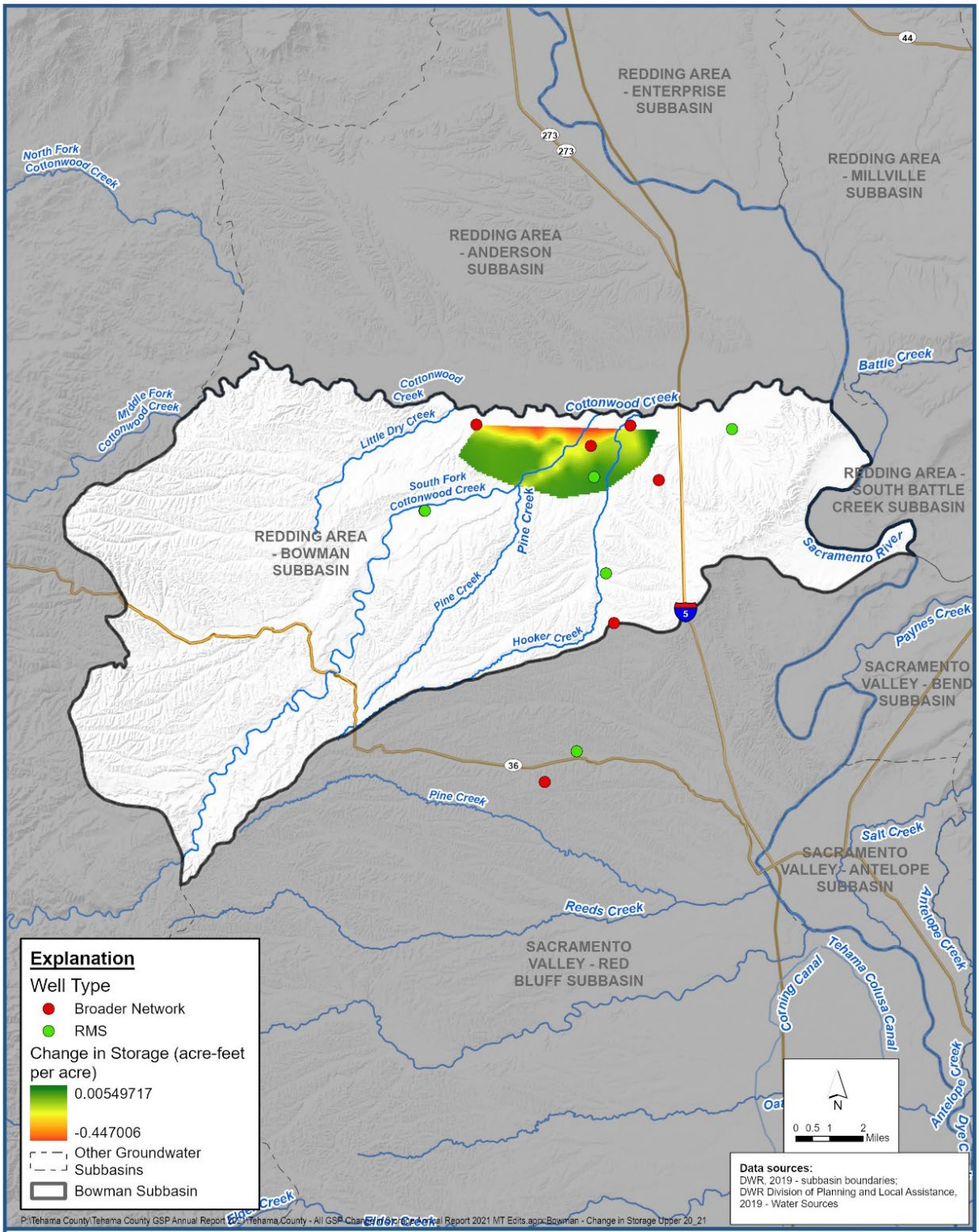
TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

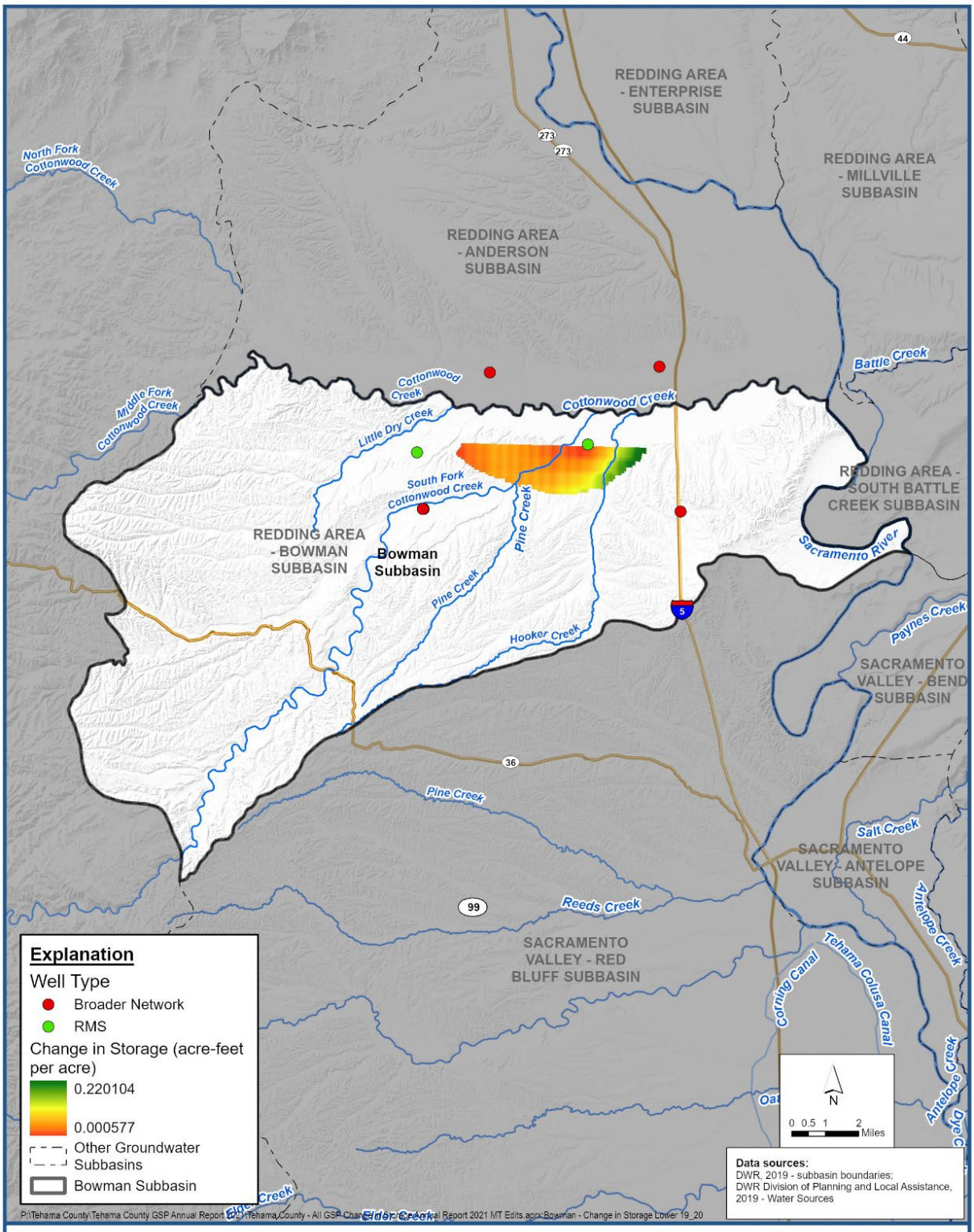
LSCE Team

Groundwater Change in Storage, Upper Aquifer - 2019-2020

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 4-1


REDDING AREA - ENTERPRISE SUBBASIN
REDDING AREA - MILLVILLE SUBBASIN
REDDING AREA - ANDERSON SUBBASIN
REDDING AREA - BOWMAN SUBBASIN
REDDING AREA - SOUTH BATTLE CREEK SUBBASIN
SACRAMENTO VALLEY - BEND SUBBASIN
SACRAMENTO VALLEY - ANTELOPE SUBBASIN
SACRAMENTO VALLEY - RED BLUFF SUBBASIN
North Fork Cottonwood Creek
Middle Fork Cottonwood Creek
Cottonwood Creek
Little Dry Creek
South Fork Cottonwood Creek
Pine Creek
Hooker Creek
Battle Creek
Sacramento River
Paynes Creek
Salt Creek
Reeds Creek
Antelope Creek
Corning Canal
Tehama Colusa Canal
Explanation
Well Type
Broader Network
RMS
Change in Storage (acre-feet per acre)
0.00549717
-0.447006
Other Groundwater Subbasins
Bowman Subbasin
N
0 0.5 1 2 Miles
Data sources:
DWR, 2019 - subbasin boundaries;
DWR Division of Planning and Local Assistance, 2019 - Water Sources
P:\Tehama County\Tehama County GSP Annual Report 2021\Tehama County - All GSP Chapters\Annual Report 2021 MT Edits.aprx:Bowman - Change in Storage Upper 20_21
TEHAMA COUNTY
LSCE Team
Groundwater Change in Storage, Upper Aquifer - 2020-2021
Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin
Figure 4-2



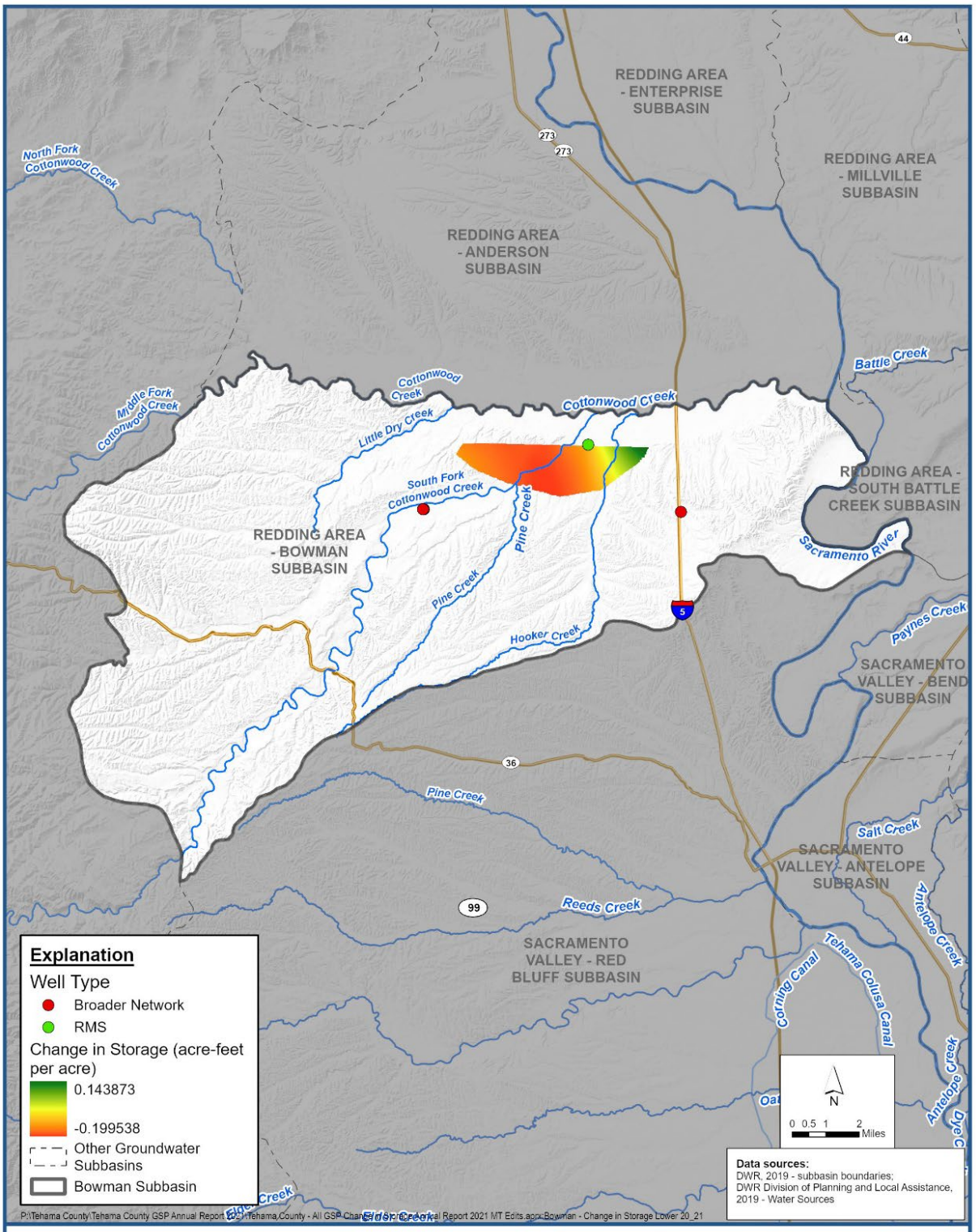
TEHAMA COUNTY
FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Groundwater Change in Storage, Lower Aquifer - 2019-2020

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 4-3



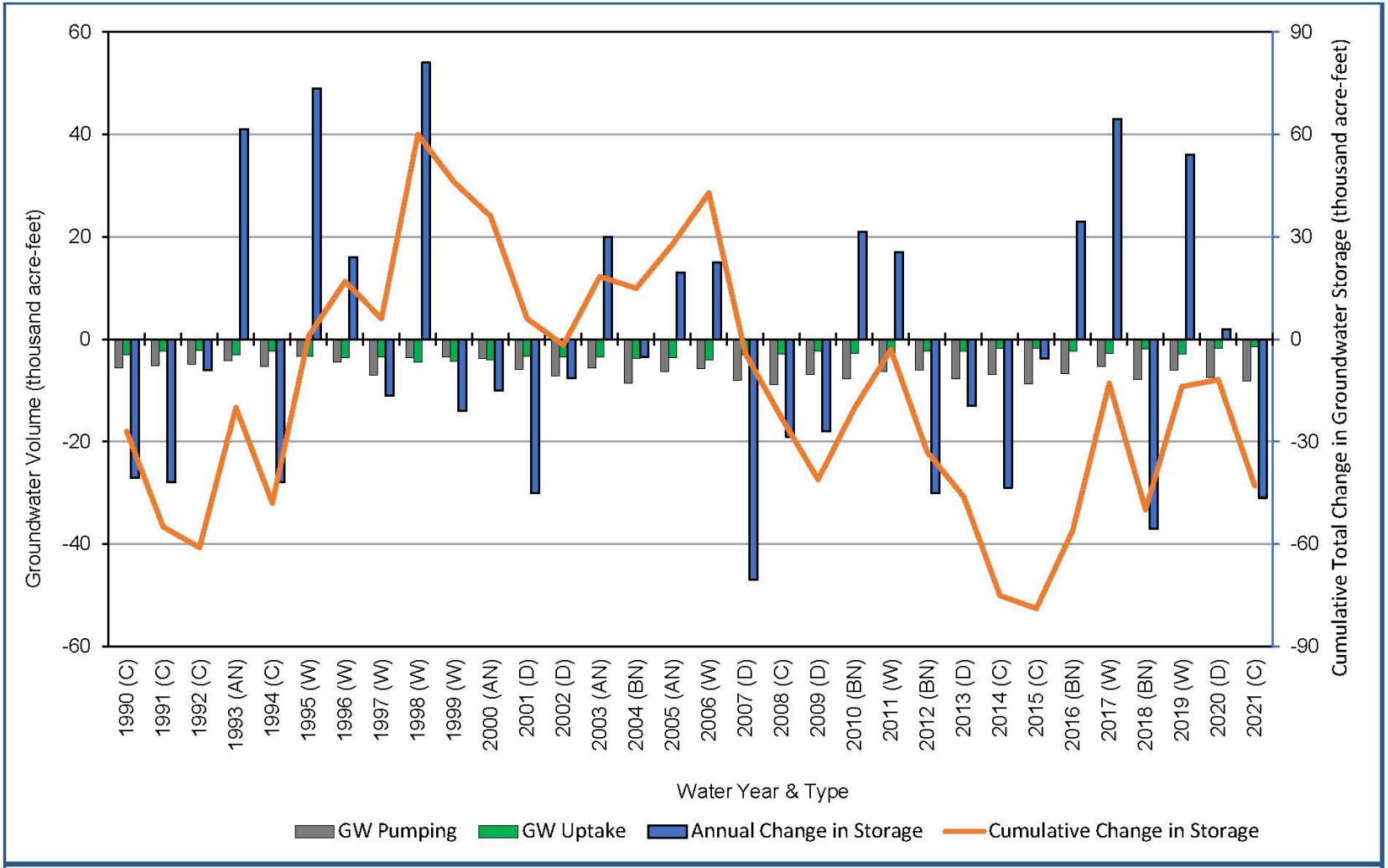
TEHAMA COUNTY
FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Groundwater Change in Storage, Lower Aquifer - 2020-2021

Groundwater Sustainability Plan – Annual Report WY 2020-2021
Bowman Subbasin

Figure 4-4



TEHAMA COUNTY
FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Groundwater Extraction and Change in Groundwater Storage

Figure 4-5

2021 Groundwater Sustainability Plan Annual Report
Tehama County Flood Control and Water Conservation District

5. GSP IMPLEMENTATION PROGRESS - §356.2(B)

The GSP for the Bowman Subbasin was adopted by the GSA in December 2021 and submitted to DWR in January 2022. This is the first annual report to be prepared since the GSP was submitted. The GSP implementation progress reported in this report covers ongoing work during GSP development since late 2021.

Projects and management actions (PMAs) were developed to manage groundwater conditions in the Subbasin and achieve groundwater sustainability objectives described in the GSP. Due to the recent adoption of the GSP, progress towards the implementation of PMAs has not progressed since GSP adoption. The Bowman Subbasin GSA is continuing to engage stakeholders in the subbasin as they coordinate to develop a workplan for 2022 and discuss implementation priorities.

Finally, ongoing activities include monitoring and reporting, updating, and maintaining the subbasin's DMS, outreach to stakeholders, interbasin coordination, and coordination with outside efforts to improve characterization of the subbasin (such as DWR's Airborne Electromagnetic Survey Program expected to collect data in the subbasin in May 2022).

As part of the GSA's efforts to address data gaps in the subbasin, An Airborne Electromagnetic (AEM) Survey is scheduled by DWR in May of 2022. The data collected will provide a better understanding of aquifer characteristics and will help refine current hydrogeologic conceptual models. Additionally, the GSA is scheduled to survey the Bow-5L RMS well to establish a more accurate vertical datum. This surveying will take place before the end of the year.

6. CONCLUSIONS

Recent progress made on all of the above-mentioned activities applicable to the GSA since late 2021 demonstrates the commitment of the GSA to implement the GSP by allocating the necessary time and resources to achieve long-term sustainable management of the groundwater resources in the subbasin.

7. REFERENCES

California Department of Water Resources, 2004, Redding Groundwater Basin, Bowman Subbasin, California's Groundwater, Bulletin 118. https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/2003-Basin-Descriptions/5_006_01_BowmanSubbasin.pdf

California Department of Water Resources, 2003, Tehama County Groundwater Inventory, Pre-Publication Draft

California Department of Water Resources, 2018 Groundwater Basin Boundary Assessment Tool https://gis.water.ca.gov/app/bbat/

California Department of Water Resources, 2019, SVSim: Sacramento Valley Groundwater-Surface Water Simulation Model. https://data.cnra.ca.gov/dataset/svsim

Tehama County Flood Control and Water Conservation District, 2022: Bowman Groundwater Sustainability Plan. https://tehamacountywater.org/gsa/groundwater-sustainability-plans-public-draft/#bowman-subbasin-final-gsp

APPENDIX A

Water Level Hydrographs of Representative Monitoring Wells for Groundwater Level

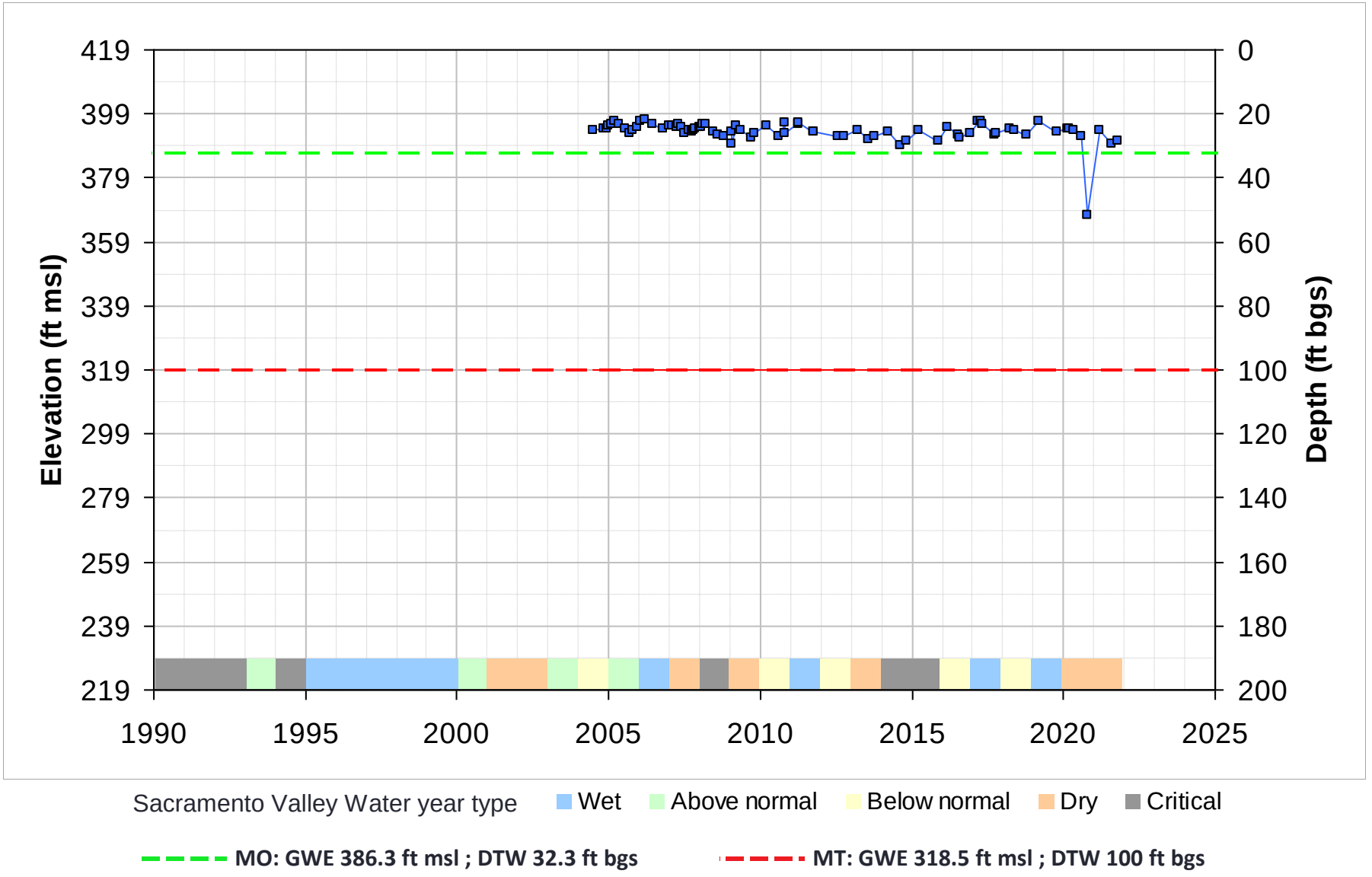
See Figure 2-5 to see the location of wells.

Bow-1U (Bowman Subbasin - Upper Aquifer)

SWN: 29N03W18M001M

Well Depth (ft): 234; Screens (ft bgs): N/A

Well Type: Irrigation

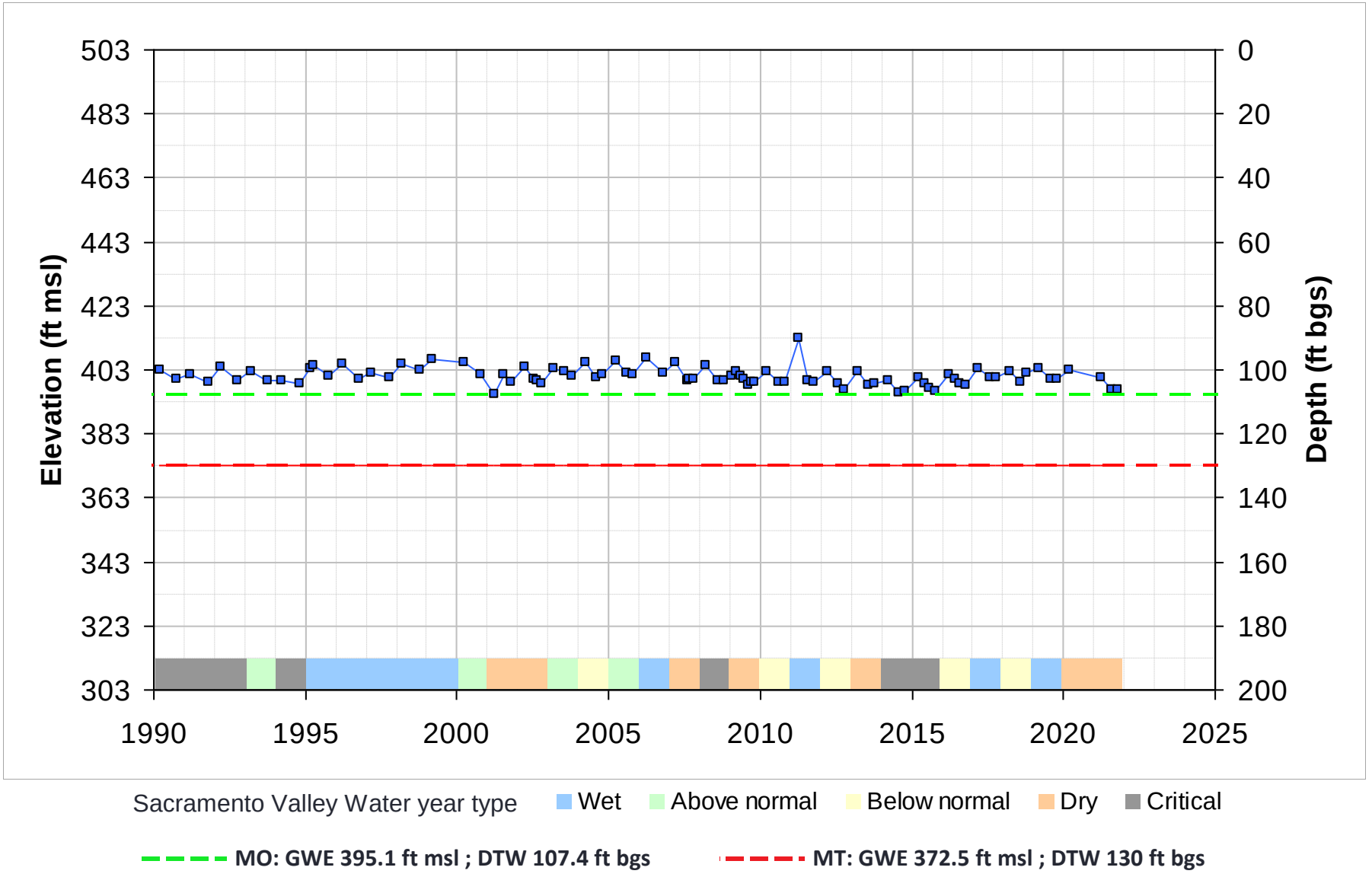


Bow-2U (Bowman Subbasin - Upper Aquifer)

SWN: 29N04W28D001M

Well Depth (ft): 134; Screens (ft bgs): 114 - 134

Well Type: Domestic



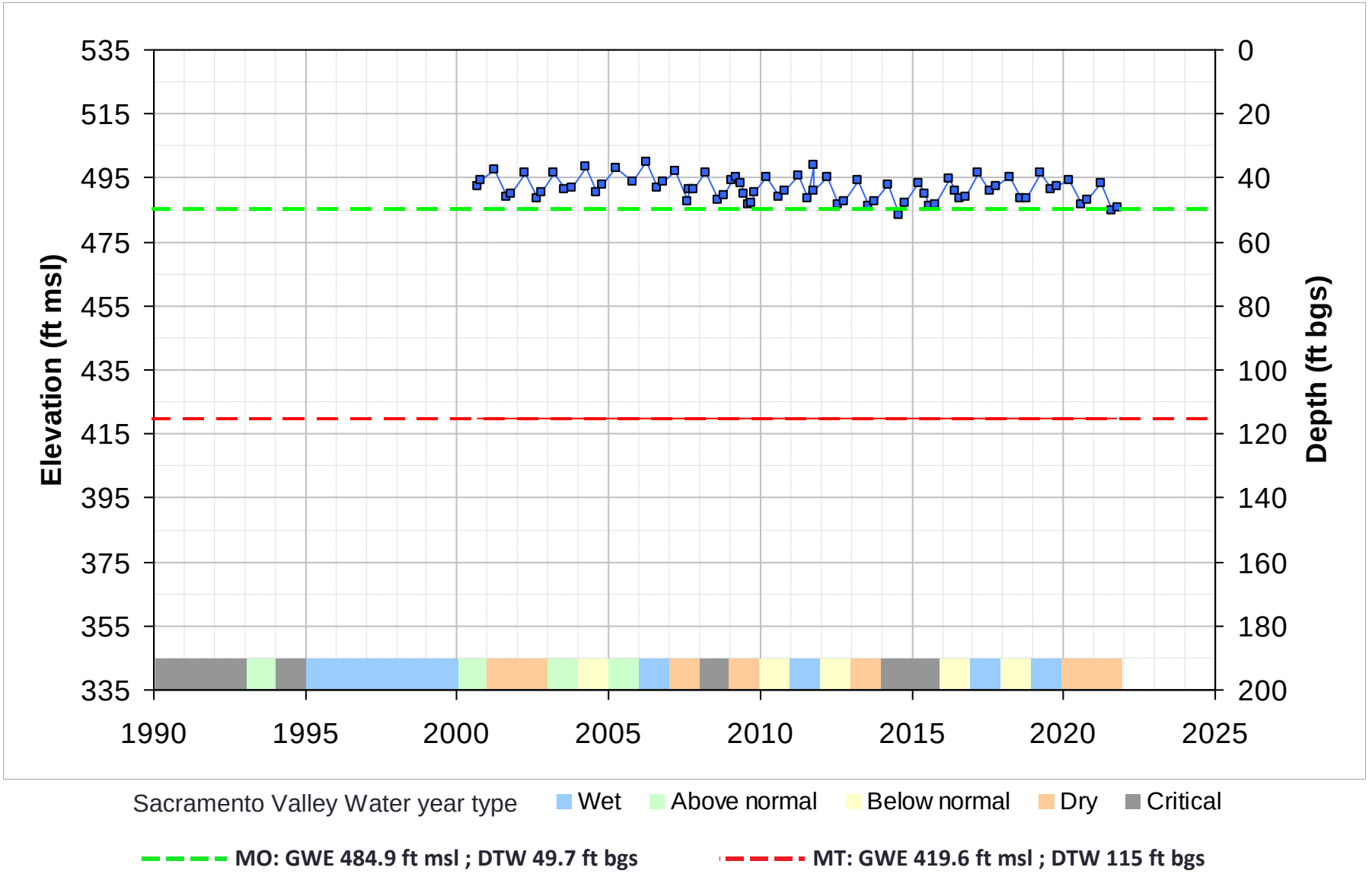
LSCE

Bow-3U (Bowman Subbasin - Upper Aquifer)

SWN: 29N05W33A004M

Well Depth (ft): 210; Screens (ft bgs): 110 - 210

Well Type: Monitoring



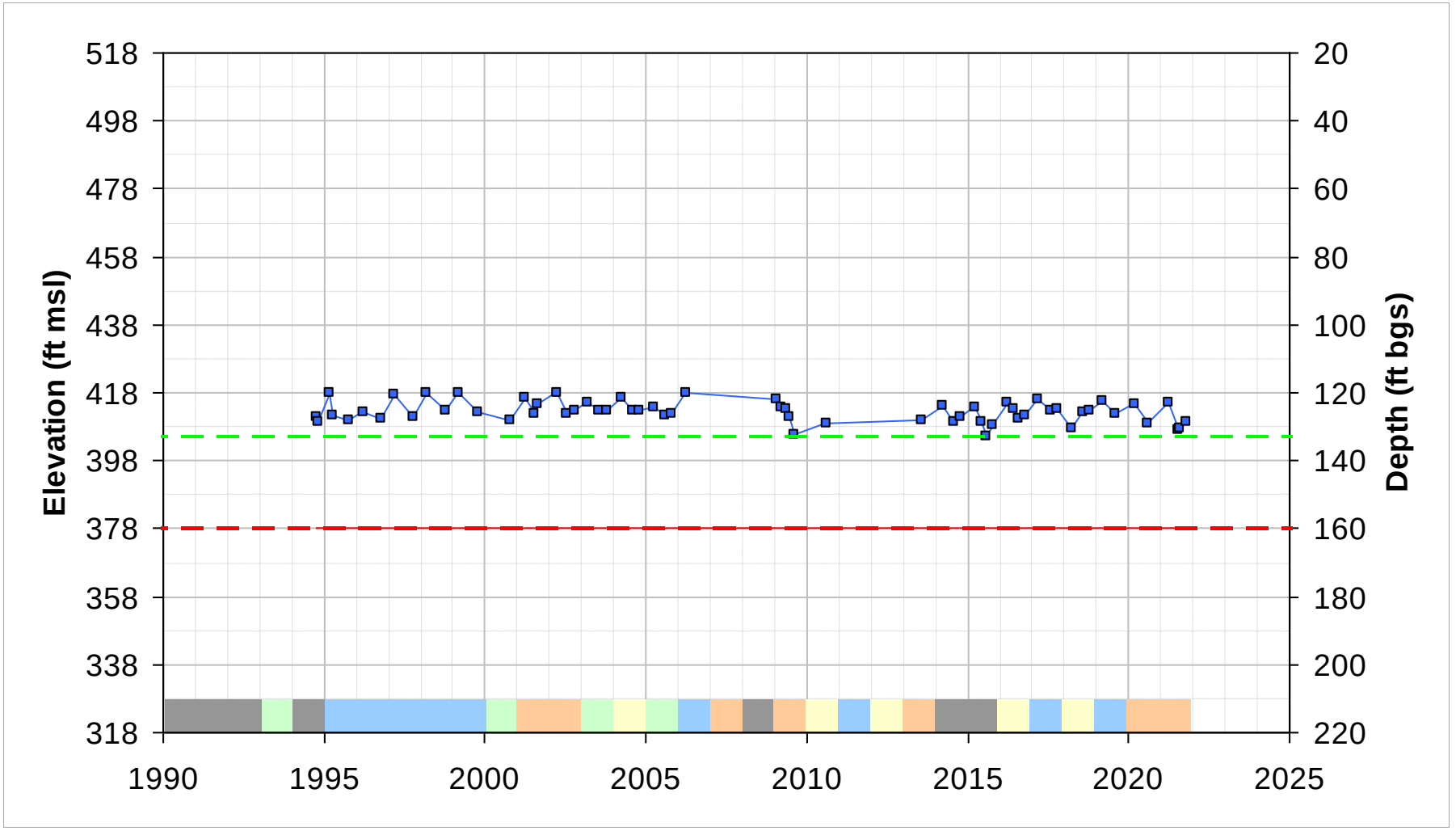
LSCE

Bow-4U (Bowman Subbasin - Upper Aquifer)

SWN: 28N04W04P001M

Well Depth (ft): 270; Screens (ft bgs): 200 - 270

Well Type: Domestic



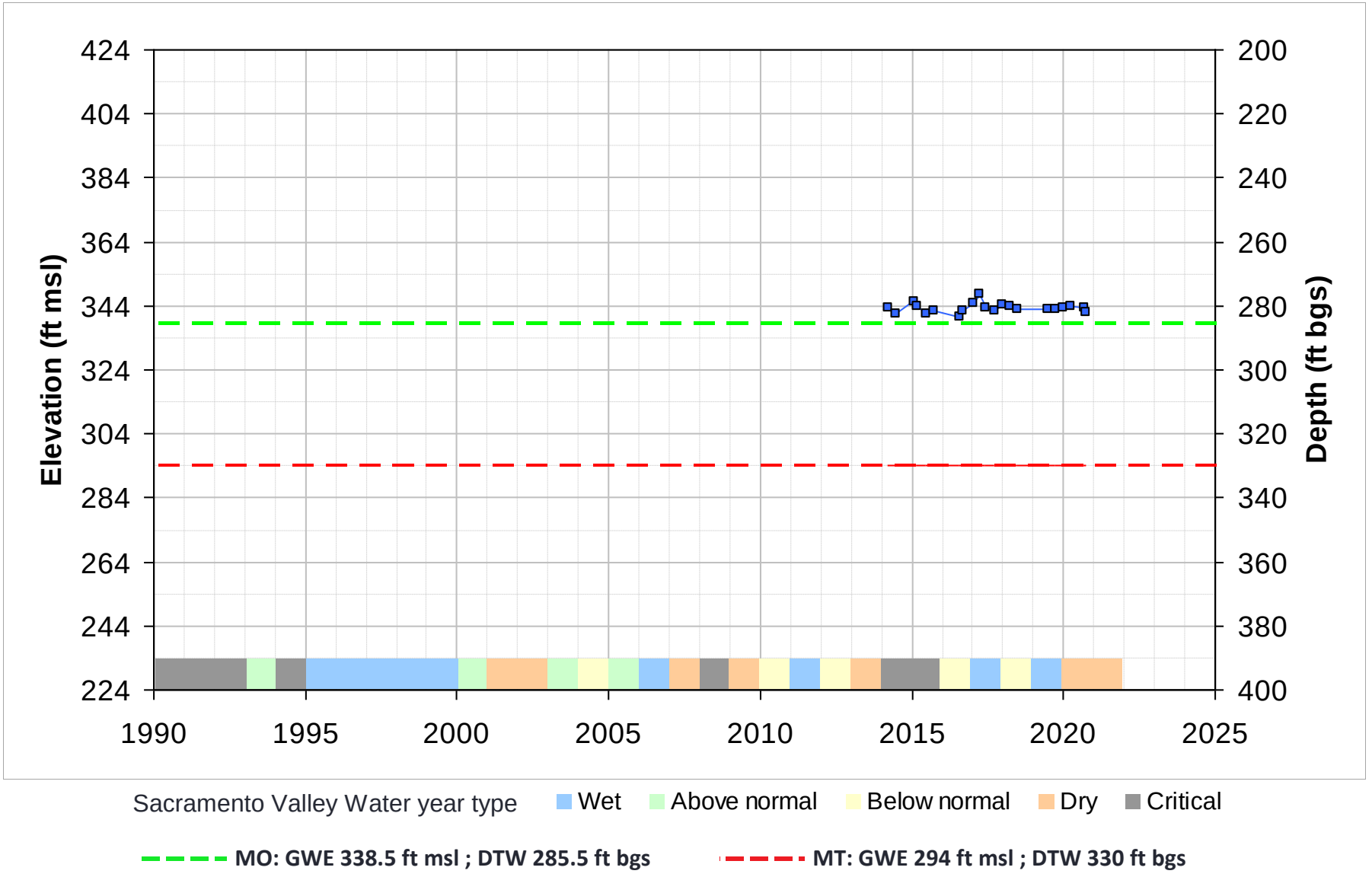
LSCE

Bow-5L (Bowman Subbasin - Lower Aquifer)

SWN: NA

Well Depth (ft): 760; Screens (ft bgs): 390 - 750

Well Type: Municipal



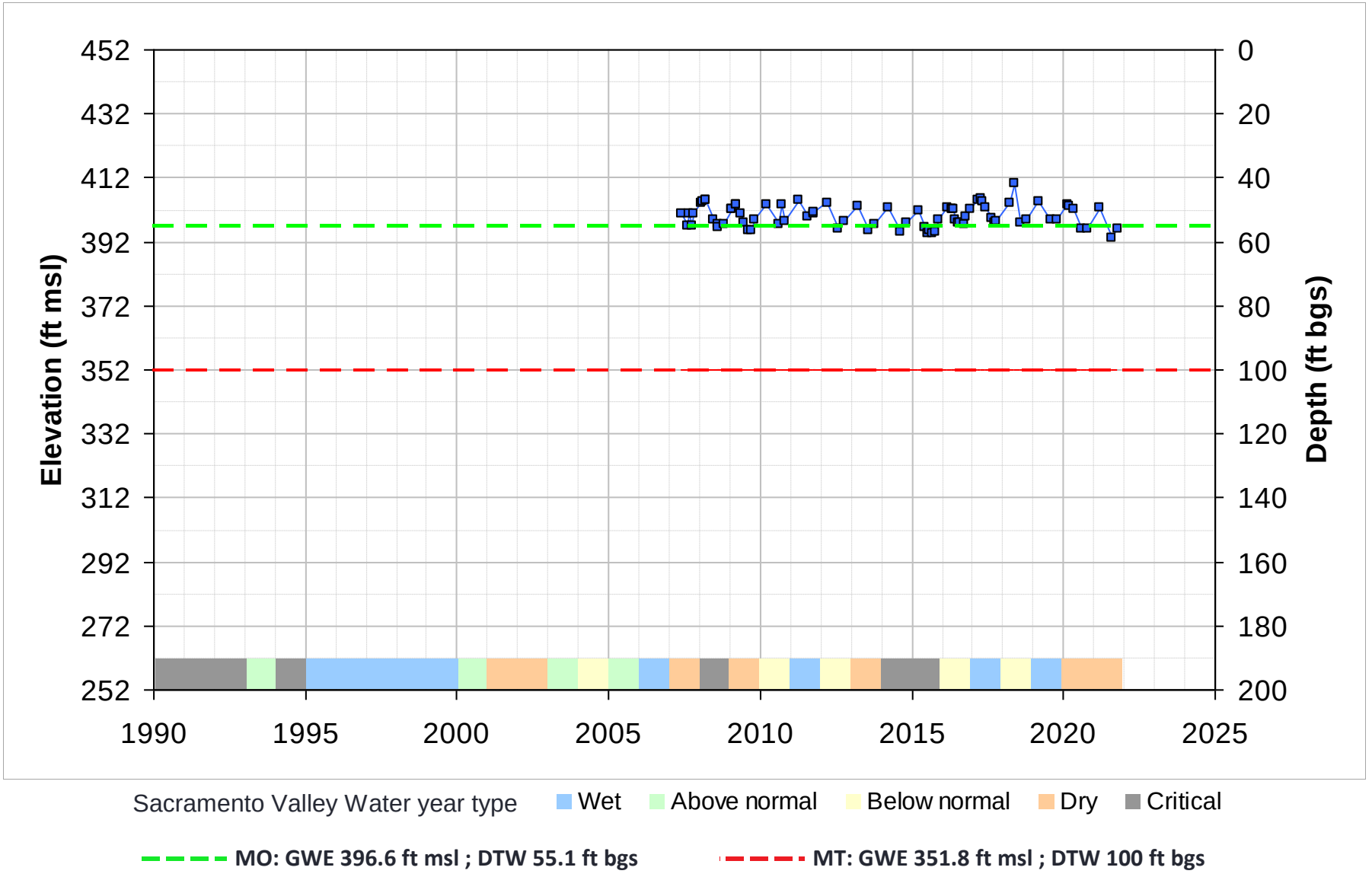
LSCE

Bow-6L (Bowman Subbasin - Lower Aquifer)

SWN: 29N04W20A002M

Well Depth (ft): 451; Screens (ft bgs): 360 - 430

Well Type: Monitoring



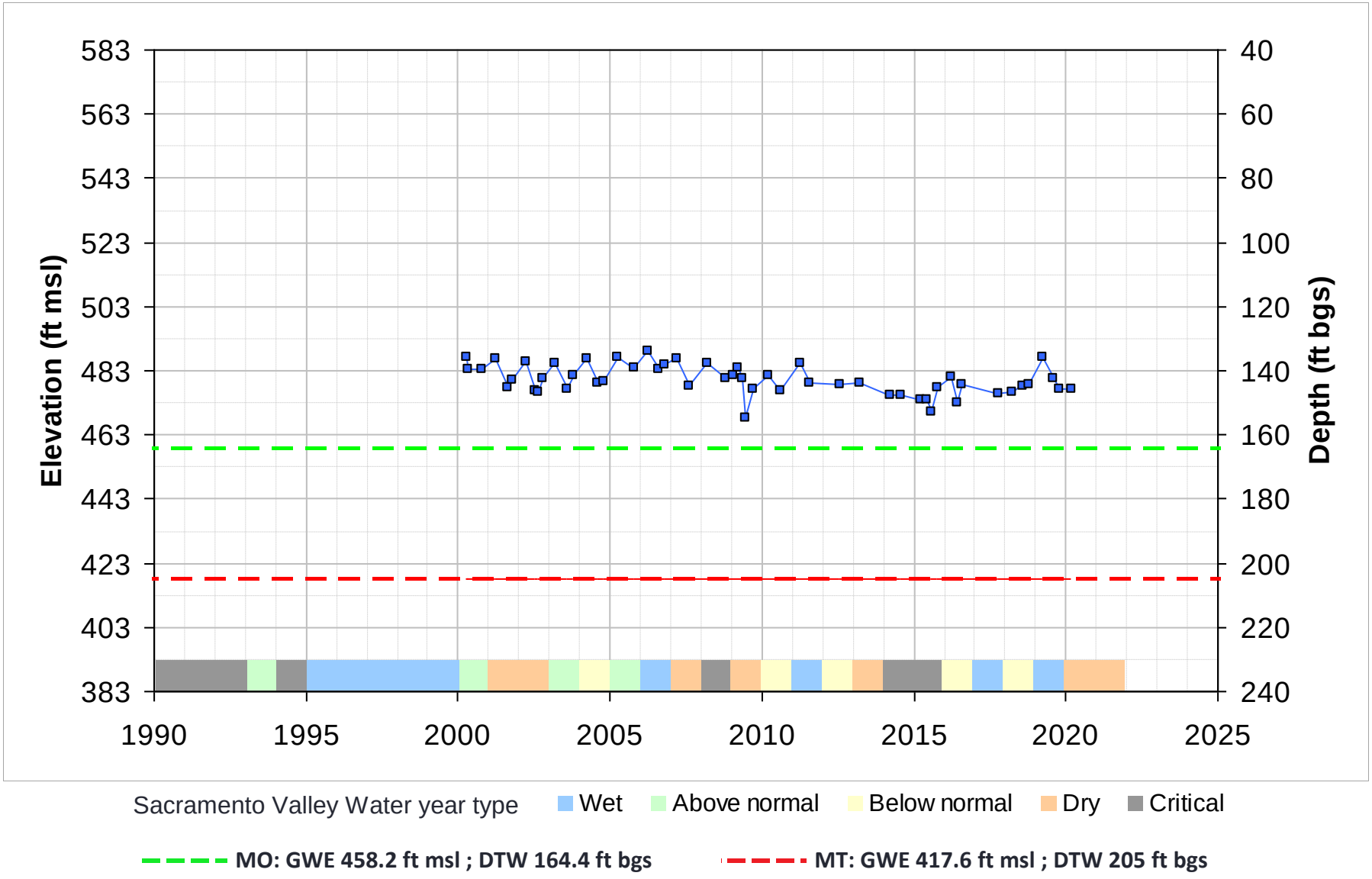
LSCE

Bow-7L (Bowman Subbasin - Lower Aquifer)

SWN: 29N05W21H001M

Well Depth (ft): 280; Screens (ft bgs): 250 - 280

Well Type: Domestic



LSCE

APPENDIX B

Annual Report Water Level Data

Data sources:

- CA Department of Water Resources
- Tehama County Flood Control and Water Conservation District
- United States Geological Survey
- The Nature Conservancy

LSCE

Table B-1 Water Level Data for Upper Aquifer

State Well Number	Measure. Date	RPE (ft amsl)	GSE (ft amsl)	DTW (ft bgs)	DTW (ft brp)	WSE (ft amsl)	WL QM CD[1]	Comments	QA CD	Method
29N03W18M001M	2/27/2020	419.04	418.54	24.50	25.00	394.04		NB		ES
29N04W20A003M	2/27/2020	453.92	451.76	39.04	41.20	412.72		NB		ES
29N04W20A004M	2/27/2020	453.67	451.75	35.78	37.70	415.97		NB		ES
27N04W05G002M	3/9/2020	483.83	482.53	46.10	47.40	436.43				ST
27N04W07B001M	3/9/2020	603.55	602.55	141.00	142.00	461.55				ST
28N03W28G002M	3/9/2020	341.35	340.00	27.45	28.80	312.55	6	Cascading		ST
30N04W25D003M	3/9/2020	471.19	472.47	73.93	72.65	398.54				ES
29N03W18M001M	3/12/2020	419.04	418.54	24.50	25.00	394.04		NB		ES
29N04W20A003M	3/12/2020	453.92	451.76	39.54	41.70	412.22		NB		ES
29N04W20A004M	3/12/2020	453.67	451.75	35.28	37.20	416.47		NB		ES
28N04W04P001M	3/13/2020	538.84	537.54	123.34	124.64	414.20				ES
28N04W16G001M	3/13/2020	603.73	602.53	191.42	192.62	411.11				ES
29N04W02M002M	3/13/2020	464.20	462.00	73.10	75.30	388.90	8	Oil in casing		ST
29N04W02P001M	3/13/2020	447.99	447.49	58.20	58.70	389.29				ES
29N04W03R004M	3/13/2020	460.15	457.84	62.97	65.28	394.87				ES
29N04W03R005M	3/13/2020	460.03	457.84	69.66	71.85	388.18				ES
29N04W03R006M	3/13/2020	459.81	457.84	34.76	36.73	423.08				ES
29N04W15E002M	3/13/2020	428.51	427.51	35.10	36.10	392.41	8	Oil in casing		ST
29N04W27A001M	3/13/2020	525.73	524.53	147.10	148.30	377.43				ST
29N04W28D001M	3/13/2020	503.04	502.54	100.16	100.66	402.38				ES
29N05W09L001M	3/13/2020	517.55	517.55	28.40	28.40	489.15				ST
29N05W14L001M	3/13/2020	493.55	492.55	35.10	36.10	457.45				ST
29N05W33A004M	3/13/2020	536.56	534.56	40.92	42.92	493.64				ES
29N05W33A005M	3/13/2020	536.56	534.56	38.25	40.25	496.31				ES
29N03W18M001M	5/4/2020	419.04	418.54	25.10	25.60	393.44				ES
29N04W20A003M	5/4/2020	453.92	451.76	40.24	42.40	411.52				ES
29N04W20A004M	5/4/2020	453.67	451.75	35.78	37.70	415.97				ES

[1]WL QM CD: 0 - Caved or deepened, 1 – Pumping, 3 - Casing leaking or wet, 6-Other, 8-Oil or foreign substance in casing

State Well Number	Measure. Date	RPE (ft amsl)	GSE (ft amsl)	DTW (ft bgs)	DTW (ft brp)	WSE (ft amsl)	WL QM CD[1]	Comments	QA CD	Method
29N03W18M001M	8/3/2020	419.04	418.54	27.15	27.65	391.39				ES
29N04W20A003M	8/3/2020	453.92	451.76	45.36	47.52	406.40				ES
29N04W20A004M	8/3/2020	453.67	451.75	39.58	41.50	412.17				ES
28N04W04P001M	8/4/2020	538.84	537.54	129.20	130.50	408.34				ST
28N04W16G001M	8/4/2020	603.73	602.53	193.50	194.70	409.03				ES
29N04W15E002M	8/4/2020	428.51	427.51	38.30	39.30	389.21	8			ST
29N05W33A004M	8/4/2020	536.56	534.56	48.23	50.23	486.33				ES
29N05W33A005M	8/4/2020	536.56	534.56	43.16	45.16	491.40				ES
27N04W07B001M	8/5/2020	603.55	602.55	143.60	144.60	458.95	1			ST
28N03W28G002M	8/5/2020	341.35	340.00	33.95	35.30	306.05	3			ST
29N04W15E002M	10/12/2020	428.51	427.51	37.50	38.50	390.01	8			ST
28N04W16G001M	10/13/2020	603.73	602.53	193.67	194.87	408.86				ES
29N05W33A004M	10/13/2020	536.56	534.56	46.77	48.77	487.79				ES
29N05W33A005M	10/13/2020	536.56	534.56	44.55	46.55	490.01				ES
29N03W18M001M	10/16/2020	419.04	418.54	51.50	52.00	367.04	1			ES
29N04W20A003M	10/16/2020	453.92	451.76	44.79	46.95	406.97				ES
29N04W20A004M	10/16/2020	453.67	451.75	39.46	41.38	412.29				ES
27N04W05G002M	3/16/2021	483.83	482.53	48.20	49.50	434.33				ST
27N04W07B001M	3/16/2021	603.55	602.55	144.50	145.50	458.05				ST
28N03W28G002M	3/16/2021	341.35	340.00	22.25	23.60	317.75	3			ST
29N03W18M001M	3/17/2021	419.04	418.54	25.08	25.58	393.46				ES
29N04W20A003M	3/17/2021	453.92	451.76	40.24	42.40	411.52				ES
29N04W20A004M	3/17/2021	453.67	451.75	36.90	38.82	414.85				ES
28N04W04P001M	3/22/2021	538.84	537.54	122.90	124.20	414.64				ST
28N04W16G001M	3/22/2021	603.73	602.53	191.60	192.80	410.93				ES
29N04W15E002M	3/22/2021	428.51	427.51	34.50	35.50	393.01	8			ST
29N04W27A001M	3/22/2021	525.73	524.53	147.70	148.90	376.83				ST
29N04W28D001M	3/22/2021	503.04	502.54	102.15	102.65	400.39				ES

[1]WL QM CD: 0 - Caved or deepened, 1 – Pumping, 3 - Casing leaking or wet, 6-Other, 8-Oil or foreign substance in casing

State Well Number	Measure. Date	RPE (ft amsl)	GSE (ft amsl)	DTW (ft bgs)	DTW (ft brp)	WSE (ft amsl)	WL QM CD[1]	Comments	QA CD	Method
29N05W14L001M	3/22/2021	493.55	492.55	38.00	39.00	454.55				ST
29N05W33A004M	3/22/2021	536.56	534.56	41.70	43.70	492.86				ES
29N05W33A005M	3/22/2021	536.56	534.56	39.84	41.84	494.72				ES
28N03W28G002M	7/28/2021	341.35	340.00	45.85	47.20	294.15				ES
28N04W04P001M	7/28/2021	538.84	537.54	130.70	132.00	406.84				ST
28N04W16G001M	7/28/2021	603.73	602.53	194.64	195.84	407.89				ES
29N04W15E002M	7/28/2021	428.51	427.51	41.10	42.10	386.41	8			ST
29N04W27A001M	7/28/2021	525.73	524.53	151.90	153.10	372.63				ST
29N03W18M001M	8/2/2021	419.04	418.54	29.21	29.71	389.33				ES
29N04W20A003M	8/2/2021	453.92	451.76	48.93	51.09	402.83				ES
29N04W20A004M	8/2/2021	453.67	451.75	42.95	44.87	408.80				ES
29N05W33A004M	8/2/2021	536.56	534.56	50.36	52.36	484.20				ES
29N05W33A005M	8/2/2021	536.56	534.56	45.57	47.57	488.99				ES
28N04W04P001M	8/3/2021	538.84	537.54	130.40	131.70	407.14				ST
28N04W16G001M	8/3/2021	603.73	602.53	195.26	196.46	407.27				ES
29N04W15E002M	8/3/2021	428.51	427.51	40.10	41.10	387.41	8			ST
29N04W27A001M	8/3/2021	525.73	524.53	167.80	169.00	356.73	3			ST
29N04W28D001M	8/3/2021	503.04	502.54	106.05	106.55	396.49				ES
29N05W14L001M	8/3/2021	493.55	492.55	43.60	44.60	448.95				ST
27N04W05G002M	8/5/2021	483.83	482.53	61.70	63.00	420.83				ST
27N04W07B001M	8/5/2021	603.55	602.55	146.90	147.90	455.65				ST
28N04W04P001M	10/11/2021	538.84	537.54	128.60	129.90	408.94				ST
28N04W16G001M	10/11/2021	603.73	602.53	194.98	196.18	407.55				ES
29N04W15E002M	10/11/2021	428.51	427.51	39.10	40.10	388.41	8			ST
29N04W27A001M	10/11/2021	525.73	524.53	152.30	153.50	372.23	3			ST
29N04W28D001M	10/11/2021	503.04	502.54	106.10	106.60	396.44				ES
29N05W14L001M	10/11/2021	493.55	492.55	44.10	45.10	448.45				ST
29N05W33A004M	10/11/2021	536.56	534.56	49.19	51.19	485.37				ES

[1]WL QM CD: 0 - Caved or deepened, 1 – Pumping, 3 - Casing leaking or wet, 6-Other, 8-Oil or foreign substance in casing

State Well Number	Measure. Date	RPE (ft amsl)	GSE (ft amsl)	DTW (ft bgs)	DTW (ft brp)	WSE (ft amsl)	WL QM CD[1]	Comments	QA CD	Method
29N05W33A005M	10/11/2021	536.56	534.56	47.22	49.22	487.34				ES
27N04W05G002M	10/13/2021	483.83	482.53	57.20	58.50	425.33				ST
27N04W07B001M	10/13/2021	603.55	602.55	150.30	151.30	452.25				ST
29N03W18M001M	10/22/2021	419.04	418.54	28.21	28.71	390.33				ES
29N04W20A003M	10/22/2021	453.92	451.76	45.79	47.95	405.97				ES
29N04W20A004M	10/22/2021	453.67	451.75	40.96	42.88	410.79				ES
Rio Alto Well 6 (Bow-5L)	9/22/2020	624	624	281.84	281.84	342.16				
Rio Alto Well 6 (Bow-5L)	12/31/2019	624	624	280.71	280.71	343.29				
Rio Alto Well 6 (Bow-5L)	3/23/2020	624	624	280.26	280.26	343.74				
Rio Alto Well 6 (Bow-5L)	9/18/2020	624	624	280.58	280.58	343.42				

[1]WL QM CD: 0 - Caved or deepened, 1 – Pumping, 3 - Casing leaking or wet, 6-Other, 8-Oil or foreign substance in casing

Table B-2 Water Level Data for Lower Aquifer

State Well Number	Measure. Date	RPE (ft amsl)	GSE (ft amsl)	DTW (ft bgs)	DTW (ft brp)	WSE (ft amsl)	WL QM CD[1]	Comments	QA CD	Method
29N04W20A001M	2/27/2020	454.34	451.71	44.55	47.18	407.16		NB		ES
29N04W20A002M	2/27/2020	454.14	451.75	48.21	50.60	403.54		NB		ES
29N05W11A002M	3/9/2020	514.54	514.54	54.50	54.50	460.04	0	Possibly caved		ST
29N04W20A001M	3/12/2020	454.34	451.71	44.57	47.20	407.14		NB		ES
29N04W20A002M	3/12/2020	454.14	451.75	48.86	51.25	402.89		NB		ES
29N04W03R002M	3/13/2020	460.49	457.84	65.61	68.26	392.23				ES
29N04W03R003M	3/13/2020	460.33	457.84	64.68	67.17	393.16				ES
29N04W35B001M	3/13/2020	541.53	537.53	83.19	87.19	454.34				ES
29N05W21H001M	3/13/2020	624.05	622.55	145.80	147.30	476.75				ES
29N05W33A001M	3/13/2020	536.96	534.96	43.71	45.71	491.25				ES
29N05W33A002M	3/13/2020	534.56	532.56	45.30	47.30	487.26				ES
29N05W33A003M	3/13/2020	536.56	534.56	42.35	44.35	492.21				ES
29N04W20A001M	5/4/2020	454.34	451.71	44.87	47.50	406.84				ES
29N04W20A002M	5/4/2020	454.14	451.75	49.91	52.30	401.84				ES
29N04W20A001M	8/3/2020	454.34	451.71	48.59	51.22	403.12				ES
29N04W20A002M	8/3/2020	454.14	451.75	56.11	58.50	395.64				ES
29N04W35B001M	8/4/2020	541.53	537.53	85.70	89.70	451.83				ES
29N05W33A001M	8/4/2020	536.96	534.96	52.06	54.06	482.90				ES
29N05W33A002M	8/4/2020	534.56	532.56	51.90	53.90	480.66				ES
29N05W33A003M	8/4/2020	536.56	534.56	54.31	56.31	480.25				ES
29N04W35B001M	10/12/2020	541.53	537.53	86.43	90.43	451.10				ES
29N05W33A001M	10/13/2020	536.96	534.96	49.56	51.56	485.40				ES
29N05W33A002M	10/13/2020	534.56	532.56	50.22	52.22	482.34				ES
29N05W33A003M	10/13/2020	536.56	534.56	48.55	50.55	486.01				ES
29N04W20A001M	10/16/2020	454.34	451.71	49.97	52.60	401.74				ES
29N04W20A002M	10/16/2020	454.14	451.75	55.93	58.32	395.82				ES
29N04W20A001M	3/17/2021	454.34	451.71	47.01	49.64	404.70				ES

[1]WL QM CD: 0 - Caved or deepened, 1 – Pumping, 3 - Casing leaking or wet, 6-Other, 8-Oil or foreign substance in casing

State Well Number	Measure. Date	RPE (ft amsl)	GSE (ft amsl)	DTW (ft bgs)	DTW (ft brp)	WSE (ft amsl)	WL QM CD[1]	Comments	QA CD	Method
29N04W20A002M	3/17/2021	454.14	451.75	49.47	51.86	402.28				ES
29N04W35B001M	3/22/2021	541.53	537.53	87.40	91.40	450.13				ES
29N05W33A001M	3/22/2021	536.96	534.96	45.50	47.50	489.46				ES
29N05W33A002M	3/22/2021	534.56	532.56	44.20	46.20	488.36				ES
29N05W33A003M	3/22/2021	536.56	534.56	41.70	43.70	492.86				ES
29N04W35B001M	7/28/2021	541.53	537.53	88.05	92.05	449.48				ES
29N04W20A001M	8/2/2021	454.34	451.71	55.88	58.51	395.83				ES
29N04W20A002M	8/2/2021	454.14	451.75	58.71	61.10	393.04				ES
29N05W33A001M	8/2/2021	536.96	534.96	53.24	55.24	481.72				ES
29N05W33A002M	8/2/2021	534.56	532.56	54.32	56.32	478.24				ES
29N05W33A003M	8/2/2021	536.56	534.56	53.37	55.37	481.19				ES
29N04W35B001M	8/3/2021	541.53	537.53	88.12	92.12	449.41				ES
29N04W35B001M	10/11/2021	541.53	537.53	88.33	92.33	449.20				ES
29N05W33A001M	10/11/2021	536.96	534.96	52.95	54.95	482.01				ES
29N05W33A002M	10/11/2021	534.56	532.56	55.02	57.02	477.54				ES
29N05W33A003M	10/11/2021	536.56	534.56	51.05	53.05	483.51				ES
29N04W20A001M	10/22/2021	454.34	451.71	55.25	57.88	396.46				ES
29N04W20A002M	10/22/2021	454.14	451.75	56.13	58.52	395.62				ES

[1]WL QM CD: 0 - Caved or deepened, 1 – Pumping, 3 - Casing leaking or wet, 6-Other, 8-Oil or foreign substance in casing