ANNUAL REPORT | APRIL 2024

VINA SUBBASIN (5-021.57)
GROUNDWATER SUSTAINABILITY PLAN
ANNUAL REPORT – 2023

SUBMITTED BY

VINA AND ROCK CREEK RECLAMATION DISTRICT
GROUNDWATER SUSTAINABILITY AGENCIES

PREPARED UNDER CONTRACT WITH

BUTTE COUNTY DEPARTMENT OF
WATER AND RESOURCE CONSERVATION

PREPARED BY

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
µS/cm	micro siemens per centimeter
AEM	Airborne Electromagnetic
AF	acre-feet
AFY	acre-feet per year
AMSL	above mean sea level
BBGM	Butte Basin Groundwater Model
CSUC	California State University, Chico
DMS	Data Management System
DWR	Department of Water Resources
DID	Durham Irrigation District
GSP	Groundwater Sustainability Plan
GSA	Groundwater Sustainability Agency
MA	Management Areas
MO	Measurable Objective
MT	Minimum / Maximum Threshold
PMAs	projects and management actions
RCRD	Rock Creek Reclamation District
RMS	representative monitoring site
SI	sustainability indicator
SGMA	Sustainable Groundwater Management Act
SMC	sustainable management criteria
Subbasin	Vina Subbasin
SWRCB	State Water Resources Control Board
WY	Water Year (October 1-September 30)

EXECUTIVE SUMMARY

The Vina Subbasin (Subbasin) (5-021.57) Annual Report was prepared on behalf of the Vina Groundwater Sustainability Agency (GSA) and the Rock Creek Reclamation District (RCRD) GSA to fulfill the statutory requirements set by the Sustainable Groundwater Management Act (SGMA) legislation (§10728) and the Groundwater Sustainability Plan (GSP) regulations (§354.40 and §356.2) developed by the California Department of Water Resources (DWR). The regulations mandate the submission of an Annual Report to DWR by April 1st after the reporting year, which spans the water year (WY) from October 1st to September 30th. This Annual Report includes information from the recent WY 2023 for the Vina Subbasin, located within Butte County and shown in **Figure ES-1.**

Measured conditions in the Subbasin were in compliance with all Minimum/Maximum Thresholds (MTs) for all applicable sustainability indicators (SIs). A Minimum Threshold is the quantitative value that represents the groundwater conditions at a representative monitoring site that, when exceeded individually or in combination with minimum thresholds at other monitoring sites, may cause an undesirable result(s) in the basin per DWR's definition. If groundwater levels are lower than the value of the Measurable Objective (MO) for that site, they are moving in the direction of the MT. On the contrary, for the groundwater quality SMC, as the value of the electrical conductivity concentration increases from the MO established for that site, they are moving in the direction of the MT. The SIs and sustainable management criteria (SMC), including MTs, are summarized in **Table ES-1.** Note that seawater intrusion is not an applicable SI in this Subbasin. Each SI is measured at Representative Monitoring Sites (RMS).

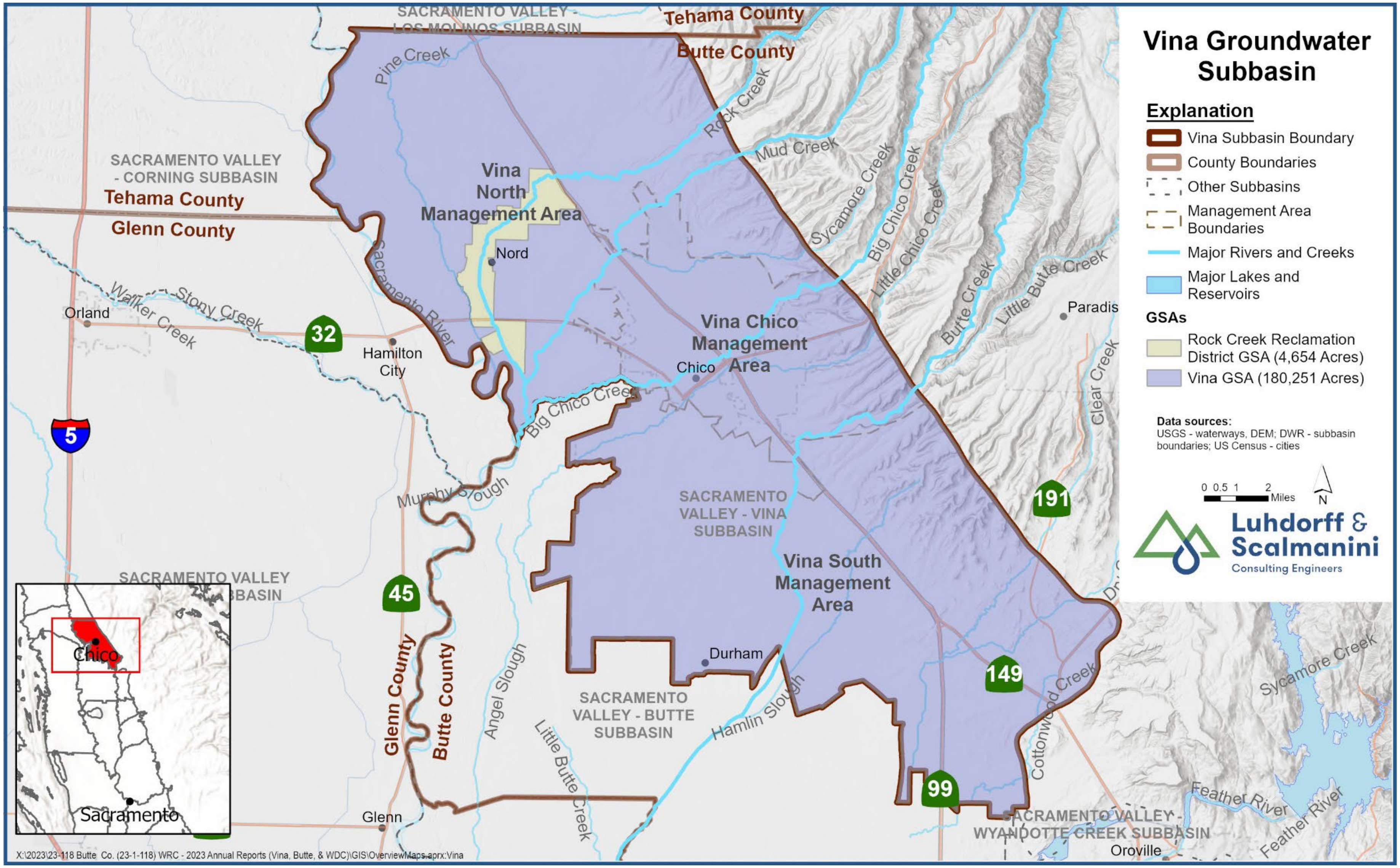

Figure ES-1. Vina Subbasin and Groundwater Sustainability Agency Boundaries

Table ES-1. Sustainability Indicator Summary

2023 Status	Undesirable Result Identification	Measurable Objective (MO) Definition	Minimum Threshold (MT) Definition
Chronic Lowering of Groundwater Levels			
No indication of undesirable results There were no RMS wells with spring or fall 2023 groundwater level measurements below the MT.	When 2 RMS wells within a management area reach their MT for two consecutive non-dry year types.	The groundwater level is based on the groundwater trend line for the dry periods (over the period of record) of observed short-term climatic cycles extended to 2030 for each RMS well.	An elevation protective of sustainably constructed domestic wells (based on their well depths for wells drilled since 1980) within the polygon associated with the RMS well
Reduction of Groundwater Storage			
No indication of undesirable results There were no RMS wells with spring or fall 2023 groundwater level measurements below the MT.	Groundwater levels are a proxy, per SGMA regulations.	Groundwater levels are a proxy, per SGMA regulations.	Groundwater levels are a proxy, per SGMA regulations.
Degraded Water Quality			
No indication of undesirable results There were no RMS wells with electrical conductivity levels above their MTs in 2023, a non-dry year. The first year of monitoring, 2022, was a dry year.	When 2 RMS wells exceed their MT for two consecutive non-dry years.	Measured electrical conductivity less than or equal to the recommended Secondary Maximum Contaminant Level (900 µS/cm) based on State Secondary Drinking Water Standards at each well.	The upper limit of the Secondary Maximum Contaminant Level for electrical conductivity (1,600 µS/cm) is based on the State Secondary Drinking Water Standards.
Land Subsidence			
No indication of undesirable results There were no RMS wells with spring or fall 2023 groundwater level measurements below the MT.	Groundwater levels are a proxy, per SGMA regulations.	Groundwater levels are a proxy, per SGMA regulations.	Groundwater levels are a proxy, per SGMA regulations.

Table ES-1. Sustainability Indicator Summary			
2023 Status	**Undesirable Result Identification**	**Measurable Objective (MO) Definition**	**Minimum Threshold (MT) Definition**
Depletion of Interconnected Surface Water			
No indication of undesirable results There were no RMS wells with spring or fall 2023 groundwater level measurements below the MT.	Uses groundwater levels as a proxy. GSP identifies data gap and describes "Interconnected Surface Water Sustainable Management Criteria Framework."	Groundwater levels are a proxy, per SGMA regulations.	Groundwater levels are a proxy, per SGMA regulations.

Notes:

Salinity is the primary water quality constituent of concern, which is evaluated by measuring electrical conductivity (EC).

MO = Measurable Objective, MT = Minimum/Maximum Threshold, RMS = representative monitoring site, µS/cm = micro siemens per centimeter

Current Groundwater Level and Storage Conditions

The current groundwater conditions in the Subbasin are characterized by groundwater elevations that have remained consistently near or above the Measurable Objectives (MO), have stayed well above the corresponding MT, and remain within the Subbasin's established margin of operational flexibility for each RMS well. Importantly, none of the RMS wells experienced a decline below the MT for two consecutive non-dry years, hence avoiding undesirable results as defined in the GSP.

Generally, groundwater elevations are, on average, 65 feet above the MT throughout the Subbasin and, on average, 16 feet above the MOs in WY 2023. Elevations are mostly near or slightly higher than those observed in recent years. This positive trend is influenced by the wet conditions experienced in WY 2023, which resulted in increased natural recharge, reliable surface water supplies, and reduced groundwater extractions.

Fluctuations in groundwater levels and storage within the Subbasin are influenced by the balance between aquifer recharge and extraction. Groundwater levels are used as a proxy for estimating changes in groundwater storage, with observed patterns closely mirroring those in the broader Sacramento Valley. In years characterized by drought and low precipitation, diminished surface water supplies lead to increased extraction and reduced recharge, causing a decline in groundwater storage.

In contrast, WY 2023, classified as a Wet WY (CDEC, 2023), marked an increase in groundwater storage of approximately 70,200 acre-feet (AF) in the Primary Aquifer (a 177% change from the previous WY). For context, in the past 23 years the largest decrease in groundwater storage is estimated to be -151,700 AF and the greatest increase was estimated to be 144,100 AF. **Figure ES-2** shows groundwater pumping, as well as annual and cumulative change in groundwater storage from WY 2000 to WY 2023.

Water Use

Groundwater extraction was approximately 242,000 AF in WY 2023, about 36,700 AF lower than the 278,700 AF extracted in WY 2022. The annual volume of surface water delivered to the Subbasin from surface water features such as Butte Creek was about 27,200 AF in WY 2023, higher than the 20,500 AF delivered in WY 2022.

Groundwater provided the majority (89%) of the water for agriculture in the Subbasin, and surface water was the source for the remainder. Groundwater also met the demand for municipal and rural residential users in the 2023 WY. The volume of groundwater and surface water used on an annual basis within the Subbasin is summarized directly from measured and reported groundwater pumping and surface water diversions when available; however, a water budget approach has been used to estimate the remaining unmeasured volume of groundwater extraction. The water use analysis methodology is discussed in **Appendix E. Table ES-2** provides a summary of water use by water sector. Numbers are rounded to the nearest 100.

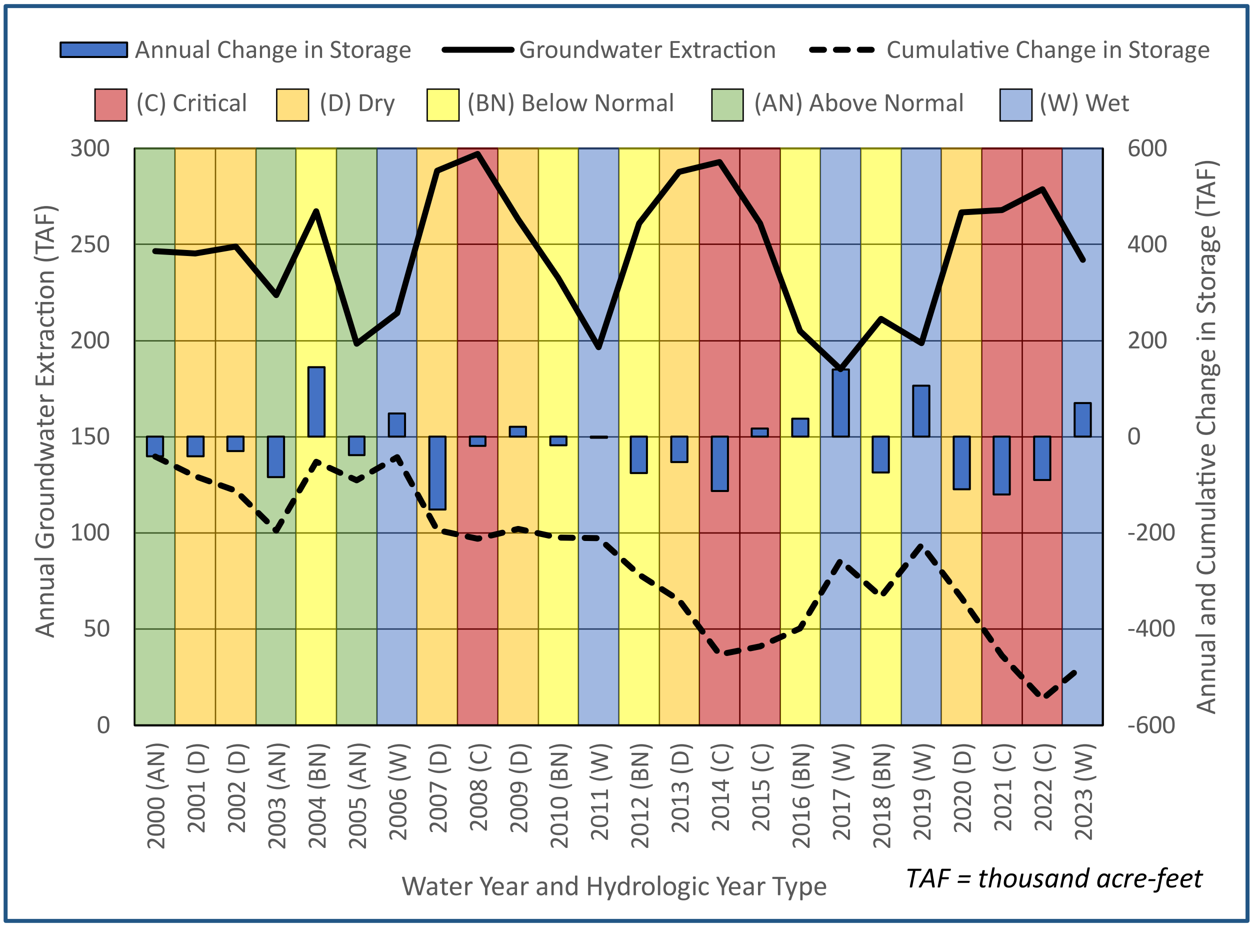

Figure ES-2. Groundwater Pumping, Annual and Cumulative Change in Storage from WY 2000 to WY 2023

Table ES-2. Total Water Use by Water Use Sector				
Sector	**WY 2023 (AF)**			
	Groundwater	**Surface Water**	**Total**	**Total Irrigated Area (acres)**
Agricultural	218,600	27,200	**245,800**	**74,900**
Municipal	21,900	0	**21,900**	**--**
Rural Residential	1,500	0	**1,500**	**--**
Total	**242,000**	**27,200**	**269,200**	**74,900**

GSP Implementation Progress

Since the previous Annual Report (Butte County, 2023), the Vina Subbasin GSAs have coordinated with stakeholders to seek funding through DWR's Sustainable Groundwater Management Grant Program for projects and management actions (PMAs) previously identified in the GSP. An awards list for the grant application was released by DWR in September 2023. Additionally, several actions by the GSAs continue to fulfill GSP requirements, such as monitoring groundwater levels and quality, updating the Data Management System (DMS), and annual reporting to DWR.

Also, since the previous Annual Report, DWR has formally approved the Vina Subbasin GSP. The Vina Subbasin GSAs acknowledge and will address the six key recommended corrective actions listed in the DWR's **GSP determination letter** (https://sgma.water.ca.gov/portal/service/gspdocument/download/9927), including:

1. Providing additional information on historical and current groundwater quality conditions in the Subbasin, and refining the definition of sustainable management criteria through a number of actions further described in the letter,
2. Review the model inputs/outputs and provide consistent information regarding stream loss and gains, clarifying whether values represent the overall interaction between the surface water and groundwater system or the quantity of depletion due to groundwater pumping,
3. Providing more information regarding criteria used to identify significant and unreasonable conditions, undesirable results, and the potential impacts to various beneficial uses and users of groundwater related to the chronic lowering of groundwater level minimum thresholds through a number of actions further described in the letter,
4. Revising the definition of undesirable results to remove the non-dry year condition or discuss how degradation during dry periods will be managed as necessary to ensure that adverse water quality conditions are offset during other periods,
5. Providing more information about the criteria used to identify undesirable results and sustainable management criteria for land subsidence through a number of actions further described in the letter,
6. Using future DWR guidance regarding estimations of the location, quantity, and timing of depletions of interconnected surface water and establishing specific sustainable management criteria to sustainably manage depletions of interconnected surface water through a number of actions further described in the letter.

In 2023, the GSAs in the Subbasin prepared to implement future projects to address recommended corrective actions, which will be largely funded by the SGM Implementation Grant Program. The ongoing implementation of PMAs, described in **Section 5**, aims to address these corrective actions effectively through the Periodic Evaluation of the GSP, which is due in January 2027.

1 GENERAL INFORMATION §356.2(A)

The Annual Report for the Vina Subbasin (Subbasin) (5-021.57) was prepared on behalf of the Vina Groundwater Sustainability Agency (GSA) and the Rock Creek Reclamation District (RCRD) 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 GSAs to submit an Annual Report to DWR by April 1st following the reporting year, which spans the water year (WY) from October 1st to September 30th. This Annual Report is the third Annual Report submitted on behalf of the Subbasin and includes data for the most recent WY 2023 (October 1, 2022, to September 30, 2023). Public seeking information on Vina Subbasin and GSP Implementation, Vina Advisory Board meeting schedules and recordings, and other resources should visit the **Vina Sustainable Groundwater website** (https://www.vinagsa.org/sgma).

1.1 Report Contents

This report is the third Annual Report prepared for the adopted Vina Subbasin GSP submitted in January 2022. The first Annual Report included data elements for the first reporting year, WY 2021, as well as a "bridge year," WY 2020. The second and third Annual Reports contain data only for the current reporting year, WY 2022 and WY 2023, respectively. Data elements presented in this report refer to WY 2023, the 12-month period spanning October 2022 through September 2023 unless otherwise noted. Pursuant to GSP regulations, the Annual Report includes:

- Groundwater Elevation Data
- Water Supply and Use
- Change in Groundwater Storage
- GSP Implementation Progress

1.2 Subbasin Setting

The Subbasin is a 289 square mile (184,917 acres) area on the eastern side of Butte County. The Subbasin is managed by the Vina and Rock Creek Reclamation District GSAs. The two GSAs worked cooperatively to develop and submit a single GSP for the Subbasin and to submit Annual Reports every year.

The Subbasin is shown in **Figure 1-1** and **Figure 1-2**. The Subbasin lies in the eastern central portion of the Sacramento Groundwater Basin, **Figure 1-1**. The Subbasin's northern boundary is the Butte-Tehama County line, the western boundary is the Butte-Glenn County line, the southern boundary is a combination of property boundaries owned by the M&T Ranch, Reclamation District 2106 and Western Canal Water District, and the eastern boundary is the edge of the alluvium as defined by DWR Bulletin 118 (DWR, 2018), **Figure 1-2**. There are several surface water features located in the Subbasin, including the Big Chico Creek, Butte Creek, Mud Creek, and Rock Creek. Generally, the streams traverse the Subbasin, moving northeast to southwest. Groundwater generally flows from north to southwest.

The GSP defines three management areas (MAs) in the Vina Subbasin: Vina North, Vina Chico, and Vina South. An MA refers to an area within a subbasin for which a GSP may identify different minimum thresholds (MTs), measurable objectives (MOs), monitoring, and projects and management actions (PMAs) based on unique local conditions or other circumstances as described in the GSP regulations. Although all stakeholders have a shared interest in the sustainable management of groundwater in this predominantly groundwater-dependent Subbasin, the landscape of beneficial users varies between MAs. Vina North is dominated by irrigated agriculture dependent on wells with sparsely distributed rural residential domestic well users and the small community of Nord. The Vina-Chico MA is predominantly an urban area with California Water Service, Chico (Cal Water-Chico), providing groundwater supplies for residential and municipal/industrial use. To a very limited extent, private domestic wells provide the primary source of water to households or, in some cases, provide a secondary supply for outdoor water use. The Vina South MA is dominated by irrigated agriculture dependent on groundwater and, to a lesser extent, surface water diversions (primarily from Butte Creek). In and around the community of Durham, significant numbers of rural residents and ranchettes depend on groundwater, typically from relatively shallow domestic wells interspersed with agricultural land uses. In addition, Durham Irrigation District serves household water needs using groundwater from district wells for a portion of the Durham community.

The Vina Subbasin GSP estimates the sustainable yield of the Subbasin to be 233,500 acre-feet per year (AFY) based on historical groundwater pumping averages of 243,500 AFY and an annual decrease in storage of 10,000 AFY (Geosyntec, 2021). Water use in the Subbasin is dominated (91%) by agricultural uses, including irrigation of nut and fruit trees, vineyards, row crops, grazing, and rice fields. Municipal and household water use accounts for the rest (9%) of water used. Groundwater constitutes the majority (89%) of the Subbasin’s water supplies, while surface water constitutes the remaining 11%.

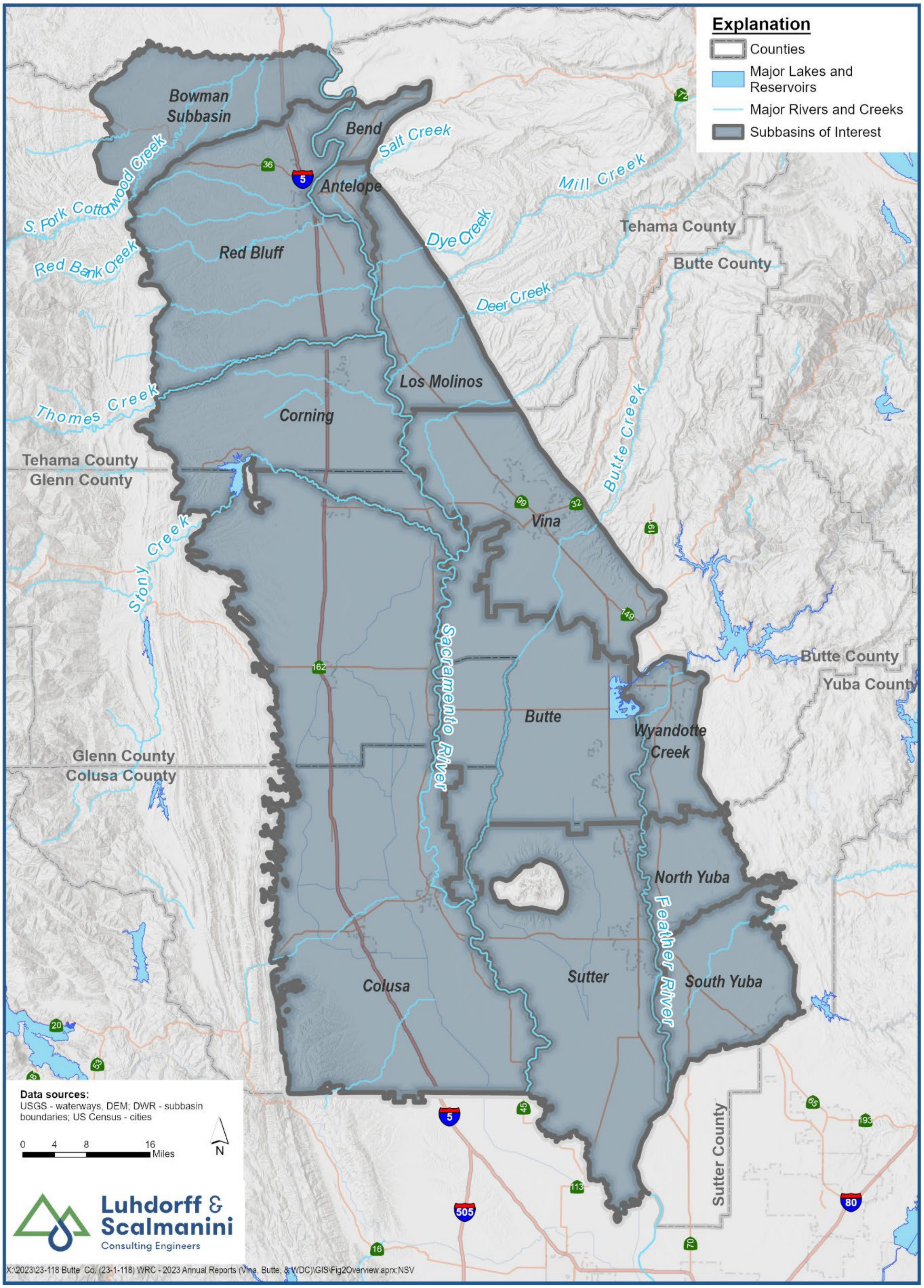

Figure 1-1. Subbasins in the Northern Sacramento Valley

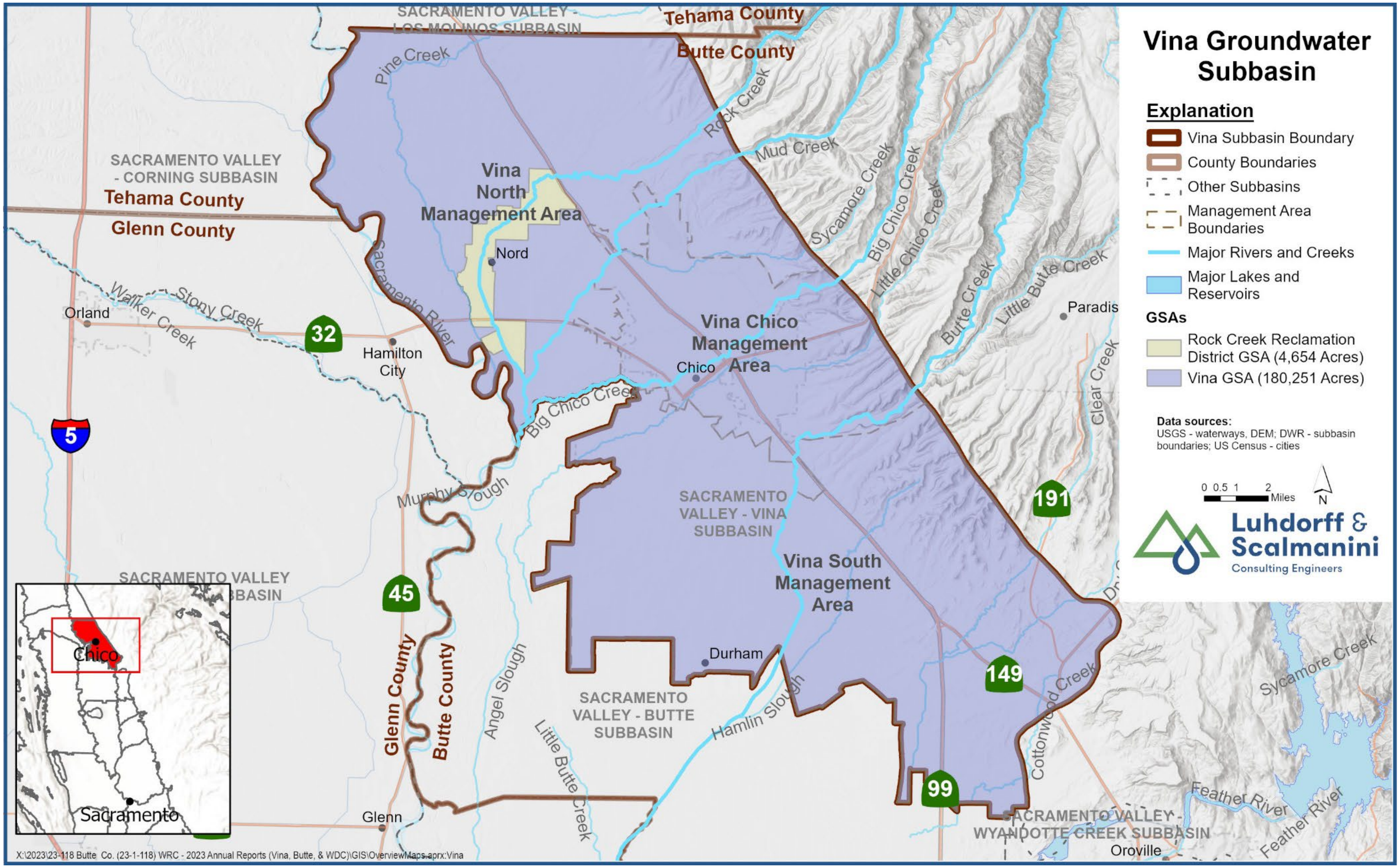

Figure 1-2. Vina Subbasin and Groundwater Sustainability Agency Boundaries

2 GROUNDWATER ELEVATIONS §356.2(b)(1)

Groundwater elevations in the Subbasin typically fluctuate seasonally between and within water years, particularly in groundwater-dependent areas or during drought years when groundwater is used to compensate for diminished surface water supplies. Seasonal fluctuations of groundwater levels occur in response to groundwater pumping and recovery, land and water use activities, recharge, and natural discharge. Sources of recharge into the groundwater system include precipitation, applied irrigation water, and seepage from local creeks and rivers.

Groundwater pumping for irrigation typically occurs from April to September, although depending on the timing of rainfall, it may shift earlier and/or later into the season. Consequently, groundwater levels are usually highest in the spring and lowest during the irrigation season in the summer months. Fall groundwater measurements (typically measured in October) provide an indication of groundwater conditions after the primary irrigation season. Groundwater levels follow a variety of patterns in different areas of the Subbasin; depth to groundwater ranges from about 20 feet below ground surface to over 150 feet below ground surface.

Groundwater levels in the Subbasin are monitored in representative monitoring site (RMS) wells that were selected in the GSP to represent localized groundwater conditions for specified areas of the Subbasin. RMS wells include a mixture of domestic wells, irrigation wells, and dedicated observation wells. In total, 17 RMS wells are used to monitor conditions in the Primary Aquifer. **Appendix A** includes a map of the approximate locations of the RMS wells and hydrographs depicting groundwater elevations in the RMS wells. Sustainable management criteria (SMC), described in **Appendix B**, are assigned for groundwater levels at the RMS wells.

Certain RMS wells measured by DWR and Butte County are equipped with data loggers and pressure transducers, which continuously monitor and record hourly changes in groundwater levels. These and the remaining wells in the network are measured by hand at least twice in Spring and Fall but up to four times each year in March, July, August, and October. Data from groundwater level monitoring wells is available from DWR's online SGMA Data Viewer tool (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer).

Spring and Fall 2023 groundwater elevation measurements from RMS wells in the Primary Aquifer systems are summarized in **Table 5-2**. Groundwater elevation data in the Subbasin is collected by DWR and Butte County and is publicly available from DWR's online SGMA Data Viewer tool (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). The groundwater level monitoring methods are consistent with the protocols described in the Vina Subbasin GSP. Depending on the well, groundwater elevations are measured using steel tape, electric sounder, or pressure transducers. The accuracy of groundwater level measurements is typically either 0.01 feet or 0.1 feet, depending on the equipment used.

The following sections provide a summary of groundwater elevations and conditions during WY 2023 through the presentation and description of groundwater elevation contours (**Section 2.1**) and hydrographs of groundwater elevations (**Section 2.2; Appendix A**).

2.1 Groundwater Elevation Contour Maps – §356.2(b)(1)(A)

Groundwater elevation contour maps for Spring and Fall 2023 were prepared for the Primary Aquifer, as shown in **Figures 2-1** through **2-2**. Spring contours are intended to generally represent seasonal high groundwater elevations (shallower depth to water), while fall contours are intended to generally represent seasonal low groundwater elevations (deeper depth to water). Groundwater elevation contours were developed by creating a continuous groundwater elevation surface based on available monitoring well data using the kriging interpolation method. Questionable groundwater elevation measurements were excluded, and minor adjustments to the contours were made based on professional judgment.

The contour maps of the Primary Aquifer (**Figures 2-1** and **2-2**) each show that groundwater elevations are generally higher in the northern and eastern areas of the Subbasin versus the southern and western areas, indicating a general gradient – and thus groundwater flow, from the northeast to the southwest. The contour maps illustrate several general features of the groundwater flow system in the Vina Subbasin, including:

- Overall, west-southwest groundwater flow is consistent with recharge from the north and along the eastern foothills.
- Convergence of groundwater flow toward pumping areas west of Butte Creek and near Durham in the Vina South MA.
- The higher concentration of contours in the southeast portion of the Subbasin indicates a steeper gradient and could suggest higher groundwater flow. However, given the characteristics of aquifer materials on the eastern portion of the Subbasin, the steep gradient is likely evidence of aquifer materials with lower transmissivity. Nonetheless, the contours are consistent with the current understanding of recharge coming from the lower foothills. New sources of information and data may improve understanding of this area.

Elevations in Fall 2023 tend to be ten feet lower than elevations in Spring 2023 throughout the Subbasin. Groundwater levels are typically lower in the fall in valley floor locations due to irrigation season pumping. Maps showing the regional context of groundwater contours, including groundwater contours in the Vina, Butte, and Wyandotte Creek Subbasins, are included in **Appendix A**.

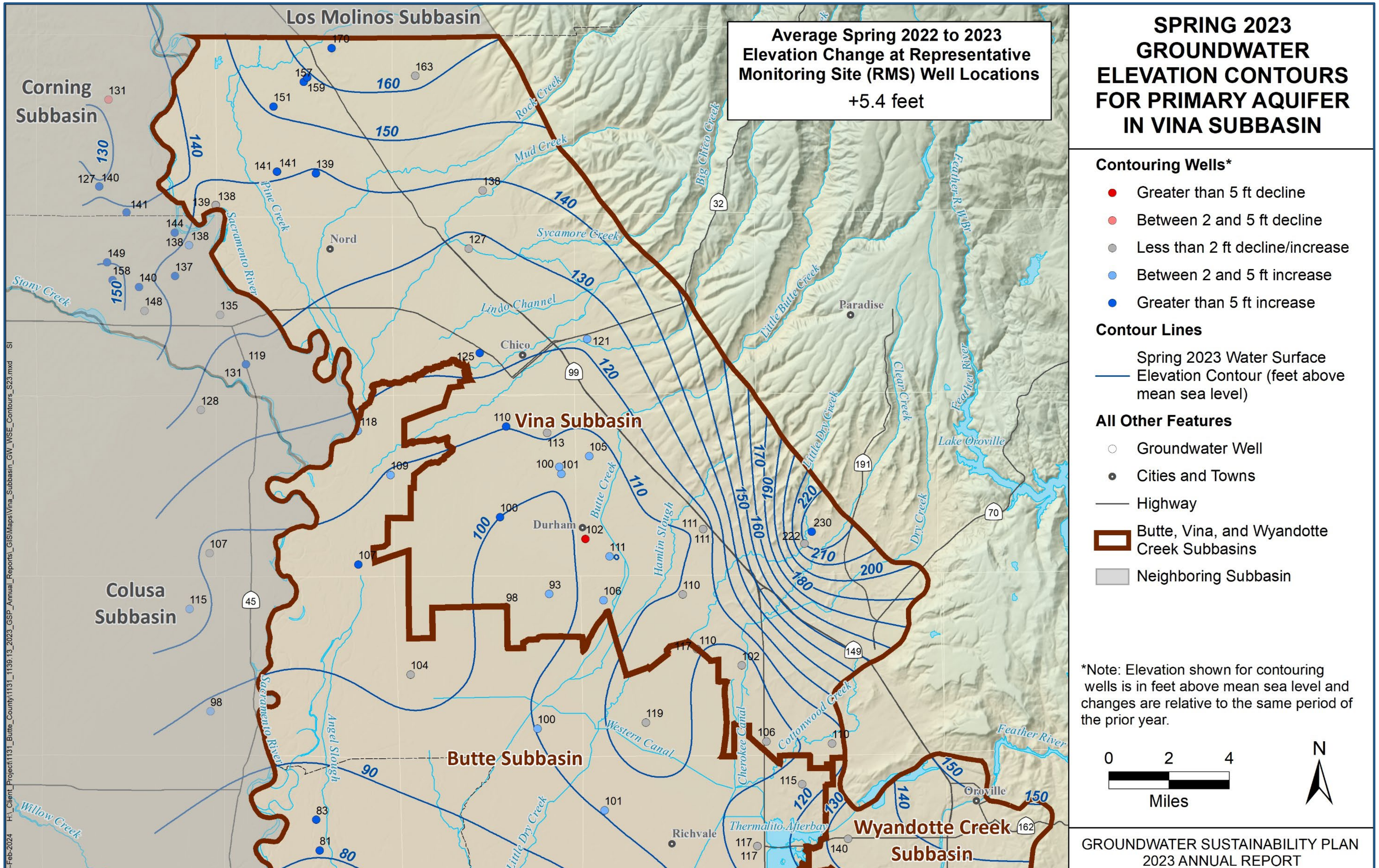

Figure 2-1. Subbasin Contours of Equal Groundwater Elevation for the Primary Aquifer, Spring 2023 (Seasonal High)

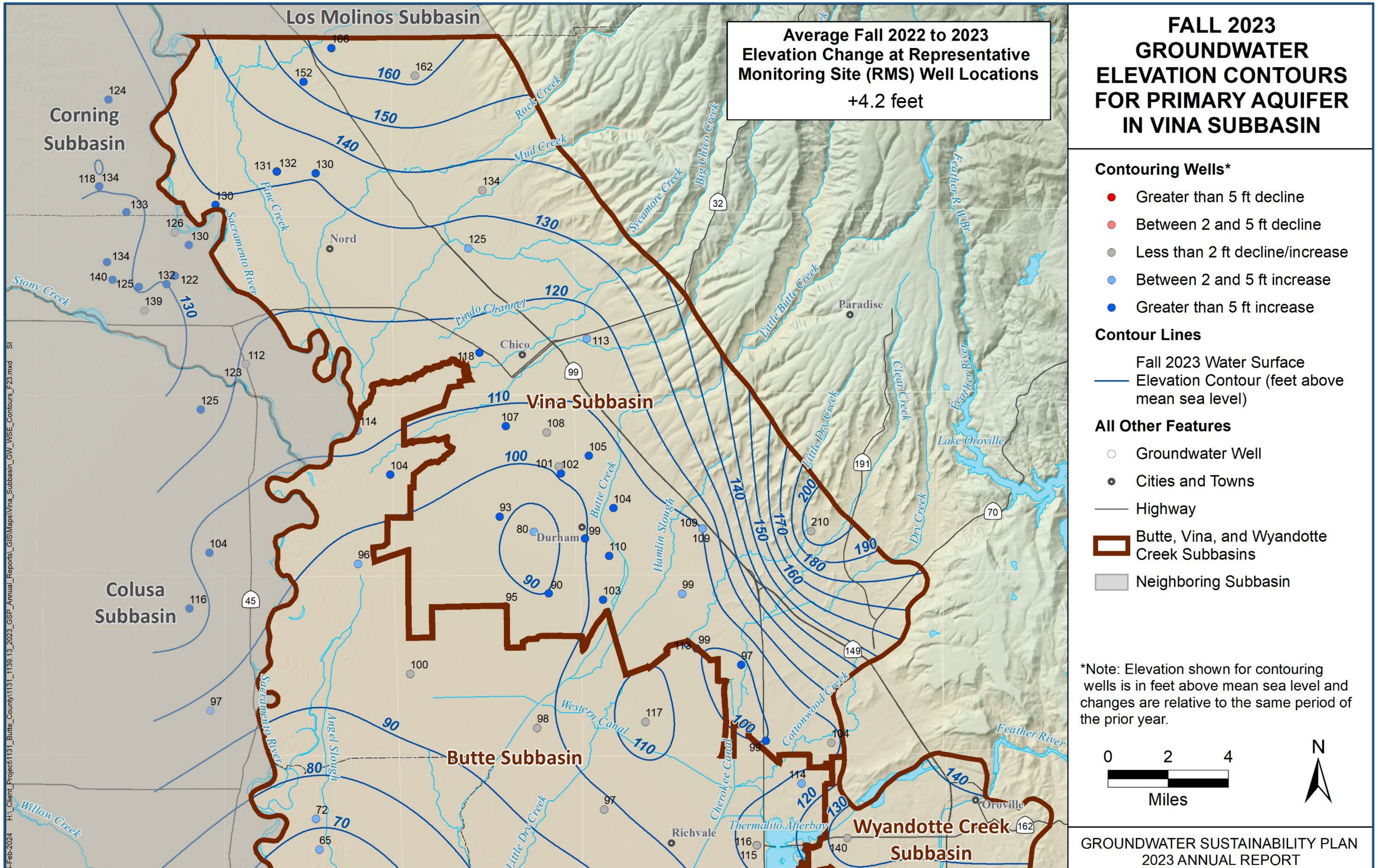

Figure 2-2. Subbasin Contours of Equal Groundwater Elevation for the Primary Aquifer, Fall 2023 (Seasonal Low)

2.2 Hydrographs of Groundwater Elevations – §356.2(b)(1)(B)

Groundwater elevation hydrographs for each RMS well are presented in **Appendix A**. **Appendix B** provides an explanation of the SMC terminology defined in Section 3 of the GSP (e.g., Minimum Threshold [MT], Measurable Objective [MO], Interim Milestone [IM]). **Table 5-1** summarizes the MOs, MTs, and identification of undesirable results for WY 2023, and **Table 5-2** contains a summary of the Spring 2023 (Seasonal High) and Fall 2023 (Seasonal Low) groundwater elevations measured at each RMS well. **Table 5-2** also summarizes the established MO and MT for groundwater elevations, the IM for 2027, the changes in groundwater elevations from WY 2022 to WY 2023, and the differences between the 2023 groundwater elevations and the MO.

Historically, groundwater levels have typically remained at or above their respective MOs in the Subbasin. The GSP also established IMs to provide numerical metrics for GSAs to track the Subbasin's conditions relative to the overall sustainability goal, ensuring that the groundwater management of the Subbasin remains sustainable.

Spring and Fall 2023 groundwater elevations were generally near or slightly higher than seasonal groundwater elevations in previous years, particularly WY 2022. In WY 2023, the average seasonal high was 128 feet above mean sea level (AMSL), and the average seasonal low was 118 feet AMSL. In WY 2022, the average seasonal high was 123 feet AMSL, and the average seasonal low was 115 feet AMSL. Increases in groundwater levels generally were expected to result from decreased groundwater extraction in WY 2023 relative to WY 2022, as well as increased recharge due to wet climate conditions.

All wells remained above the MO during Spring 2023 and Fall 2023. All measured groundwater elevations also remained above the corresponding MT of that RMS well, avoiding undesirable results related to groundwater levels as defined in the GSP. Groundwater levels in RMS wells were on average about 65 feet higher than MT elevations over both spring and fall 2023. All measured groundwater levels remained within the Subbasin's margin of operational flexibility and above the MTs.

3 WATER SUPPLY AND USE

As required by §356.2, this section summarizes water supply and use in the Subbasin, categorized by groundwater supply, surface water supply, and total supply. The total water available for use in the Subbasin was tabulated from groundwater extraction volumes reported in **Table 3-1** and the surface water supply reported in **Table 3-2**. The total water available is summarized in **Table 3-3** for WY 2023. Groundwater extraction volumes are either based on measured data or are estimates from a water use analysis based on 2023 land use data and climate conditions. The water use analysis methodology is discussed in **Appendix E**. Surface water use was estimated from historic deliveries when records were not available.

3.1 Groundwater Extraction – §356.2(b)(2)

Groundwater extraction in the Subbasin is summarized in **Table 3-1**. Groundwater extraction is reported from pumping records where available, while the remaining groundwater extraction is estimated through the water use analysis approach described in the previous section and in **Appendix E**.

The majority of the Subbasin uses groundwater supplies for agricultural irrigation, although portions of the Subbasin may rely on surface water for irrigation. In years characterized by drought and low precipitation, diminished surface water supplies lead to increased extraction and reduced recharge and can cause a decline in groundwater storage. Contrastingly, in wet years, such as WY 2023, substantial surface water supplies help to increase recharge and offset extraction and can increase groundwater storage.

Municipal water users extracted approximately 21,900 AF in the Subbasin in WY 2023. Municipal water supplies are measured and were provided by Cal Water, Chico, and Durham Irrigation District (DID). The record of municipal supplies does not distinguish between urban and industrial water uses.

Rural residential water users rely on private domestic wells to meet their household water needs and extracted approximately 1,500 AF in WY 2023. Rural residential groundwater extraction was quantified based on average per capita water use and estimated population. The average per capita water use reported in the California Water Service Chico-Hamilton City District 2020 Urban Water Management Plan 2020 (Cal Water Chico, 2020) was 181 gallons per capita per day. This is considered representative of rural residential per capita water use in the region. Parcels were chosen within the Subbasin, except for those in municipal service areas. Residential parcels were selected based on Butte County's general plan zoning codes from the general plan. Population estimates were derived from these zoning codes and average household sizes from the US census. The resulting population estimate was used to estimate residential groundwater pumping.

The total estimated groundwater extraction was approximately 242,000 AF in WY 2023, the majority of which was used to meet agricultural water demands (approximately 218,600 AF). The total groundwater extraction is about 3,100 AF less than the historical (2000 – 2022) groundwater pumping average (245,100 AFY; **Table 4-1**) but higher than 198,600 AF, which was the average annual extraction of the last four wet WYs on record (2006, 2011, 2017, and 2019). **Figure 3-1** shows the general areas and pumping rates where extraction occurs by sector. Roughly 90% of the total groundwater extraction was used by the agricultural sector, while the remaining 10% was used for municipal and rural residential water needs.

Table 3-1. Groundwater Use by Water Use Sector

Sector	WY 2023 (AF)
Agricultural	218,600
Municipal	21,900
Rural Residential	1,500
Total	**242,000**

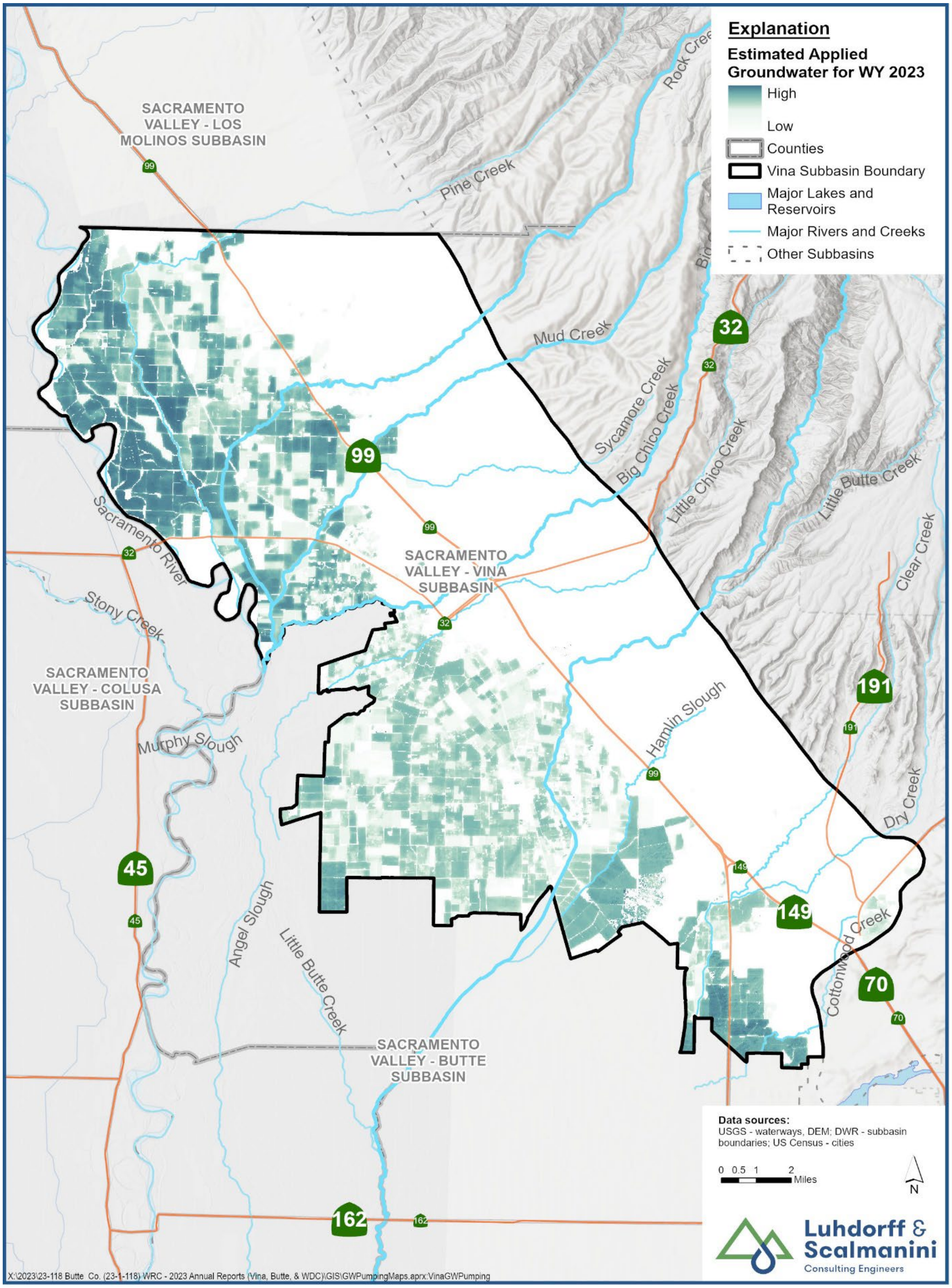

Figure 3-1. Estimated Applied Groundwater – WY 2023

3.2 Surface Water Supply – §356.2(b)(3)

Surface water supplies used or available for use in the Subbasin are summarized in **Table 3-2.** Surface water supplies are reported directly from water supplier records or collected from publicly available sources (water rights diversion records, etc.) where available. Missing surface water supply data was estimated based on available historical diversions data in similar water years.

Surface water provided about 11% of the agricultural water demand in the Subbasin for WY 2023. Diversions from Butte Creek were accessed from the State Water Resource Control Board's (SWRCB) Electronic Water Rights Information Management System (SWRCB, 2023) or direct request from diverters. Data from eWRIMS on surface water delivery indicated which water rights holders on Butte Creek had made diversions during WY 2023. There are currently no surface water supplies for municipal use in the Vina Subbasin. Total surface water diversions and deliveries for the Vina Subbasin are estimated to be about 30,400 AF and 27,200 AF, respectively.

In contrast with the curtailments and reduced surface water supplies experienced in WY 2022, WY 2023 was a Wet WY with more substantial surface water supplies. These, combined with wet climate conditions and increased stream flows, supported groundwater recharge and offset groundwater extraction volumes compared to WY 2022.

Table 3-2. Surface Water Use by Water Use Sector for WY 2023

Sector	Diverted (AF)	Applied (AF)
Agricultural	30,400	27,200
Total	30,400	27,200

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

Groundwater supplied approximately 89% of the agricultural water demand in the Subbasin in WY 2023, while surface water supplied the remaining approximately 11% of the agricultural water. The total water available for use in the Subbasin was tabulated from groundwater extraction volumes reported in **Table 3-1** and the surface water supply reported in **Table 3-2**. The total water available is summarized in **Table 3-3** for WY 2023. The results are either based on measured data or estimates, as described in the previous two sections. **Table 3-3** also shows the total irrigated area in WY 2023 within the Subbasin.

Table 3-3. Total Water Use by Water Use Sector

Sector	WY 2023 (AF)			
	Groundwater	Surface Water	Total	Total Irrigated Area (acres)
Agricultural	218,600	27,200	**245,800**	**74,900**
Municipal	21,900	0	**21,900**	**--**
Rural Residential	1,500	0	**1,500**	**--**
Total	**242,000**	**27,200**	**269,200**	**74,900**

3.4 Uncertainties in Water Use Estimates

Estimated uncertainties in the water budget components are presented in **Table 3-4**. The uncertainty of these water budget components is based on typical accuracies given in technical literature and the cumulative estimated accuracy of all inputs used to calculate the components.

Table 3-4. Estimated Uncertainty in Water Use Estimates

Water Budget Component	Data Source	Estimated Uncertainty (%)	Source
Groundwater			
Agricultural	Measurement	20%	Typical uncertainty from water balance calculation.
Municipal/Industrial	Measurement/ Estimate	5%	Typical accuracy of municipal water system reporting.
Rural Residential	Calculation	15%	Estimated from per capita water use and Census information.
Surface Water			
Agricultural	Calculation	10%[1]	Estimated from Senate Bill 88 measurement accuracy standards.

[1] *Higher uncertainty of 10%-20% is typical for estimated surface water inflows, including un-gaged inflows from small watersheds into creeks that enter the Subbasin.*

4 Groundwater Storage

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, and groundwater storage decreases. 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.

A review of the RMS well hydrographs (**Appendix A**) indicates that groundwater elevations are either relatively stable or showing a declining trend over time. Declines may be influenced by the significant percentage of water years since 2006 that have been dry (i.e., characterized as Below Normal, Dry, or Critical). Since groundwater storage is closely related to groundwater levels, measured changes in groundwater levels can serve as a proxy for and be utilized to estimate changes in groundwater storage. Changes in groundwater storage in the Subbasin follow a pattern typically seen in the majority of the Sacramento Valley. During normal to wet years, groundwater is withdrawn during the summer for irrigation and is replenished during the winter through recharge of precipitation and surface water inflows, allowing groundwater storage to potentially rebound by the following spring. During dry years and drought conditions, this pattern is disrupted when more groundwater may be pumped to meet irrigation demand, and less recharge may occur due to reduced precipitation, diminished or curtailed surface water supplies, and lower stream levels.

In WY 2023 (a Wet WY), groundwater storage increased by approximately 70,200 AF in the Primary Aquifer. Decreased groundwater extraction in WY 2023 relative to WY 2022 contributed to the increase, as well as increased recharge due to wet climate conditions. These and related factors, such as flood irrigation with surface water and increased stream flows, resulted in higher groundwater levels in Spring 2023 compared to Spring 2022.

The following sections present a summary of groundwater use and change in storage over time, along with a description of the uncertainty in storage change estimates.

4.1 Change in Groundwater Storage – §356.2(b)(5)(B)

Annual groundwater pumping, groundwater storage changes, and the cumulative change in storage over time are presented for WY 2000 through WY 2023 in **Table 4-1** and **Figure 4-1**. In contrast to the Critically Dry conditions of WY 2022, WY 2023 was a Wet WY and correspondingly saw a marked increase in groundwater storage, totaling approximately 70,200 AF in the Primary Aquifer. For context, in the past 23 years the largest decrease in groundwater storage is estimated to be -151,700 AF and the highest increase was estimated to be 144,100 AF.

The historical record since 2000 includes multiple data sources. Groundwater extractions for WY 2000 through WY 2018 were obtained from the Butte Basin Groundwater Model (BBGM, BCDWRC, 2021), and the water budgets were prepared as part of the Vina Subbasin GSP (Geosyntec, 2021). The WY 2019 and WY 2020 groundwater extraction values were calculated as the average based on the hydrologic year type from WY 2000 to WY 2018. The WY 2021 and WY 2022 groundwater extraction values were obtained from prior Annual Reports and were developed using the same methods as WY 2023, as described in **Section 3** and **Appendix E**. Groundwater extractions for the entire period include pumping for agricultural, municipal, and rural residential purposes.

The annual and cumulative changes in groundwater storage are both calculated for the period from WY 2000 through WY 2023 based on the methodology described below in **Section 4.2**. This methodology differs from the change in groundwater storage estimates available through the BBGM. An evaluation of a total of 20 pairs of concurrent annual storage changes over the period from WY 1999 through WY 2018 was assembled from the BBGM, and the methodology described in **Section 4.2** was completed to evaluate the consistency of the new methodology with the BBGM results. Although groundwater storage changes differ in some cases, the general trends are similar, and there is agreement between the methodologies. It is anticipated that the methodology described in **Section 4.2** will be utilized for Annual Report updates until the BBGM model is updated from 2018 through the present (anticipated to be completed as part of the Periodic Evaluation of the GSP due in January 2027, if not sooner).

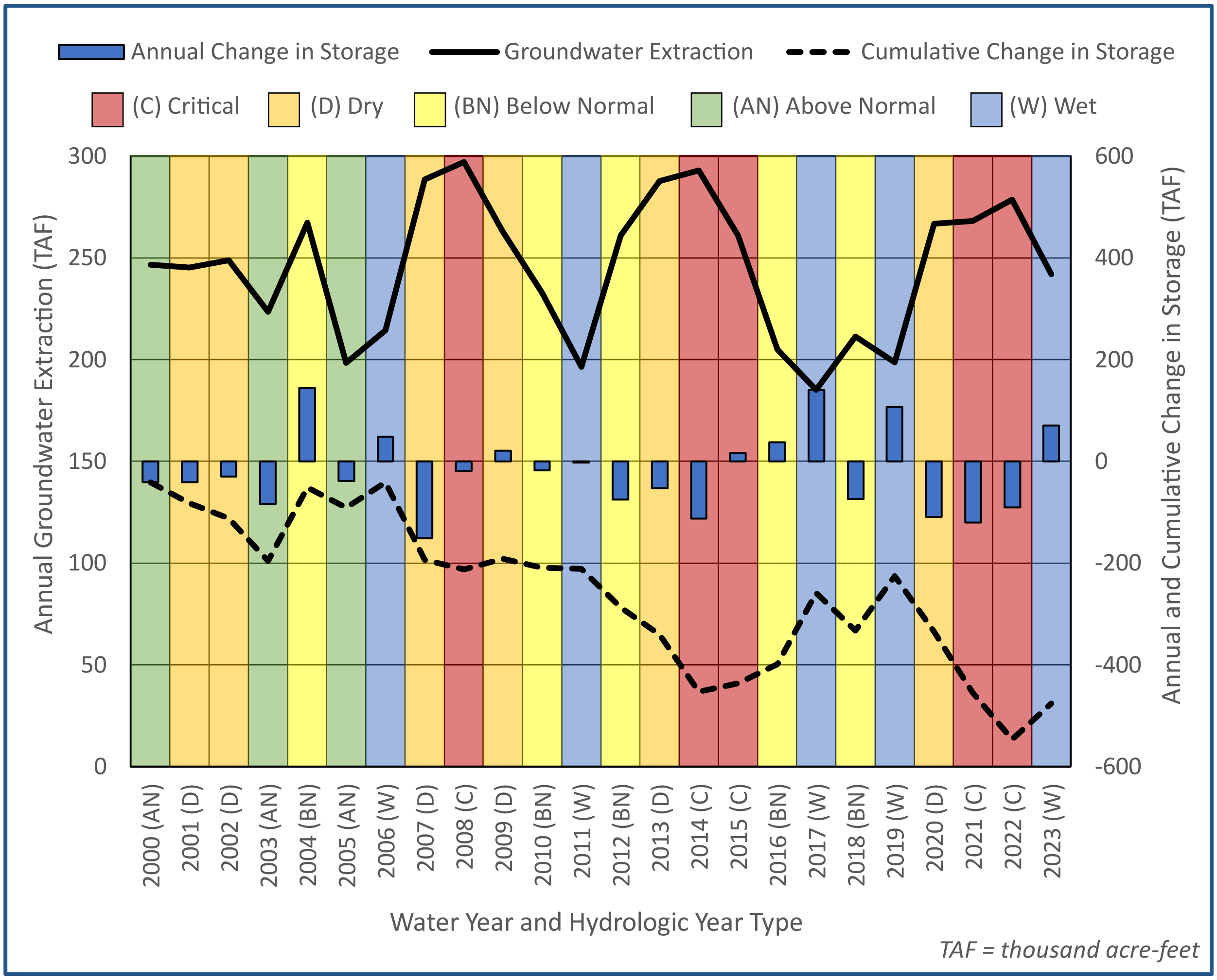

Figure 4-1. Groundwater Pumping and Annual and Cumulative Change in Storage from WY 2000 to WY 2023

Table 4-1. Annual Groundwater Extraction and Change in Storage			
Water Year (Hydrologic Year Type)	**Groundwater Extraction[1] (AF)**	**Annual Change in Storage (AF)**	**Cumulative Change in Storage (AF)**
Storage Change and Cumulative Change in Storage			
2000 (AN)	246,600	-41,000	-41,000
2001 (D)	245,200	-40,800	-81,800
2002 (D)	248,900	-30,300	-112,100
2003 (AN)	223,500	-83,900	-196,000
2004 (BN)	267,200	144,100	-51,900
2005 (AN)	198,400	-38,800	-90,700
2006 (W)	214,400	48,700	-42,000
2007 (D)	288,400	-151,700	-193,700

Table 4-1. Annual Groundwater Extraction and Change in Storage			
Water Year (Hydrologic Year Type)	Groundwater Extraction[1] (AF)	Annual Change in Storage (AF)	Cumulative Change in Storage (AF)
2008 (C)	297,100	-18,900	-212,600
2009 (D)	263,000	20,700	-191,900
2010 (BN)	232,700	-17,600	-209,500
2011 (W)	196,500	-2,100	-211,600
2012 (BN)	261,000	-75,700	-287,300
2013 (D)	287,600	-53,000	-340,300
2014 (C)	293,000	-112,600	-452,900
2015 (C)[2]	260,900	16,800	-436,100
2016 (BN)	205,100	37,200	-398,900
2017 (W)	185,000	140,300	-258,600
2018 (BN)	211,400	-73,900	-332,500
2019 (W)	198,600	106,700	-225,800
2020 (D)	266,600	-109,400	-335,200
2021 (C)[2]	267,980	-120,400	-455,600
2022 (C)[2]	278,700	-90,700	-546,300
2023 (W)	242,000	70,200	-476,100
Historic Averages (2000 – 2022)[3]			
2000-2022 (22 years)	245,100	-23,800	
W (4 years)	198,600	73,400	
AN (3 years)	222,800	-54,600	
BN (5 years)	235,500	2,800	
D (6 years)	266,600	-60,800	
C (6 years)	279,500	-65,200	

Positive values indicate inflows to the groundwater system and negative values indicate outflows from the groundwater system.

GW = Groundwater, AF = acre-feet

Water Year Types Classified According to the Sacramento Valley Water Year Index:
AN = Above Normal, BN = Below Normal, C = Critical, D = Dry, W = Wet

[1] *Groundwater extraction values from 2000 to 2018 were determined using BBGM (Geosyntec, 2021). Values for 2019-2020 are averages from that period. Estimates for 2021 were based on a drought impact analysis (**Appendix E**), while estimates for 2022-2023 are based on a GEEEO process, described in the same appendix.*

[2] *Indicates curtailment year with reduced surface water supply allocations to Feather River water districts.*

[3] *The historical average calculation covers the period from 2000 to 2022, excluding the current water year.*

4.2 Groundwater Storage Maps – §356.2(b)(5)(A)

The spatial distribution of estimated changes in groundwater storage for the period from Spring 2022 to Spring 2023 are shown in **Figure 4-2** and **Figure 4-3** for the Primary Aquifer. Since groundwater storage is closely related to groundwater levels, measured changes in groundwater levels can serve as a proxy for and be utilized to estimate changes in groundwater storage. Change in groundwater storage was estimated based on the change in measured spring-to-spring groundwater levels at each RMS well, multiplied by the area of a Thiessen polygon surrounding that RMS well (defining a representative area for each RMS well) and a representative storage coefficient of 0.1 for the Primary Aquifer.

Spring measurements used to calculate the change in groundwater storage were computed as the average of all available groundwater level measurements from March and April of the respective year. The representative storage coefficient was established by roughly calibrating the estimated change in storage based on changes in observed groundwater levels (i.e., calculated using groundwater level data, representative area, and a storage coefficient parameter) with estimated change in storage outputs from the BBGM, as reported in the GSP to aggregate characteristics across all zones of the Primary Aquifer system. A total of 20 pairs of concurrent annual storage changes assembled from both methods over the period from WY 1999 through WY 2018 were used for calibration. Determination of a representative storage coefficient allows for estimating the change in volume of groundwater storage based on the measured change in groundwater levels and known representative area (i.e., Thiessen polygon) associated with each groundwater level measurement.

Negative changes in storage values indicate lowering groundwater levels and depletion of groundwater storage, whereas a positive change in storage values represents rising groundwater levels and accretion of groundwater in storage. As shown in **Figure 4-2**, the change in storage for each representative area (i.e., Thiessen polygon) in the Primary Aquifer over the previous year ranged from roughly zero to 10,000 AF. The representative areas around the northwestern and central portions of the Subbasin had a larger positive change in storage, while the areas in the northeastern and southeastern portions of the Subbasin had a very slight negative change in storage. Total groundwater storage change in the Primary Aquifer was estimated to be approximately 70,200 AF between Spring 2022 and Spring 2023.

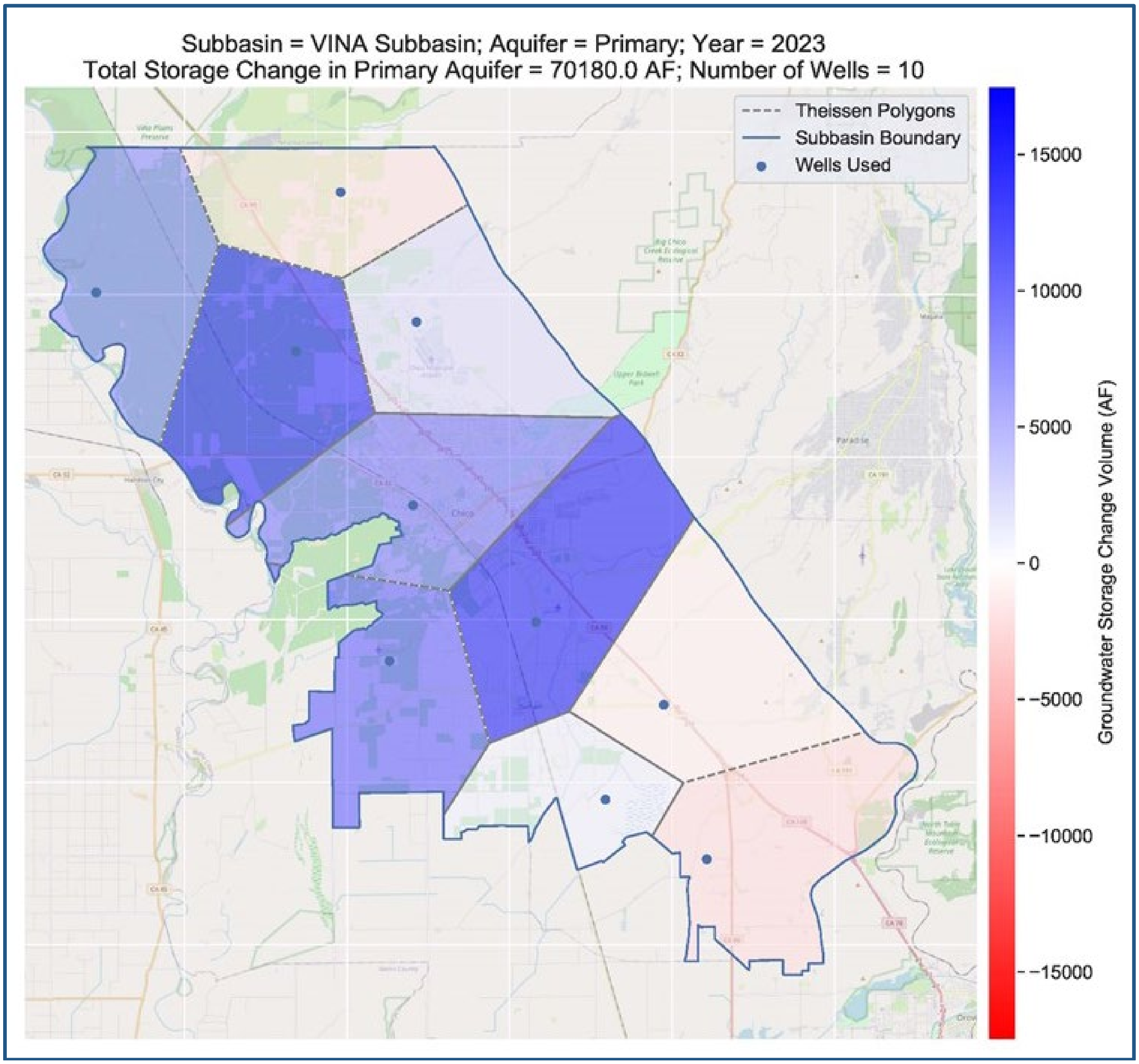

Figure 4-2. Change in Groundwater Storage from Spring 2022 to Spring 2023 in the Primary Aquifer

4.3 Uncertainty in Groundwater Storage Estimates

The uncertainty associated with the change in groundwater storage estimates depends in part on the underlying uncertainty of the groundwater level data, the representative area (i.e., Thiessen polygon), and the calibrated storage coefficient parameter used to calculate the change in groundwater storage. As described in **Section 4.2**, a calibration process was conducted to roughly align the estimated change in groundwater storage based on observed groundwater levels to the estimated change in groundwater storage outputs from the BBGM. Thus, the uncertainty of the estimated change in groundwater storage reported in **Table 4-1** and **Figure 4-2** is estimated to be approximately equal to the uncertainty of the estimated change in groundwater storage outputs from the BBGM (typically 20-30% for integrated hydrologic models).

5 GSP IMPLEMENTATION PROGRESS – §356.2(B)(5)(C)

5.1 Main Activities of Water Year 2023

The main activities and updates since the previous Annual Report are as follows:

- The GSAs completed the WY 2023 Annual Report and other critical tasks. Butte County agreed to serve as the fund administrator for the GSA.
- The Vina GSA adopted a property-related service fee to fund the operations of the GSA and implementation costs to comply with SGMA.
- The GSAs coordinated a proposal seeking funding through DWR's SGM Grant Program. Coordination efforts included planning and refinement of PMAs, evaluating and ranking PMAs, and preparing and submitting the grant application. The grant application was submitted in December 2022, and a final award list was released by DWR in September 2023. The application was fully funded; results are summarized below in **Table 5-3**.
- An airborne electromagnetic (AEM) survey by DWR took place in the summer of 2022. The data collected provides a better understanding of aquifer characteristics and will help support future efforts to refine the current hydrogeologic conceptual model. Data is available at: https://data.cnra.ca.gov/dataset/aem.
- All sustainability indicators (SIs) are in compliance with their MTs (see summary **Table 5-1**).
- Progress has been made on 10 PMAs since the last annual report (**Tables 5-3** and **5-4**).

Several other actions continue in the Subbasin to fulfill the requirements of the GSP. These include:

- Monitoring and recording groundwater levels and groundwater quality.
- Maintaining and updating the DMS with newly collected data.
- Annual reporting of Subbasin conditions and submission to DWR as required by SGMA.
- Ongoing intra- and inter-basin coordination.

The GSP was approved in July of 2023, and DWR proposed six recommended corrective actions that will enhance the GSP:

1. Providing additional information on historical and current groundwater quality conditions in the Subbasin, and refining the definition of sustainable management criteria through a number of actions further described in the letter,
2. Review the model inputs/outputs and provide consistent information regarding stream loss and gains, clarifying whether values represent the overall interaction between the surface water and groundwater system or the quantity of depletion due to groundwater pumping,
3. Providing more information regarding criteria used to identify significant and unreasonable conditions, undesirable results, and the potential impacts to various beneficial uses and users of

groundwater related to the chronic lowering of groundwater level minimum thresholds through a number of actions further described in the letter,

4. Revising the definition of undesirable results to remove the non-dry year condition or discuss how degradation during dry periods will be managed as necessary to ensure that adverse water quality conditions are offset during other periods,
5. Providing more information about the criteria used to identify undesirable results and sustainable management criteria for land subsidence through a number of actions further described in the letter,
6. Using future DWR guidance regarding estimations of the location, quantity, and timing of depletions of interconnected surface water and establishing specific sustainable management criteria to sustainably manage depletions of interconnected surface water through a number of actions further described in the letter.

In 2023, the GSAs prepared to implement future projects to address recommended corrective actions, which will be largely funded by the SGM Implementation Grant Program. The ongoing implementation of PMAs, outlined in this section (**Section 5**), aims to address these corrective actions effectively by the periodic evaluation of the GSP, which is due in January 2027.

5.2 Progress Toward Achieving Interim Milestones

Observed conditions for all SIs are in compliance with their MTs (see summary **Table 5-1**). An MT is a quantitative value that represents the groundwater conditions at an RMS that, when exceeded individually or in combination with MTs at other monitoring sites, may cause a UR in the basin per DWR's definition. If groundwater levels are lower than the value of the MO for that site they are moving in the direction of the MT. On the contrary, for the groundwater quality SMC, as the value of the electrical conductivity concentration increases from the MO established for that site, they are moving in the direction of the MT. Seawater Intrusion is not an applicable SI.

Groundwater elevations have remained near or above their MOs and above their corresponding MTs and, therefore, remained within the Subbasin's margin of operational flexibility established for each RMS well. Therefore, none of the RMS wells fell below the MT for two consecutive non-dry years, hence avoiding undesirable results as defined in the GSP.

Overall, groundwater conditions in the Subbasin are on track to meet the first 5-year 2027 Interim Milestones for groundwater levels at each of the RMS wells. Groundwater elevations are all above the MTs throughout the Subbasin, with elevations mostly near or slightly higher than those observed in recent years (**Appendix A**). This positive trend is influenced by the wet conditions experienced in WY 2023, which resulted in increased surface water supplies and reduced groundwater extractions. **Table 5-2** shows measurements from WY 2023 for spring seasonal highs and fall seasonal lows, along with measurable objectives and minimum thresholds. It also compares the WY 2023 measurements to those from WY 2022 and to the measurable objectives. Spring and Fall 2023 groundwater elevations were all at or above the established MOs (**Table 5-2**).

Table 5-1. Sustainability Indicator Summary			
2023 Status	**Undesirable Result Identification**	**Measurable Objective (MO) Definition**	**Minimum Threshold (MT) Definition**
Chronic Lowering of Groundwater Levels			
No indication of undesirable results There were no RMS wells with spring or fall 2023 groundwater level measurements below the MT.	When 2 RMS wells within a management area reach their MT for two consecutive non-dry year types.	The groundwater level is based on the groundwater trend line for the dry periods (over the period of record) of observed short-term climatic cycles extended to 2030 for each RMS well.	An elevation protective of sustainably constructed domestic wells (based on their well depths for wells drilled since 1980) within the polygon associated with the RMS well
Reduction of Groundwater Storage			
No indication of undesirable results There were no RMS wells with spring or fall 2023 groundwater level measurements below the MT.	Groundwater levels are a proxy, per SGMA regulations.	Groundwater levels are a proxy, per SGMA regulations.	Groundwater levels are a proxy, per SGMA regulations.
Degraded Water Quality			
No indication of undesirable results There were no RMS wells with electrical conductivity levels above their MTs in 2023, a non-dry year. The first year of monitoring, 2022, was a dry year.	When 2 RMS wells exceed their MT for two consecutive non-dry years.	Measured electrical conductivity less than or equal to the recommended Secondary Maximum Contaminant Level (900 µS/cm) based on State Secondary Drinking Water Standards at each well.	The upper limit of the Secondary Maximum Contaminant Level for electrical conductivity (1,600 µS/cm) is based on the State Secondary Drinking Water Standards.
Land Subsidence			
No indication of undesirable results There were no RMS wells with spring or fall 2023 groundwater level measurements below the MT.	Groundwater levels are a proxy, per SGMA regulations.	Groundwater levels are a proxy, per SGMA regulations.	Groundwater levels are a proxy, per SGMA regulations.

Table 5-1. Sustainability Indicator Summary			
2023 Status	**Undesirable Result Identification**	**Measurable Objective (MO) Definition**	**Minimum Threshold (MT) Definition**
Depletion of Interconnected Surface Water			
No indication of undesirable results There were no RMS wells with spring or fall 2023 groundwater level measurements below the MT.	Uses groundwater levels as a proxy. GSP identifies data gap and describes "Interconnected Surface Water Sustainable Management Criteria Framework."	Groundwater levels are a proxy, per SGMA regulations.	Groundwater levels are a proxy, per SGMA regulations.

Notes:

Salinity is the primary water quality constituent of concern, which is evaluated by measuring electrical conductivity (EC)

MO = Measurable Objective, MT = Minimum/Maximum Threshold, RMS = representative monitoring site, µS/cm = micro siemens per centimeter

Table 5-2. Measurable Objectives, Minimum Thresholds, and Seasonal Groundwater Elevations of Representative Monitoring Site Wells

State Well Number[1]	Groundwater Elevation (feet above mean sea level)				Spring 2023 vs. MO (ft)	Fall 2023 vs. MO (ft)	Spring 2023 vs. Spring 2022 (ft) (seasonal high)	Fall 2023 vs. Fall 2022 (ft) (seasonal low)
	2023 Measurements		MO	MT				
	Spring (seasonal high)	Fall (seasonal low)						
Vina North Management Area								
23N02W**25C001M**	140.8	134.1	130	50	10.8	4.1	5.2	2.9
23N01W**10E001M**	158.68	--	136	80	22.7	--	6.5	--
23N01E**07H001M**	163.6	161.7	136	72	27.6	25.7	-0.3	0.5
22N01W**05M001M**	138.13	--	115	31	23.1	--	9	--
23N01W**36P001M**	128.95	115.2	108	45	21	7.2	11.1	7.3
23N01E**33A001M**	137.74	133.59	125	72	12.7	8.6	1.3	1.4
Vina Chico Management Area								
CWSCH01b	117	110	106	85	11	4	7	7
CWSCH02	118	111	105	85	13	6	6	3
CWSCH03	120	115	108	85	12	7	3	5
CWSCH07	109	102	95	85	14	7	8	2
22N01E**28J003M**	128.39	122.36	111	85	17.4	11.4	5.2	7.7
Vina South Management Area								
21N01E**21C001M**	94.44	86.94	64	10	30.4	22.9	7.5	6.9
21N02E**18C003M**	167.26	160.7	130	65	37.3	30.7	13.6	10.1
20N01E**10C002M**	--	--	92	20	--	--	--	--
20N02E**24C001M**	102.67	91.42	77	18	25.7	14.4	1.7	0
20N02E**09L001M**	111.73	105.83	91	30	20.7	14.8	0.9	4.6
21N02E**26E005M**	111.04	104.33	95	36	16	9.3	1.1	0.2

[1] *The portion of the State Well Number shown in bold underlined text is the RMS ID.*

MO = measurable objective, MT = minimum/maximum threshold, -- = Indicates missing or questionable measurements.

5.2.1 Chronic Lowering of Groundwater Levels and Reduction in Groundwater Storage SMC

The reduction in groundwater storage SMC utilizes the chronic lowering of groundwater levels SMC as a proxy (**Table 5-1**). Thus, groundwater conditions related to storage and chronic lowering of groundwater levels are discussed together. Groundwater conditions in the Subbasin are on track to meet the first 5-year 2027 Interim Milestones and avoid undesirable results for groundwater levels at each of the RMS wells. In Spring 2023, all groundwater elevations were above the established MOs and MTs (as indicated in **Table 5-2**). Higher water levels were observed in Spring 2023 compared to Spring 2022 due to wet conditions, which has helped to increase recharge and offset extraction, bolstering groundwater storage in the Subbasin.

5.2.2 Degraded Water Quality SMC

The degraded water quality MT and MO are summarized in **Table 5-1**. Salinity is the main constituent of concern in the Subbasin and is evaluated by electrical conductivity (EC). Salinity (i.e., EC) is measured at RMS wells throughout the Subbasin, and data was collected by the GSA in WY 2023. There were no wells above the MT in 2023. A summary of groundwater quality monitoring data is available in **Appendix F**. Groundwater conditions are on track to avoid undesirable water quality results.

5.2.3 Land Subsidence SMC

The land subsidence SMC utilizes the chronic lowering of groundwater levels SMC as a proxy (**Table 5-1)**. Interferometric Synthetic Aperture Radar (InSAR) data provided by DWR (DWR, 2024) was analyzed from October 2022 to October 2023 to track annual changes. Subsidence estimates based on InSAR methodology were reviewed and compared to continuous GPS measurements (Towill, 2023). The accuracy report found that a one-year measurement error, reported as a root-mean-squared error (RMSE), was approximately 0.025 feet. **Figure 5-1** shows maximum vertical displacement between 0.5 feet and -0.04 feet occurred within the subbasin from October 2022 to October 2023. Groundwater conditions in the Subbasin are on track to meet the first 5-year 2027 Interim Milestones and avoid undesirable results for land subsidence. Conditions indicate that there has not been any inelastic land subsidence during the reporting period.

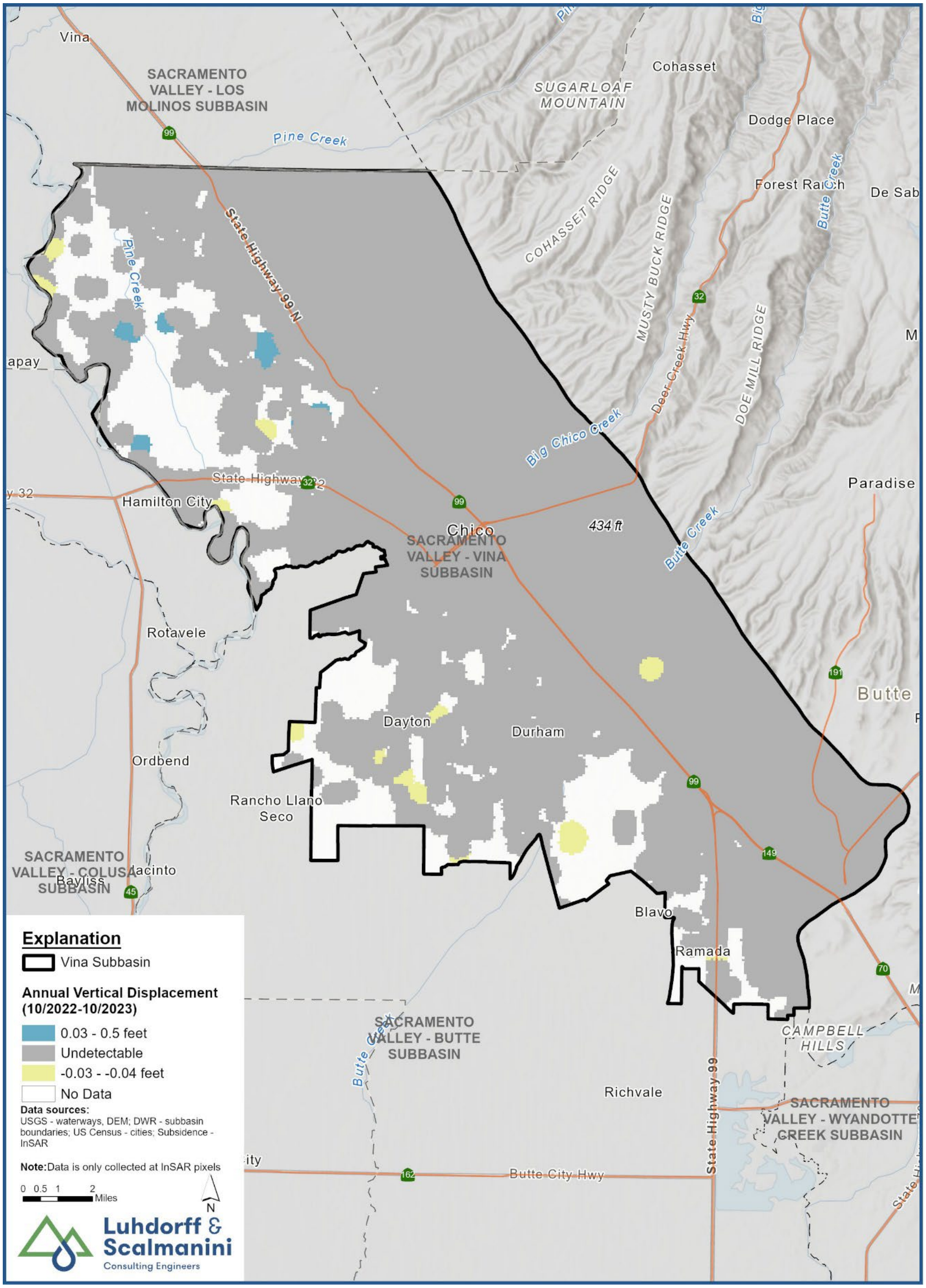

Figure 5-1. Vertical Displacement in Ground Surface from 10/2022 to 10/2023

5.2.4 *Depletion of Interconnected Surface Water SMC*

The depletion of interconnected surface utilizes the chronic lowering of groundwater levels SMC as a proxy (**Table 5-1**). Groundwater conditions in the Subbasin are on track to meet the first 5-year 2027 Interim Milestones and to avoid undesirable results for groundwater levels at each of the RMS wells.

5.3 Progress Toward PMA Implementation

The following sections summarize the GSAs' progress towards implementing PMAs that were developed to manage groundwater conditions in the Subbasin and achieve the groundwater sustainability objectives described in the GSP. Projects as outlined in the GSP are provided below and summarized in **Table 5-3**. Updates on the status of management actions are described below and summarized in **Table 5-4**.

Table 5-3. Summary of Project Implementation Status

GSP Section Reference	Project (Proponent)	Current Status	Notable Progress Since Last Annual Report
5.2.3.2	Residential Water Conservation Project	Ongoing	Conservation programs saved ~400 acre-feet per year of water
5.2.3.3	Scoping for Flood Managed Aquifer Recharge (FloodMAR)/Surface Water Supply and Recharge	Funded	DWR SGM Grant Program application submitted in December 2022 was funded for the planning phase of the project.
5.2.4.3	Streamflow Augmentation Projects	Funded	DWR SGM Grant Program application submitted in December 2022 was funded, for the feasibility phase.
5.2.4.4	Community Monitoring Program	Funded	DWR SGM Grant Program application submitted in December 2022 was funded to expand monitoring.
5.2.4.6	Rangeland Management and Water Retention Project	Funded	Grant awarded in December 2023
5.2.4.7	Removal of Invasive Species	Funded	Grant awarded in Fall 2023
5.2.4.8	Surface Water Supply and Recharge Project	Funded	DWR SGM Grant Program application submitted in December 2022 was funded, in the feasibility/initial design phase
5.2.5.1	Extend Orchard Replacement Program	Funded	DWR SGM Grant Program application submitted in December 2022 was funded to support the program design and implement pilot project.

Table 5-4. Summary of Management Actions			
GSP Section Reference	Management Action	Current Status	Notable Progress Since Last Annual Report
5.3.1	General Plan Updates	In Progress	The 2040 general plan update was adopted in March 2023.
5.3.2	Domestic Well Mitigation	Funded	Not in effect. Grant funds were secured to conduct a domestic well survey to address the data gap identified in the GSP.

5.4 GSP Project Implementation Progress

5.4.1 Residential Water Conservation Project (GSP Section 5.2.3.2)

Notable progress on this project since 2022 has included continued implementation of water conservation practices by municipal/industrial water providers such as the California Water Service Company in Chico (Cal Water-Chico), which is reliant on groundwater, in accordance with their 2020 Urban Water Management Plan. In WY 2023, urban pumping declined by about 400 AF compared to WY 2022, resulting in a benefit to the Subbasin.

5.4.2 Scoping for Flood Managed Aquifer Recharge (FloodMAR) / Surface Water Supply and Recharge (GSP Section 5.2.3.3)

Notable progress on this project since 2022 has included the Vina GSA's December 2022 submittal of a grant application to pursue funds through DWR's SGM Grant Program for two efforts that directly support this project: a Groundwater Recharge Feasibility Analysis and Site Evaluation, which will focus on the initial scoping and identification of specific recharge opportunities in the Subbasin and an analysis of the legal implications associated with actively managing recharge water in the Subbasin. This project was fully funded.

5.4.3 Streamflow Augmentation Project (GSP Section 5.2.4.3)

Notable progress on this project since 2022 has included the submittal of two grant applications. The first was an application to the Wildlife Conservation Board's Stream Flow Enhancement Project Program by the Friends of Butte Creek to fund the Butte Creek Integrated Stream Flow Enhancement Planning Project to increase flows in Butte Creek to benefit both irrigators, threatened fish species and recharge of the Vina Subbasin aquifer.

The second was the Vina GSA's December 2022 application to pursue funds through DWR's SGM Grant Program for the Agricultural Surface Water Supplies Feasibility Analysis project, which is expected to support the overarching goals of the Streamflow Augmentation Projects through efforts aimed at increasing surface water supplies to meet both agricultural and urban water demands by identifying and refining, in preparation for future implementation efforts, the two most promising agricultural surface water supply projects in the Subbasin. This project was fully funded.

5.4.4 Community Monitoring Program (GSP Section 5.2.4.4)

Notable progress on this project since 2022 has included the Vina GSA's December 2022 submittal of a grant application to pursue funds through DWR's SGM Grant Program for a Community Monitoring and Domestic Well Survey project with a focus on monitoring groundwater level conditions in domestic wells. This project was fully funded.

5.4.5 Rangeland Management and Water Retention Project (GSP Section 5.2.4.6)

Notable progress on this project since 2022 has included Big Chico Creek Ecological Reserve (BCCER) securing grant funds through the Wildlife Conservation Board to gather baseline information and develop a long-term master management plan for all 7,835 acres of the Reserve's properties. This includes baseline surveys and biological and cultural resource surveys to inform management recommendations and provide data for long-term comparative analysis of land management actions. It also includes management planning on CSE Reserve properties and associated CEQA compliance that includes:

- Hydrologic resource data collection—surface/spring water flow and quality & ground water monitoring and,
- Botanical surveys and mapping—species composition, diversity, vegetation alliances, and locations.

5.4.6 Removal of Invasive Species (GSP Section 5.2.4.7)

Notable progress on this project since 2022 has included BCCER securing grant funds through the US Fish and Wildlife Service to manage invasive species on approximately nine acres around two springs in the areas of interest. BCCER is currently pursuing funds through Point Blue to install wildlife-friendly spring enclosure fencing on approximately 10 acres around two springs and to conduct approximately 20 acres of invasive species management and blue oak restoration.

5.4.7 Surface Water Supply and Recharge Project (GSP Section 5.2.4.8)

Notable progress on this project since 2022 has included progress on four projects that seek to increase the surface water supply to the Subbasin through:

- direct application of surface water to crops,
- application of surface water and/or flood water to land surface (i.e., existing orchards) for recharge purposes and
- application of surface water and/or flood water to recharge basins and/or recharge ponds or other applications.

First, funding for the Rock and Sand Creek Flood Mitigation Project has been secured by the Rock Creek Reclamation District through the Integrated Regional Water Management Program Proposition 1 program. A feasibility study was completed in 2023 to consider solutions to flooding, public safety, and recharge of the aquifer, focusing on potential floodwater detentions on Sand Creek.

Notable progress on the other three projects (the Lindo Channel Surface Water Recharge Implementation project, the Agricultural Surface Water Supplies Feasibility Analysis project, and the Groundwater Recharge Feasibility Analysis and Site Evaluation project) has included the Vina GSA's December 2022 submittal of a grant application to pursue funds through DWR's SGM Grant Program to support the projects. Funding has been secured for these projects.

5.4.8 Extend Orchard Replacement Program (GSP Section 5.2.5.1)

Notable progress on this project since 2022 included the Vina GSA's December 2022 submittal of a grant application to pursue funds through DWR's SGM Grant Program for the Extend Orchard Replacement Program, which seeks to reduce overall groundwater pumping demand from the Vina Subbasin through increased temporary land fallowing. This is intended to be a demand-side intervention aimed at extending the fallowing period an additional year during orchard replacement, which may then reduce the average annual evapotranspiration of groundwater. This project has been funded for program design and implementation of a pilot program.

5.5 GSP Management Action Implementation Progress

Below are Management Action Updates and their progress in implementation since the last Annual Report.

5.5.1 General Plan Updates (GSP Section 5.3.1)

Notable progress on this project since 2022 has included updates from Butte County (Vina GSA Management Committee members) on the 2040 General Plan Update in cooperation with the Butte County Water Commission and Department of Development Services to the Water Resources Element and applicable General Plan Goals, Policies, and Actions. These updates ensured that important components of the GSP are supported by the 2040 General Plan, available at: https://www.buttecounty.net/DocumentCenter/View/7749/Butte_County_General_Plan_2040_Compiled_Appendix_Optimized---Updated?bidId=.

5.5.2 Domestic Well Mitigation (GSP Section 5.3.2)

Notable progress on this project since 2022 has included the Vina GSA's December 2022 submittal of a grant application to pursue funds through DWR's SGM Grant Program for a Community Monitoring and Domestic Well Survey project that would support the goals of this management action by creating a registry of domestic wells in the region. The Domestic Well Survey project has been funded.

6 Conclusions

The Vina Subbasin GSAs adopted and submitted the GSP to DWR in January 2022 and continue to actively work on sustainable groundwater management in the Subbasin directly and with partners. As presented in **Section 5** of this report, recent progress made on activities applicable to the GSA 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 Vina Subbasin.

7 References

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