

# S U T T E R   S U B B A S I N

## Water Year 2023 Annual Report to the GROUNDWATER SUSTAINABILITY PLAN



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# Sutter Subbasin WY 2023 Annual Report

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## Acronyms

AF	acre-feet
AFY	acre-feet per year
AZ	Aquifer Zone
C2VSimFG-Sutter	California Central Valley Groundwater-Surface Water Simulation Model, Fine Grid, Sutter Subbasin
CASGEM	California Statewide Groundwater Elevation Monitoring
CVP	Central Valley Project
DMS	data management system
DWR	California Department of Water Resources
ft bgs	feet below ground surface
GMP	Groundwater Management Plan
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GSW	groundwater substitution transfer
HCM	Hydrogeologic Conceptual Model
MAF	million acre-feet
MCL	maximum contaminant level
MSL	mean sea level
SEWD	Sutter Extension Water District
SGMA	Sustainable Groundwater Management Act
SMC	sustainable management criteria
SMCL	secondary maximum contaminant level
SSGMCC	Sutter Subbasin Groundwater Management Coordination Committee
SWP	State Water Project
TDS	total dissolved solids
USBR	United States Bureau of Reclamation
WY	Water Year

## EXECUTIVE SUMMARY

### ES-1. INTRODUCTION

The Sutter Groundwater Subbasin (Sutter Subbasin or Subbasin) has been identified by the California Department of Water Resources (DWR) as a medium priority groundwater basin. The nine Sutter Subbasin Groundwater Sustainability Agencies (GSAs) developed and submitted a Groundwater Sustainability Plan (GSP) to DWR prior to the January 31, 2022 deadline. The GSP was developed to address the Sustainable Groundwater Management Act (SGMA) regulatory requirements while reflecting local needs and preserving local control over water resources, providing a path to achieve and maintain sustainable groundwater management within 20 years following Plan adoption.

This Annual Report provides information on conditions in the Sutter Subbasin and progress towards GSP implementation for Water Year (WY) 2023 (October 1, 2022 to September 30, 2023). The report has been prepared in accordance with Article 7 *Annual Reports and Periodic Evaluations by the Agency*, §356.2 *Annual Reports* of the GSP Emergency Regulations as contained within the California Code of Regulations.

### ES-2. GROUNDWATER MANAGEMENT AND MILESTONES

WY 2023 was the second year of GSP implementation. This Annual Report uses information contained within the GSP, as well as data collected during the first two years of implementation, to evaluate continued sustainable conditions throughout the planning and implementation horizon.

The GSP sets sustainable management criteria (SMC) for applicable sustainability indicators and identifies projects and management actions to aid in maintaining sustainable conditions throughout the Sutter Subbasin. Under SGMA, SMC can be defined as the following:

- **Minimum Threshold** – Quantitative guidance levels established at each representative monitoring site set just above conditions that could generate an undesirable result for an applicable sustainability indicator.
- **Measurable Objective** – Quantitative targets that represent the desired conditions at each representative monitoring site for an applicable sustainability indicator. The measurable objective must be reached within 20 years of GSP implementation for all applicable sustainability indicators for the basin or subbasin to be considered sustainable.
- **Interim Milestones** – Targets set in increments of five years over the 20-year implementation period of the GSP to track the Subbasin's progress toward achieving the Subbasin's sustainability goal by 2042. These 'check-in' points are used to maintain the Subbasin's path towards achieving or maintaining sustainability.

- **Margin of Operational Flexibility or Operating Range** – The range of active management between the measurable objective and minimum threshold.

During WY 2023, available monitoring data relative to all sustainability indicators indicated the Sutter Subbasin was continuing to operate under sustainable conditions as defined by the SMC set forth in the GSP. As projects and management actions are implemented, though not required for sustainability, the Sutter Subbasin GSAs will continue to assess conditions relative to established SMC, definitions of undesirable results, and the Subbasin's sustainability goal.

### **ES-3. GROUNDWATER MONITORING AND CONDITIONS ASSESSMENT**

The subsections below summarize groundwater elevation, groundwater storage, groundwater quality, land subsidence, and groundwater-surface water interaction trends in the Sutter Subbasin, as well as total water use during WY 2023. Seawater intrusion is not an applicable sustainability indicator for the Sutter Subbasin as it is located inland from the Pacific Ocean and is not adjacent to the Sacramento-San Joaquin Delta. WY 2023 was a wet (W) water year under the Sacramento Valley Water Year Hydrologic Index preceded by a dry year in WY 2020 and critical years in WY 2021 and WY 2022.

#### **Groundwater Levels**

Hydrographs for representative wells in the Sutter Subbasin generally show groundwater level declines during the irrigation season and seasonal recovery to pre-irrigation levels once irrigation has ceased. During WY 2023, similar patterns are observed with many wells operating within their respective operating range or above the measurable objective, where interim milestones are set equal to the measurable objective as a means of maintaining currently sustainable conditions. Minimum thresholds exceedances were observed at 2 wells during WY 2023 and no undesirable results were observed.

General groundwater flow patterns in the Sutter Subbasin are from north to south. During the WY 2023 seasonal high period (March and April 2023), groundwater elevations ranged from 16 to 71 feet above mean sea level (MSL) across all aquifer zones. During the WY 2023 seasonal low period (September and October 2023), groundwater elevations ranged from 11 to 68 feet MSL across all aquifer zones.

#### **Groundwater Storage**

Groundwater level SMC are used as proxy for the groundwater storage sustainability indicator, using the same representative monitoring network. Minimum thresholds for groundwater levels are designed to be protective of significant and unreasonable impacts to changes in groundwater storage. For WY 2023, groundwater storage was estimated using C2VSimFG-Sutter integrated flow model. Change in groundwater

storage from October 1, 2022 to September 30, 2023 was estimated to increase by approximately 94,000 AF.

### **Groundwater Quality**

During WY 2023, the Sutter Subbasin GSAs reevaluated and modified the representative groundwater quality monitoring network to ensure wells were selected that could be accessed for sampling in the long term. A total of 18 wells were identified for inclusion in the representative network, and most wells were sampled during the July through October sampling period. All but one sample each collected during WY 2023 were below their respective minimum thresholds for total dissolved solids (TDS) and nitrate as N. Insufficient data are available to determine if an undesirable result occurred, and the addition of WY 2024 sampling results will be used to determine if undesirable results are occurring relative to groundwater quality.

### **Land Subsidence**

The land subsidence sustainability indicator is monitored using 22 monuments in DWR's Sacramento Valley Subsidence Network. The Sacramento Valley Subsidence Network is monitored at 5-year intervals, with the last survey taking place in 2017. Since the development of the GSP, DWR has discontinued its Sacramento Valley Subsidence Monitoring Network. The 2027 Periodic Evaluation and potential Plan Amendment will evaluate alternative methods using Interferometric Synthetic Aperture Imagery (InSAR) data and/or establishing a new representative monitoring network with benchmarks to evaluate conditions relative to established numeric SMC.

InSAR data is being evaluated on an annual basis as available through DWR's SGMA Data Viewer or other publicly available databases. Between October 2022 and October 2023, between -0.1 and +0.1 feet of vertical displacement was observed throughout the Sutter Subbasin (within the realm of measurement error). Sutter Subbasin GSAs will continue to monitor available land subsidence data and confirm no negative impacts of land subsidence are reported on critical infrastructure as a result of groundwater pumping.

### **Groundwater-Surface Water Interaction**

The depletions of interconnected surface water sustainability indicator in the Sutter Subbasin uses groundwater levels as proxy for sustainable management criteria. The minimum thresholds for this sustainability indicator are established to be protective of significant and unreasonable impacts to identified interconnected surface waters, which include the Sacramento and Feather Rivers and Sutter Bypass.

The minimum thresholds for interconnected surface waters are established to be protective of significant and unreasonable impacts. Minimum threshold exceedances were observed at two wells during WY 2023, with recovery to above the minimum

threshold at each well by early calendar year 2023. No undesirable results were observed.

### **Total Water Use**

The primary water use sector in the Sutter Subbasin is agricultural, where other uses include urban, managed wetlands, and groundwater substitution transfers (which did not occur in WY 2023). During WY 2023, groundwater extraction was estimated to be approximately 124,800 AF for the Sutter Subbasin. Surface water supply during WY 2023 was estimated to be approximately 547,500 AF in the Sutter Subbasin. Total water use is the sum of the groundwater and surface water use. Total water use during WY 2023 was estimated to be approximately 755,600 AF in the Sutter Subbasin. Water use for the Subbasin as a whole was estimated as not all sources are presently metered.

### **Groundwater Substitution Transfers**

Information contained in the Sutter Subbasin GSP regarding groundwater substitution transfers in the Subbasin has been updated as part of this annual report. No groundwater substitution transfers took place in the Sutter Subbasin during WY 2023. During WY 2024, the Sutter Subbasin GSAs will work on developing a Subbasin-wide methodology for evaluating and approving groundwater substitution transfers and updates will be provided in subsequent annual reports.

## **ES-4. ANNUAL REPORT ELEMENTS**

The following table presents the sections and figure/table numbers where requirements for the Annual Report elements are included, subject to Article 7, §356.2 of the GSP Emergency Regulations.

California Code of Regulations - GSP Regulation Sections	Annual Report Elements	Section(s) and figure/table numbers(s) where requirements for Annual Report elements are included
<b>Article 7</b>	<b>Annual Reports and Periodic Evaluations by Agency</b>	
<b>§ 356.2</b>	<b>Annual Reports</b>	
	Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:	
	(a) General information, including an executive summary and a location map depicting the basin covered by the report.	Executive Summary, Section 1, Figure 1-1
	(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:	--
	(1) Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows:	--
	(A) Groundwater elevation contour maps for each principal aquifer in the basin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions.	Section 3.1, Figure 3-5 through Figure 3-12
	(B) Hydrographs of groundwater elevations and water year type using historical data to the greatest extent available, including from January 1, 2015, to current reporting year.	Section 3.1, Appendix B
	(2) Groundwater extraction for the preceding water year. Data shall be collected using the best available measurement methods and shall be presented in a table that summarizes groundwater extractions by water use sector, and identifies the method of measurement (direct or estimate) and accuracy of measurements, and a map that illustrates the general location and volume of groundwater extractions.	Section 3.6.1, Figure 3-24, Table 3-3, Table 3-4
	(3) Surface water supply used or available for use, for groundwater recharge or in-lieu use shall be reported based on quantitative data that describes the annual volume and sources for the preceding water year.	Section 3.6.2, Figure 3-25, Table 3-5

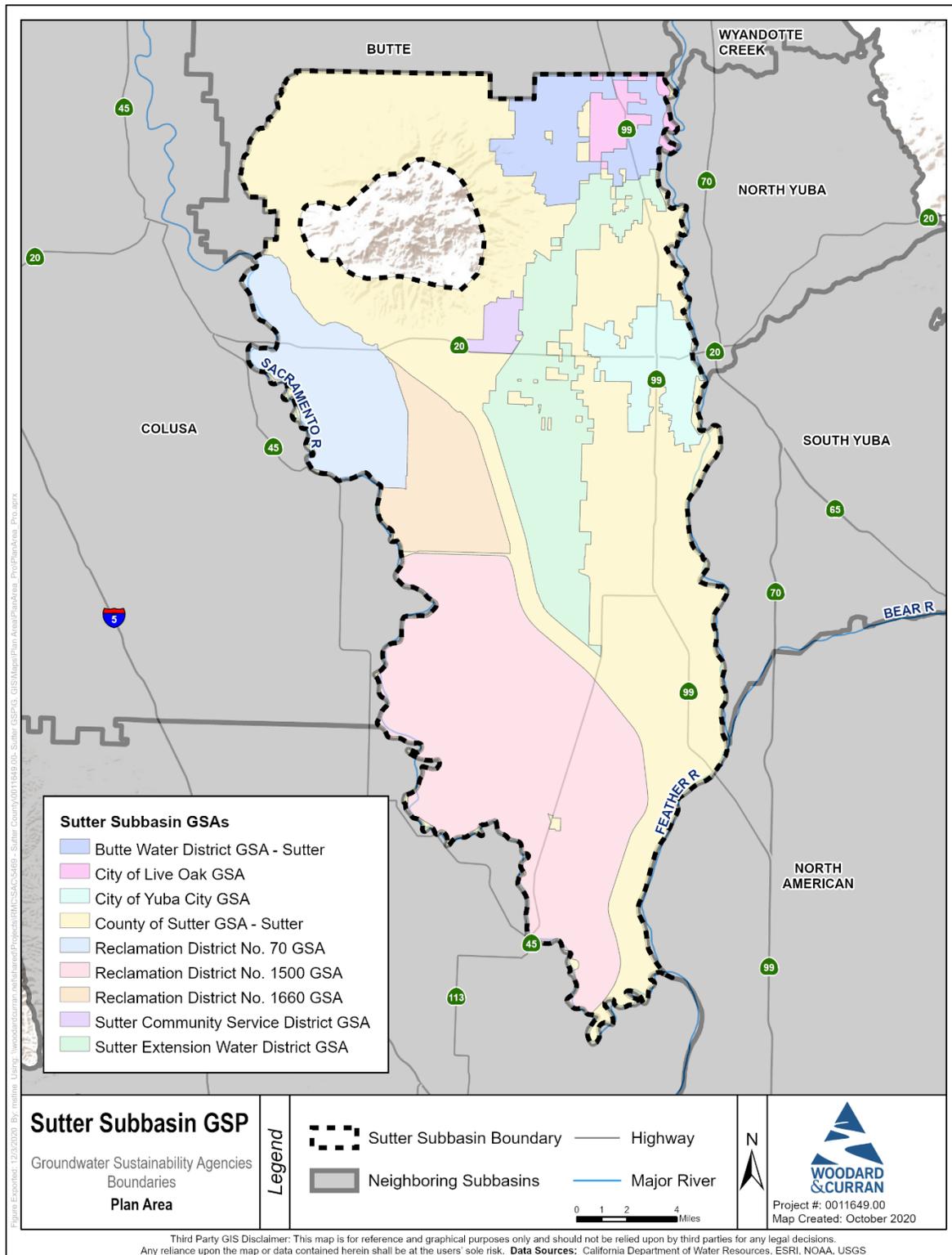
California Code of Regulations - GSP Regulation Sections	Annual Report Elements	Section(s) and figure/table numbers(s) where requirements for Annual Report elements are included
	(4) Total water use shall be collected using the best available measurement methods and shall be reported in a table that summarizes total water use by water use sector, water source type, and identifies the method of measurement (direct or estimate) and accuracy of measurements. Existing water use data from the most recent Urban Water Management Plans or Agricultural Water Management Plans within the basin may be used, as long as the data are reported by water year.	Section 3.6.3, Figure 3-26, Table 3-6
	(5) Change in groundwater in storage shall include the following:	--
	(A) Change in groundwater in storage maps for each principal aquifer in the basin.	Section 3.2, Figure 3-14, Table 3-1
	(B) A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the basin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.	Section 3.2, Figure 3-13
	(c) A description of progress towards implementing the Plan, including achieving interim milestones, and implementation of projects or management actions since the previous annual report.	Section 2.3, Appendix A

## 1. INTRODUCTION

The Sutter Groundwater Subbasin (Sutter Subbasin or Subbasin) has been identified by the California Department of Water Resources (DWR) as a medium priority groundwater basin (**Figure 1-1**). The Sutter Subbasin Groundwater Sustainability Plan (GSP or Plan) was developed and submitted to meet Sustainable Groundwater Management Act (SGMA) regulatory requirements by the January 31, 2022 deadline for medium priority basins. The Sutter Subbasin GSP was developed by the Sutter Subbasin Groundwater Sustainability Agencies (GSAs) and addresses SGMA regulatory requirements while reflecting local needs and preserving local control over water resources. The Sutter Subbasin GSP provides a path to maintaining and documenting sustainable groundwater management within 20 years following Plan adoption and promotes the long-term sustainability of locally managed groundwater resources. The GSP was developed by the nine Sutter Subbasin GSAs, including:

- Butte Water District – Sutter
- City of Live Oak
- City of Yuba City
- County of Sutter
- Reclamation District No. 70
- Reclamation District No. 1500
- Reclamation District No. 1660
- Sutter Extension Water District
- Sutter Community Service District

This Annual Report provides information on conditions in the Sutter Subbasin and progress towards GSP implementation for Water Year (WY) 2023 (October 1, 2022 through September 30, 2023). The report has been prepared in accordance with Article 7 *Annual Reports and Periodic Evaluations by the Agency*, §356.2 *Annual Reports of the GSP Emergency Regulations* as contained within the California Code of Regulations.



**Figure 1-1: Sutter Subbasin Groundwater Sustainability Agencies**

## 2. GROUNDWATER MANAGEMENT ACTIVITIES AND MILESTONES

This section summarizes the contents of the Sutter Subbasin GSP and documents GSP implementation progress during WY 2023 (the second year of GSP implementation). Implementation of the Sutter Subbasin GSP is underway, which includes this Annual Report as well as monitoring activities, assessment of sustainable management criteria (SMC), and implementation of projects and management actions as needed (not required to achieve sustainability).

### 2.1 Groundwater Sustainability Plan Development

The Sutter Subbasin GSP was developed by the nine Subbasin GSAs. Each GSA has its own individual organization and management structure as well as legal authority under which it operates. The Sutter Subbasin Groundwater Management Coordination Committee (SSGMCC) contains one representative from each GSA and was created to cooperatively carry out the purposes of SGMA by coordinating the development, adoption, and implementation of the GSP. Activities of the SSGMCC include providing technical direction for GSP development and implementation, identifying projects and management actions, reporting to the respective GSA boards, and coordinating approval and adoption of the GSP by the respective GSA boards.

Public workshops were held approximately once per quarter during GSP development (five in total) to update interested residents and stakeholders about the GSP preparation process and included presentations on data, information, and analyses, as well as activities to solicit input and feedback from participants. Beyond these meetings, information regarding Plan development, noticing, and public comments periods was distributed via the project website (<http://suttersubbasin.org/>), e-mail notices, social media postings, press releases, mailings, and utility bill notifications. Supporting materials (online and hard copy) were prepared in English, Spanish, and Punjabi.

Outreach efforts will continue throughout the implementation of the GSP and plan to include SSGMCC meetings, regular updates at GSA board or city council meetings, maintenance of the project website, and local outreach at public events.

On May 29, 2020, the GSAs filed a notice of intent to prepare a GSP with DWR. A public draft of the GSP was posted for public comment on the project website on October 1, 2021, and a notice of intent to adopt a GSP was sent by Sutter County to all cities within the Subbasin and Sutter County on October 5, 2021. The final Sutter Subbasin GSP, submitted to DWR on January 28, 2022, was adopted by the GSAs between November 2021 and January 2022.

### 2.2 Groundwater Sustainability Plan Contents Summary

The GSP was prepared in compliance with SGMA Regulations and GSP Emergency Regulations, Article 5 *Plan Contents*. The subsections below summarize the contents of

the GSP relevant to assessing conditions in the Sutter Subbasin for the purposes of evaluating GSP implementation progress in this Annual Report.

### **2.2.1 Plan Area**

The Sutter Groundwater Subbasin (DWR Basin 5-021.62) covers approximately 445 square miles of the Sacramento Valley floor and surrounding the foothills of the Sutter Buttes (**Figure 1-1**). The Subbasin is part of the larger Sacramento Valley Groundwater Basin, located within the Sacramento River Hydrologic Region. Major features within the Sutter Subbasin include portions of the Sutter Buttes, the Feather and Sacramento Rivers, Sutter Bypass, the cities of Live Oak and Yuba City, and Sutter National Wildlife Refuge.

The Plan area includes Sutter County and the cities of Live Oak and Yuba City. Land use within the Sutter Subbasin is predominantly agricultural, with rice as the primary crop grown along with walnuts, stone fruits, tomatoes, and sunflowers. Approximately 60 percent of agricultural users utilize only surface water for irrigation purposes, while 20 percent utilize only groundwater and 20 percent irrigate with a mix of surface water and groundwater (Wood Rodgers, 2012). The predominant source of water for permanent crops is groundwater. Managed wetlands use a mix of surface water and groundwater. Smaller communities and individual domestic well owners rely exclusively on groundwater, while the City of Yuba City provides mostly surface water and a smaller proportion of groundwater.

### **2.2.2 Hydrogeologic Conceptual Model**

Lying within the Sacramento Valley Groundwater Basin, the regional geology of the Sutter Subbasin consists of freshwater sediments that are underlain by marine sediments and igneous or metamorphic rocks. Freshwater sediments consist of the volcanoclastic rocks of the Sutter Buttes and sediments weathered from the Sierra Nevada to the east. The Willows Fault is the primary active fault structure within Sutter County and lies to the southwest and west of the Sutter Buttes. The Sutter Buttes, which form an elliptical lateral boundary, is the only prominent topographic feature. Located in the northern part of the Subbasin, the Sutter Buttes abruptly rise 2,000 feet above the surrounding valley floor. The topography of the Sutter Subbasin, aside from the Sutter Buttes, is primarily comprised of gentle flatlands with elevations ranging from 80 feet above mean sea level (MSL) in the northeast to 20 feet above MSL in the south. Soils consist mainly of poorly drained clay and clay loam soils, but near the rivers, well drained loam to sandy loam may be present.

The Sutter Subbasin groundwater system is composed of a single principal aquifer comprised of various formations that create zones with varying hydrogeologic properties at different locations across the Subbasin. As such, the GSP recognizes one principal aquifer comprised of three Aquifer Zones (AZ): AZ-1 (surface to 150 feet below ground surface [ft bgs]), AZ-2 (150 to 400 ft bgs), and AZ-3 (greater than 400 ft bgs). AZ-1 has

been further subdivided to include the Shallow AZ (surface to 50 ft bgs) to assess and monitor for impacts related to interconnected surface water and groundwater dependent ecosystems (GDEs), with AZ-1 then including depths from 50 to 150 ft bgs.

### **2.2.3 Existing Groundwater Conditions**

Groundwater level trends in the Sutter Subbasin are largely flat over time, indicating sustainable conditions, as aquifer rebound from seasonal pumping is observed during all water year types. Shallow groundwater levels are relatively stable over time and indicate that most groundwater production is occurring from deeper aquifer zones. More groundwater appears to be produced primarily from AZ-2 and AZ-3, as indicated by large fluctuations in groundwater elevations where responses to groundwater pumping are observed with rebound following the irrigation season as the aquifer recharges and returns to pre-pumping levels on a seasonal basis.

As with groundwater levels, groundwater storage volumes in the Sutter Subbasin have been generally stable over at least the past 30 years (the length of available record). The volume of groundwater in storage increases as groundwater levels rise and decreases as groundwater levels fall; thus, stable groundwater level conditions also result in stable groundwater storage conditions. Total groundwater storage in the Sutter Subbasin was estimated to be around 49 million acre-feet (AF) based on the C2VSimFG-Sutter integrated flow model.

Due to its location inland from the Pacific Ocean and set back from the Sacramento-San Joaquin Delta, seawater intrusion and related groundwater conditions are not applicable to the Sutter Subbasin.

Groundwater quality in the Sutter Subbasin varies by location. Several constituents have been detected at levels that exceed the associated maximum contaminant level (MCL) for drinking water, including arsenic, boron, total dissolved solids (TDS), and nitrate (as nitrogen or N). Median arsenic concentrations have decreased since 1952 and most recently are below the Primary MCL of 0.01 mg/L. Median boron concentrations peaked between 2009 and 2012 but remained below the agricultural water quality objective of 0.7 mg/L, and maximum concentrations of boron have decreased over time. Maximum TDS concentrations have substantially decreased since 1952, peaking in 2006, with the most recently observed maximum concentration occurring below the Upper Secondary MCL of 1,500 mg/L. Median nitrate concentrations have increased since 1952 and have been detected above the Primary MCL of 10 mg/L for nitrate as N as of 2012. The most recently observed maximum concentration exceeds the Primary MCL for nitrate by over 10 times. All of the referenced constituents are naturally occurring in the Subbasin, except nitrate.

Land subsidence within the Sutter Subbasin has been negligible to non-existent in recent years, and there have been no reported negative impacts of land subsidence on critical infrastructure. While elastic land subsidence is observed as a result of seasonal

fluctuations in groundwater levels and associated aquifer pressure, evidence of inelastic land subsidence has not been recorded within the Subbasin.

Interconnected surface waters (surface waters that are hydraulically connected by a saturated zone to the groundwater system) are categorized as “losing” when the groundwater elevations adjacent to a river or stream decline, causing the river or stream to “lose” water to the underlying aquifer, or “gaining” when hydraulic gradients flow from the groundwater aquifer to the river or stream. The Sutter Bypass, Feather River, and Sacramento River were all found to have fluctuating gaining and losing conditions throughout the Subbasin.

#### **2.2.4 Water Budgets**

Water budgets are developed to provide a quantitative account of water (including surface water and groundwater) entering and leaving the Sutter Subbasin under historical, current, projected, and projected with climate change conditions. The water budgets were estimated using C2VSimFG-Sutter, a numerical groundwater and surface water model developed specifically for the Sutter Subbasin. The primary components of the groundwater budget include:

- Inflows:
  - Deep percolation from rainfall, irrigation-applied water, and applied water for refuge use
  - Stream seepage
  - Land subsidence inflow
  - Conveyance seepage
  - Subsurface inflow from adjacent subbasins
- Outflows:
  - Groundwater outflow to streams
  - Groundwater pumping
  - Subsurface outflow to adjacent subbasins
- Change in groundwater storage

The average annual change in groundwater storage is stable under all water budget scenarios, with a net 0 acre-foot (AF) change in storage under projected conditions (both with and without climate change).

The sustainable yield for the Sutter Subbasin has been estimated to be 182,000 acre-feet per year (AFY). The estimated sustainable yield is higher than simulated average annual groundwater pumping in all four water budget scenarios – historical, current conditions, projected conditions, and projected conditions with climate change. Therefore, it can be reasonably stated that the Subbasin is currently operating under sustainable conditions and is expected to continue to be sustainable if changes

estimated in the projected conditions scenario hold true into the future. Additionally, sustainable yield is a long-term value and groundwater pumping may exceed the estimated sustainable yield value during certain years (e.g., during extended drought conditions), balanced by other years with reduced pumping during wetter periods so that the long-term average remains at or below the sustainable yield.

### 2.2.5 Sustainable Management Criteria

The sustainability goal for the Sutter Subbasin is as follows:

*The Sutter Subbasin will maintain locally-managed groundwater resources for existing and future beneficial uses and users that are economically viable and sustainable by managing groundwater use within the sustainable yield, resulting in the avoidance of undesirable results. This goal will be achieved through implementation of proposed projects and management actions and monitoring activities aiding in reaching or maintaining established interim milestones and measurable objectives culminating in the absence of undesirable results by 2042. Water managers in the Sutter Subbasin will work together and collaboratively with stakeholders and neighboring subbasins through GSP implementation and beyond to achieve this goal.*

The method prescribed by SGMA to measure undesirable results and achieve the sustainability goal involves setting minimum thresholds and measurable objectives for a series of representative monitoring sites. The sustainable management criteria are summarized in **Table 2-1**.

### 2.2.6 Monitoring Networks

The Sutter Subbasin GSP includes monitoring networks for the five applicable sustainability indicators. As previously noted, seawater intrusion is not applicable to the Sutter Subbasin. The objective of these monitoring networks is to monitor conditions across the Subbasin and detect trends toward undesirable results such that adaptive management actions and projects can be implemented to prevent the onset of undesirable results. Specifically, the monitoring networks were developed to:

- Monitoring changes in groundwater conditions relative to measurable objectives and minimum thresholds
- Monitor impacts to the beneficial uses and users of groundwater resulting from groundwater use
- Demonstrate progress toward achieving measurable objectives described in the GSP

The following monitoring networks were developed for the Sutter Subbasin GSP: groundwater levels by aquifer zone (also used as proxy for reduction in groundwater storage sustainability indicator), groundwater quality by aquifer zone, land subsidence,

and interconnected surface water. All monitoring networks described in the GSP are representative monitoring networks and are used to determine compliance with the quantitative minimum thresholds and measurable objectives established at each representative monitoring site.

The monitoring networks were designed by evaluating existing monitoring programs, such as the California Statewide Groundwater Elevation Monitoring Program (CASGEM), monitoring conducted by DWR, or local agency monitoring programs. The monitoring networks largely consist of monitoring sites that have historical monitoring data and no significant barriers to future monitoring events. Data gaps identified in the Sutter Subbasin monitoring networks include unknown construction details for several groundwater quality monitoring wells and limited shallow monitoring wells currently available along identified interconnected surface waters. Progress will be made to fill these identified data gaps prior to the first five-year evaluation and assessment, where updated monitoring networks will be included in future GSP updates.

Monitoring frequencies vary by sustainability indicator. For groundwater levels and interconnected surface water, measurements will be taken during seasonal high (March through April) and seasonal low (September through October) conditions. Additional groundwater level measurements may be taken in areas where rice growing activities substantially alter the timing of seasonal highs and lows in shallow aquifer zones or in areas where wildlife refuges are managed. Groundwater quality for identified constituents of concern (TDS and nitrate as N) will be analyzed annually, with samples collected between July and October<sup>1</sup>. Measurements for interconnected surface waters will be collected concurrently with those for groundwater levels. As originally planned, land subsidence would be monitored by DWR using the Sacramento Valley Global Positioning System (GPS) Subsidence Monitoring Network every five years. Since development of the GSP, DWR has discontinued its Sacramento Valley Subsidence Monitoring Network. For the Sutter Subbasin, alternative methods for monitoring for land subsidence will be conducted using publicly available Interferometric Synthetic Aperture Radar (InSAR) data to evaluate conditions relative to established SMC. This program will be described further in the 2027 Periodic Evaluation and potential Plan Amendment. Publicly available InSAR and stream gage data will be collected and evaluated on an annual basis.

### **2.2.7 Projects and Management Actions**

As the Sutter Subbasin is currently sustainable and projected to remain sustainable, there are no projects or management actions required to achieve sustainability. However, projects and management actions can enhance understanding of the

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<sup>1</sup> The Sutter Subbasin GSP indicates that groundwater sampling for TDS and nitrate as N will take place in September. The sampling period has been extended from July through October for GSAs to be able to collect samples when wells are turned on, where well shut off differs throughout the Sutter Subbasin.

groundwater system and improve the ability to adaptively manage the Subbasin so that undesirable results can be prevented. Most projects and management actions contained in the GSP will be implemented as-needed and as funding is available.

Projects and management actions listed in the Sutter Subbasin GSP include select on-going and planned projects and management actions, such as:

- System modernization by water purveyors
- Boundary flow and primary spill measurement and drainage recovery
- Multi-benefit recharge
- Grower education
- Installation of shallow monitoring wells

As-needed projects and management actions will be implemented, as deemed necessary, to support sustainability, allow for adaptation to changing conditions, and achieve other water management objectives, such as:

- Direct and in-lieu groundwater recharge
- Wetland habitat improvement, such as through securing firm water supplies or fish screen projects
- Surface water supply augmentation through backwash recovery
- Updated electrical Supervisory Control and Data Acquisition (SCADA) and telemetry
- Water quality enhancement through replacement of sewer mains
- Projects to address data gaps, such as:
  - Investigations of interactions between rivers and changes in groundwater levels
  - Investigation of source of elevated salinity in the shallow aquifer zone
  - Study of aquifer properties
  - Data collection to improve the hydrogeologic conceptual model (HCM)
  - Comprehensive groundwater quality investigation
  - Investigation and characterization of the Sutter Buttes, including salinity monitoring, airborne electromagnetic (AEM) survey, and an inter-basin working group focused on water quality
  - Groundwater dependent ecosystem mapping confirmation
  - Well census
  - Land subsidence monitoring evaluation

A living list of projects and management actions will be maintained and updated in the Subbasin data management system (DMS), reflecting the current status and continually adjusting as needed to meet changing basin conditions. The list of projects and

management actions in the DMS is considered to be 'live' and constitutes the required list for the Sutter Subbasin GSP per the GSP Emergency Regulations Subarticle 5.

*Projects and Management Actions.*

### **2.2.8 Implementation**

Implementing the Sutter Subbasin GSP will require numerous management activities by the Sutter Subbasin GSAs, including:

- GSA administration and activities associated with the SSGMCC
- Conducting outreach and stakeholder engagement
- GSP-related monitoring activities at specified timing and frequency and analysis of monitoring data relative to established SMC
- Updating the Subbasin DMS
- C2VSimFG-Sutter model refinements
- Implementing adaptive management strategies as needed
- Implementing projects and management actions, as needed and as funding is available
- Annual Report development and submittal to DWR by April 1<sup>st</sup> each year
- Evaluating and updating the GSP, if needed, at least every five years

Implementation of the Sutter Subbasin GSP will require funding from the GSAs as well as external sources. Outside grants will be sought to assist with reducing the cost of implementation to participating agencies, residents, and landowners in the Subbasin. Costs associated with the implementation of identified projects and management actions will vary depending on the project type and stage of the project (e.g., planning or construction). The Sutter Subbasin GSAs will individually fund implementation of projects and management actions in their respective areas unless otherwise agreed upon by the GSAs' governing bodies.

**Table 2-1: Summary of Sustainable Management Criteria**

Sustainability Indicator	Undesirable Results	Identification of Undesirable Results	Minimum Threshold	Measurable Objective / Interim Milestones
Chronic lowering of groundwater levels	Groundwater levels dropping to a level at which domestic or irrigation wells go dry or lose functional pumping capacity, resulting in significantly higher pumping costs and/or the significant and unreasonable effort to maintain or deepen production wells.	25% of representative monitoring locations across all aquifer zones drop below the minimum threshold criteria concurrently over two consecutive seasonal high water level measurements.	The deepest of: 1. The historic low from available record at each representative monitoring site; or 2. 90% of the average groundwater elevation from the projected water budget (baseline condition over 60-year period using C2VSimFG-Sutter) at each representative monitoring site with a 50% artificial increase in evapotranspiration; or 3. The average operating range using the above criteria for the following aquifer zones: - Shallow AZ and AZ-1 = 8.0 feet - AZ-2 and AZ-3 = 16.5 feet.	Average of the available historical record at each representative monitoring site.
Reduction of groundwater storage	Same as chronic lowering of groundwater levels. Groundwater levels are used as proxy.	Same as chronic lowering of groundwater levels. Groundwater levels are used as proxy.	Same as chronic lowering of groundwater levels. Groundwater levels are used as proxy.	Same as chronic lowering of groundwater levels. Groundwater levels are used as proxy.
Seawater intrusion	Undesirable results related to seawater intrusion are not applicable to the Sutter Subbasin.	Undesirable results related to seawater intrusion are not applicable to the Sutter Subbasin.	Minimum thresholds are not developed because undesirable results related to seawater intrusion are not applicable to the Sutter Subbasin.	Measurable objectives are not developed because undesirable results related to seawater intrusion are not applicable to the Sutter Subbasin.

Sustainability Indicator	Undesirable Results	Identification of Undesirable Results	Minimum Threshold	Measurable Objective / Interim Milestones
Degraded water quality	A result stemming from a causal nexus between groundwater-related activities, such as groundwater extraction or recharge, and a degradation in groundwater quality that causes a significant and unreasonable reduction in long-term viability of domestic, agricultural, municipal, or environmental uses over the planning and implementation horizon of this GSP.	50% of representative monitoring wells across all aquifer zones exceed the minimum threshold for two consecutive measurements at each location during non-drought years and where these minimum threshold exceedances can be tied to a causal nexus between SGMA-related activities and water quality.	The higher of: 1. The Upper Secondary Maximum Contaminant Level (SMCL) for TDS of 1,000 mg/L and Primary MCL for nitrate as N of 10 mg/L; or 2. Current water quality conditions for TDS and nitrate as N based on available data from 2000 to the time of GSP development at each representative monitoring well or nearby well in the same aquifer zone.	The higher of: 1. Current water quality conditions for TDS and nitrate as N based on available data from 2000 to the time of GSP development at each representative monitoring well or nearby well in the same aquifer zone. 2. The Recommended SMCL for TDS of 500 mg/L and 70% of the Primary MCL for nitrate as N of 7 mg/L.
Land subsidence	A result due to groundwater extraction that causes a significant reduction in the viability of the use of infrastructure for water distribution and flood control.	At least 25% of representative subsidence monitoring sites exceed the minimum threshold for subsidence over the 5-year monitoring period.	0.5 feet of subsidence over a 5-year period, representing the point at which water conveyance and levee infrastructure become sensitive to land subsidence ant twice the operational error of land survey measurements.	0.25 feet of subsidence over a 5-year period, representing the range of error for land survey measurements.
Depletions of interconnected surface water	A result that causes significant and unreasonable adverse effects on beneficial uses and users of interconnected surface water within the Sutter Subbasin over the GSP planning and implementation horizon.	25% of representative monitoring locations across all aquifer zones drop below the minimum threshold concurrently over two consecutive seasonal high water level measurements.	Same as chronic lowering of groundwater levels. Groundwater levels used as proxy with an ISW-specific representative monitoring network.	Same as chronic lowering of groundwater levels. Groundwater levels used as proxy with an ISW-specific representative monitoring network.

## 2.3 GSP Implementation Progress

The Sutter Subbasin GSP was adopted by the Subbasin GSAs between November 2021 and January 2022 and submitted to DWR on January 28, 2022. On October 26, 2023, DWR released an Approved determination for the Sutter Subbasin GSP with recommended corrective actions to be addressed as part of the 2027 Periodic Evaluation and Plan Amendment (if needed). Since DWR's determination letter was released at the beginning of WY 2024, notable progress has not yet been made in addressing the recommended corrective actions and subsequent Annual Reports will provide progress updates.

Measurable objectives, interim milestones, and minimum thresholds for applicable sustainability indicators were identified to aid in maintaining sustainable conditions throughout the Sutter Subbasin. Given that the Sutter Subbasin is currently considered sustainable, projects and management actions are not considered necessary to achieve the measurable objectives. However, projects and management actions were included and designed to allow for adaptive management of the groundwater basin, to maintain sustainable conditions, and to improve overall groundwater conditions. Section 3 *Groundwater Monitoring and Conditions Assessment* of this annual report includes comparison of conditions monitored for all applicable sustainability indicators against SMC summarized in **Table 2-1**. Projects and management actions status updates for WY 2023 are included in **Appendix A**.

In December 2022, the Sutter Subbasin applied for approximately \$8.5 million in grant funding under DWR's Sustainable Groundwater Management (SGM) Grant Program SGMA Implementation – Round 2 for development of annual reports and model updates, filling of data gaps through installation of pressure transducers on representative groundwater level and interconnected surface water wells and geophysical surveys of the Sutter Buttes, preparation of a financing plan to develop a long-term funding stream for GSP implementation, and a dual source irrigation system pilot program and lateral heading and turnout measurement modernization project within the Sutter Subbasin portion of Butte Water District. In September 2023, final awards were released and the Sutter Subbasin was awarded funding for the full amount requested. Progress in implementing projects funded by the grant will be provided in subsequent Annual Reports.

The Sutter Subbasin Groundwater Management Coordination Committee (SSGMCC) met three times during WY 2023, where meeting dates, locations, and key topics are identified in **Table 2-2**. Additionally, all subbasins in the Sacramento Valley Groundwater Basin met quarterly in WY 2023 to coordinate data sharing and implementation. These meetings are facilitated by the Northern California Water Association (NCWA). The Sutter Subbasin will actively seek opportunities to coordinate with its neighboring subbasins throughout GSP implementation to ensure sustainable conditions are achieved and maintained throughout the region. Northern Sacramento

Valley Integrated Regional Water Management Board meetings and Technical Advisory Committee meetings during WY 2023 also included SGMA-related agenda items such as groundwater conditions, SGMA implementation updates from Northern Sacramento Valley representatives, and funding opportunities. All GSAs in the Sutter Subbasin continued during WY 2023 to provide SGMA-related updates during monthly Board and city council meetings and to provide access to information related to SGMA and the GSP on their respective websites (also linking to the Subbasin website at [www.suttersubbasin.org](http://www.suttersubbasin.org)), and answering questions from interested stakeholders/growers.

Governor Gavin Newsom’s Executive Order (EO) N-7-22, issued on March 28, 2022 and later rescinded, and EO N-3-23, issued on February 13, 2023, requires approval of permits for new groundwater wells or alterations of existing wells in a high- or medium-priority groundwater basin to include written verification from the overlying GSA that the well and its use would not be inconsistent with the adopted GSP and decrease the likelihood of achieving the sustainability goal of the adopted GSP. During WY 2023, the Sutter Subbasin GSAs developed a well application review process that requires more detail regarding well construction and planned well operations, as well as a signed acknowledgement form from the applicant indicating the overlying GSA can act within its authority as a GSA to ensure the sustainability goal of the GSP is met. Similarly, the Sutter Subbasin GSAs also began working on developing a Subbasin-wide methodology for evaluating and approving groundwater substitution transfers in WY 2024, as no groundwater substitution transfers occurred during WY 2023. Refer to Section 4 *Groundwater Substitution Transfers* of this report for more information.

**Table 2-2: Sutter Subbasin Groundwater Management Coordination Committee Meetings, WY 2023**

Date	Location	Key Meeting Topics
March 28, 2023	City of Yuba City Wastewater Treatment Facility in Yuba City; Virtual	Review of WY 2022 Annual Report; GSA well application review process; Proposed future GSP implementation activities
May 30, 2023	Sutter County Development Services office; Virtual	Approval of WY 2022 Annual Report; Monitoring responsibilities and representative monitoring network revisions; GSA well application review process; DWR Technical Support Services (TSS) funding
June 23, 2023	Sutter County Development Services office; Virtual	Representative monitoring network revisions; Extension of groundwater quality monitoring period; DWR TSS funding; Report on implementation of projects and management actions

### 3. GROUNDWATER MONITORING AND CONDITIONS ASSESSMENT

This section discusses groundwater elevation, groundwater storage, groundwater quality, land subsidence, and groundwater-surface water interaction trends in the Sutter Subbasin, as well as total water use during WY 2023. Seawater intrusion is not an applicable sustainability indicator for the Sutter Subbasin as it is located inland from the Pacific Ocean and is not adjacent to the Sacramento-San Joaquin Delta.

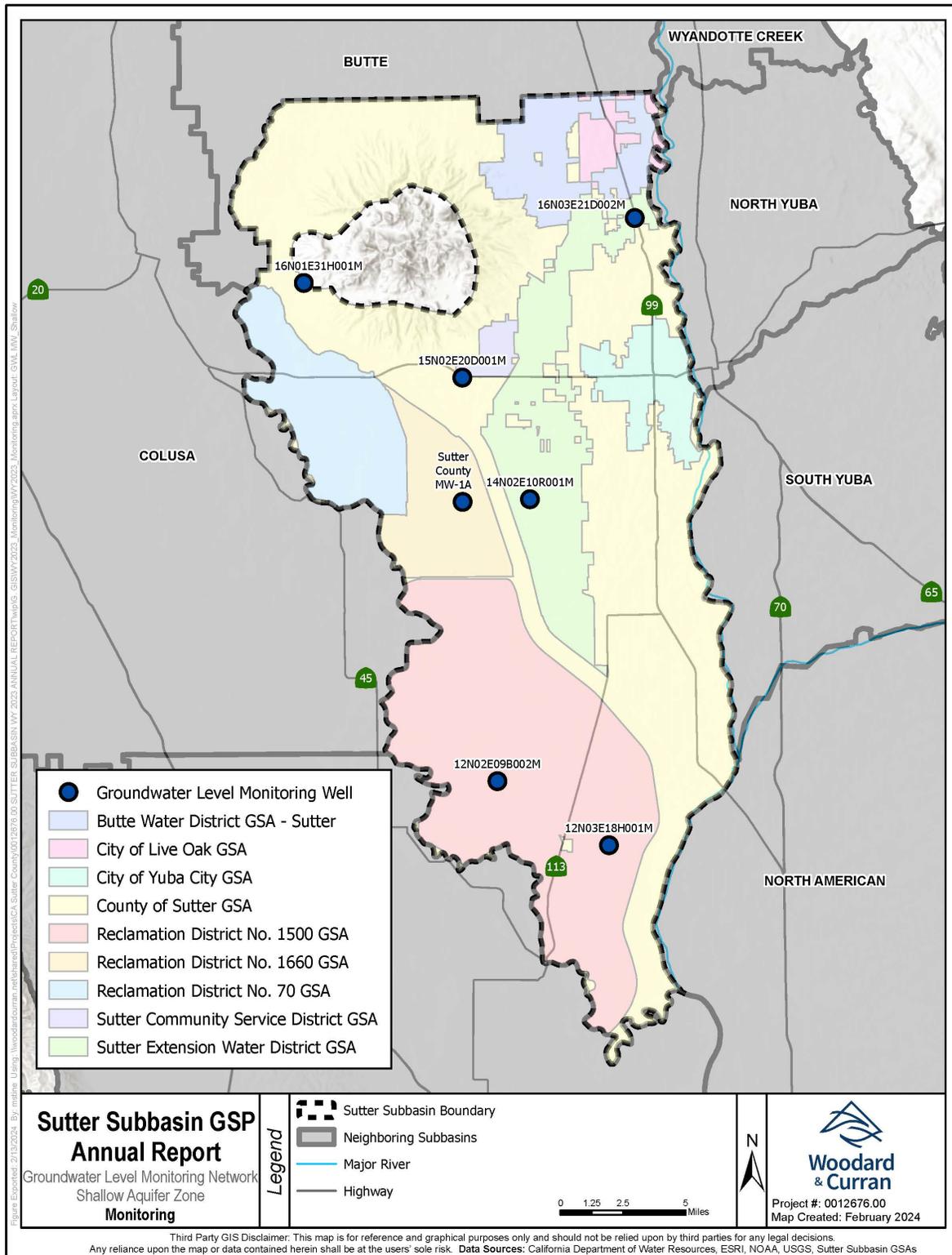
#### 3.1 Groundwater Levels

**Figure 3-1** through **Figure 3-4** show the location of representative monitoring wells in the Sutter Subbasin GSP by aquifer zone for the chronic lowering of groundwater levels sustainability indicator. As previously described in **Section 2.2.2**, AZ-1 was further divided to create the Shallow AZ (ground surface to 50 feet bgs) in order to better monitor for interconnected surface water conditions and impacts to GDEs. Site Codes 392712N1216493W001 (State Well Number 16N03E04E001M) and 391026N1216302W001 (Local ID Hillcrest Well #5) screened within AZ-1 and AZ-1/AZ-2, respectively, were removed from the representative groundwater level monitoring network during WY 2023 due to inability to access well for continued monitoring. Hydrographs for representative monitoring wells showing available historical groundwater level elevations through WY 2023 are included in **Appendix B**. Hydrographs showing established minimum thresholds and measurable objectives are also presented in Section 7.2 *Monitoring* of the GSP.

Hydrographs for representative wells in the Sutter Subbasin generally show annual groundwater level declines during the irrigation season and seasonal recovery to pre-irrigation levels once irrigation has ceased, with little to no variation by water year type (**Appendix B**). During WY 2023, similar patterns were observed with many wells operating within their respective operating range or above the measurable objective, where interim milestones are set equal to the measurable objective as a means of maintaining currently sustainable conditions. Minimum threshold exceedances were observed at 2 wells during WY 2023: Local IDs MFWC Prop 50 and Sutter County MW-6A. Local ID MFWC Prop 50 was only monitored in October 2022 where conditions were approximately 5.5 feet below the minimum threshold, but the well recovered to above the minimum threshold by April 2023. Minimum threshold exceedances in Local ID Sutter County MW-6A were observed at the beginning of WY 2023 (largely in October and November 2022) with recovery to above the minimum threshold in December 2022 and conditions largely above the measurable objective until July 2023, where groundwater levels were between the minimum threshold and measurable objective through the end of WY 2023. Recent downward trends are observed in the following wells and will be monitored to ensure minimum threshold exceedances are not observed: Local IDs (or State Well Numbers) Flood MW-1C (shall), Sutter County MW-6A, SEWD MW-3A, Feather River MW-1A, BWD MW-1C, Hillcrest Well #8, Hillcrest

Well #9, Sutter County MW-6B, Sutter County MW-6C, SEWD MW-3B, SMWC MW-1B, SEWD MW-2A, Sutter County MW-3B, Sutter County MW-3C, Sutter County MW-2D, Sutter County MW-4C, Sutter County MW-4D, SEWD MW-3C, Feather River MW-1C, Feather River MW-1D, Sutter County MW-3D, and Sutter County MW-3E. It should be noted that several representative monitoring wells (Local IDs Sutter County MW-6A, SEWD MW-3A, BWD MW-1C, SEWD MW-3B, SEWD MW-2A, and SEWD MW-3C) are located in agricultural areas and measurements were taken after two consecutive years of 50% surface water delivery reductions, which resulted in unusual increases in groundwater extraction.

Undesirable results for the chronic lowering of groundwater levels sustainability indicator occur when 25% of representative monitoring locations across all aquifer zones drop below the minimum threshold criteria concurrently over two consecutive seasonal high water level measurements. No minimum threshold exceedances were observed during the seasonal high monitoring period (March through April) in either WY 2022 or WY 2023. Therefore, an undesirable result for the chronic lowering of groundwater levels sustainability indicator was not observed in WY 2023, predominantly due to wet conditions throughout the Sacramento Valley.



**Figure 3-1: Groundwater Level Monitoring Network Wells, Shallow AZ**

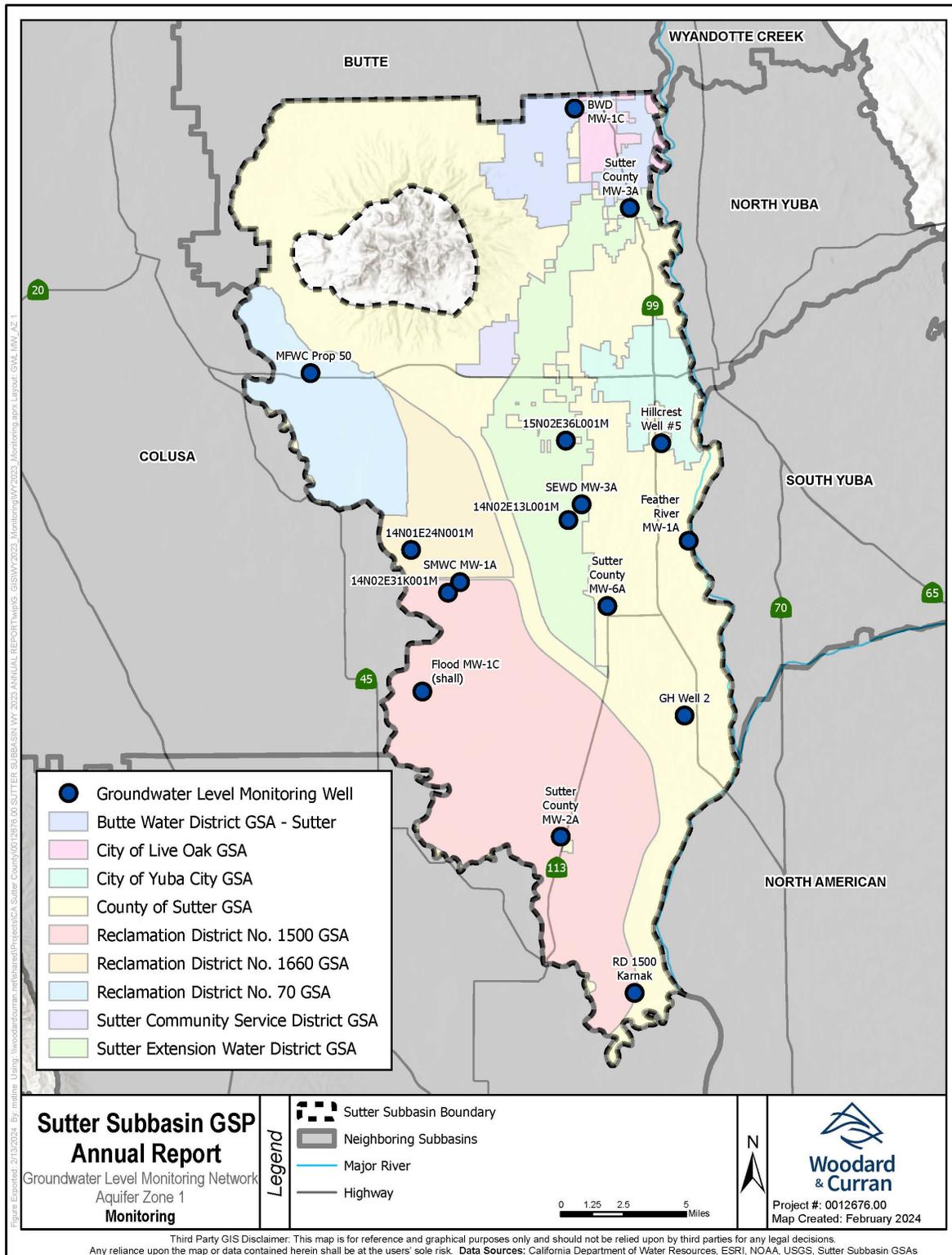


Figure 3-2: Groundwater Level Monitoring Network Wells, AZ-1

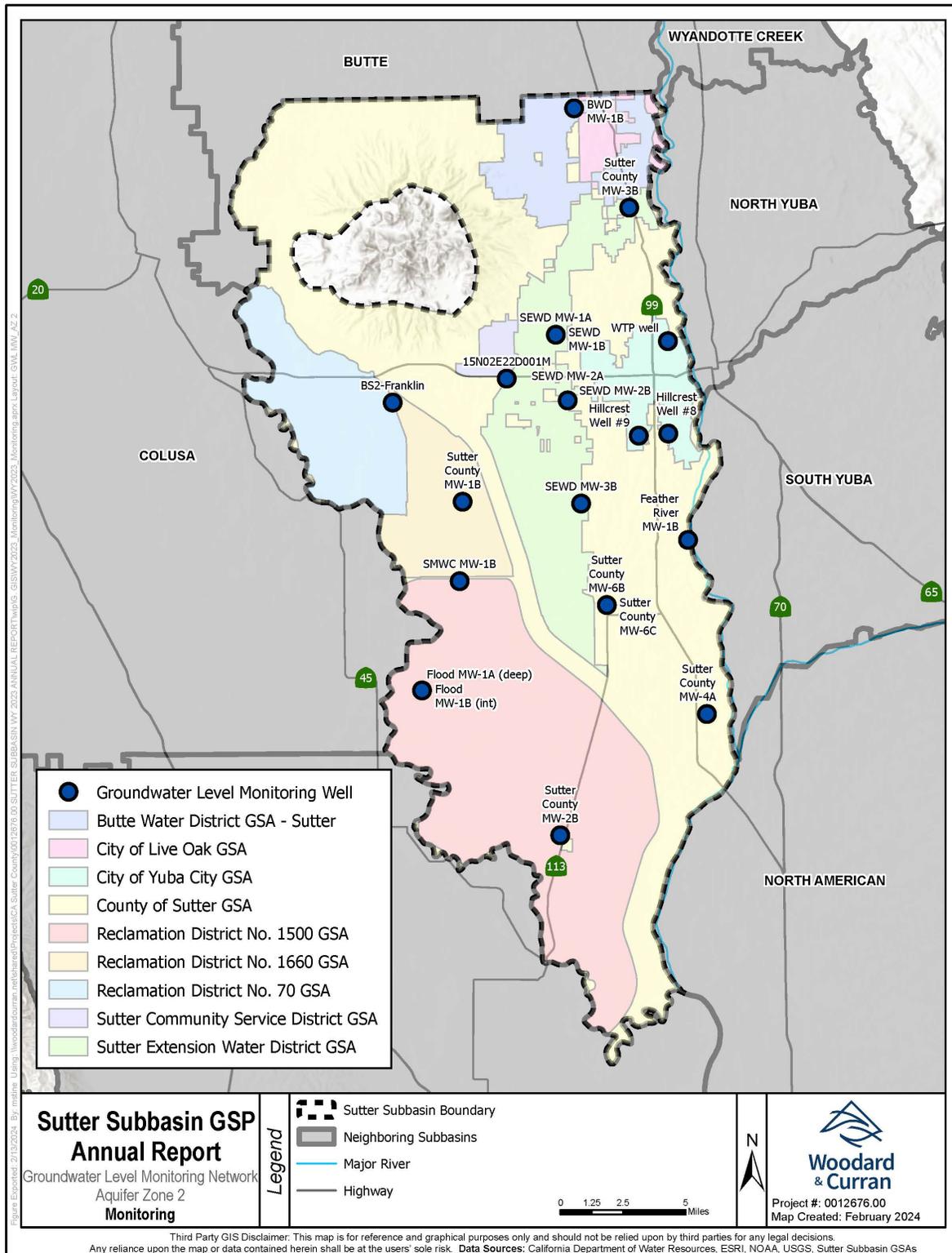


Figure 3-3: Groundwater Level Monitoring Network Wells, AZ-2

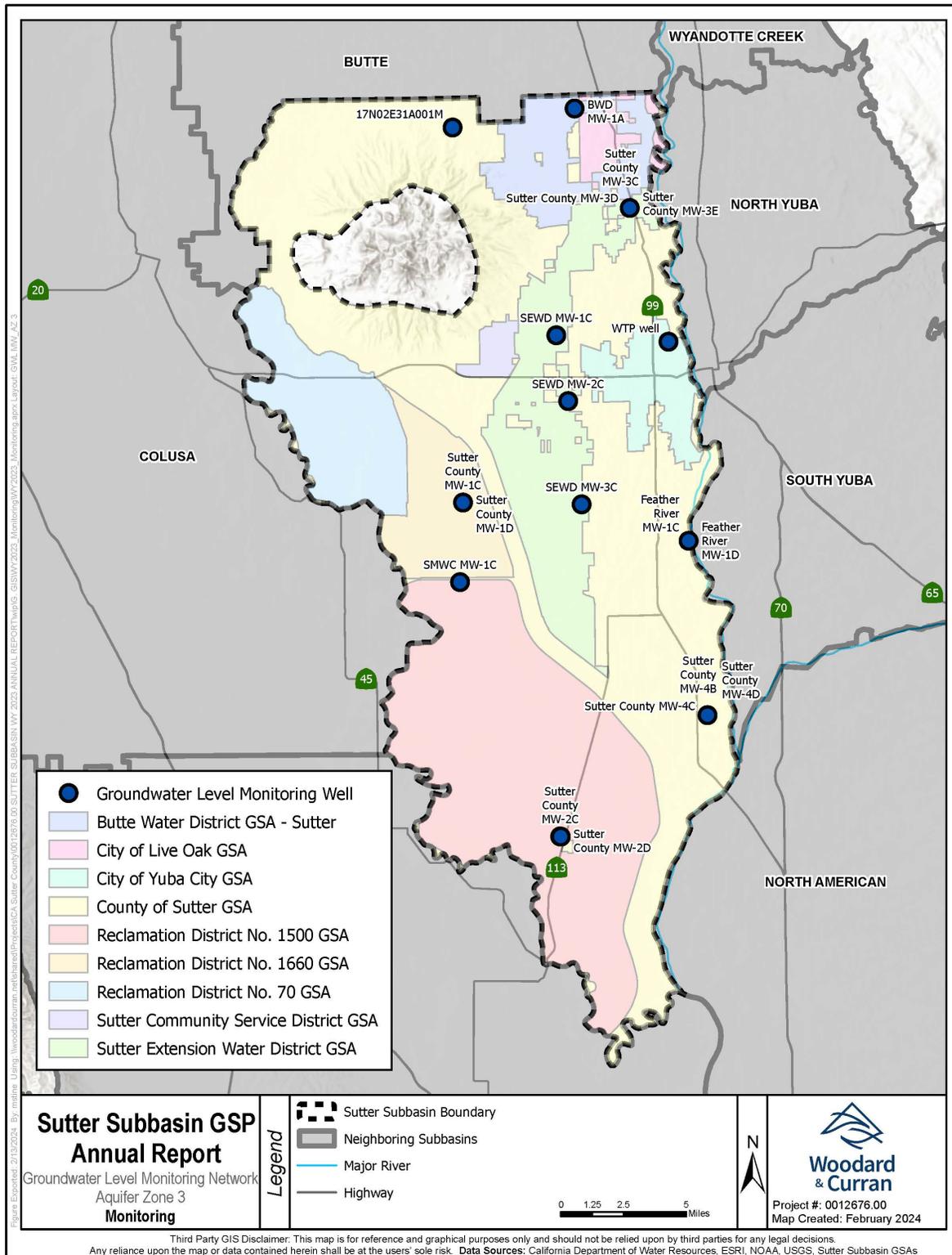
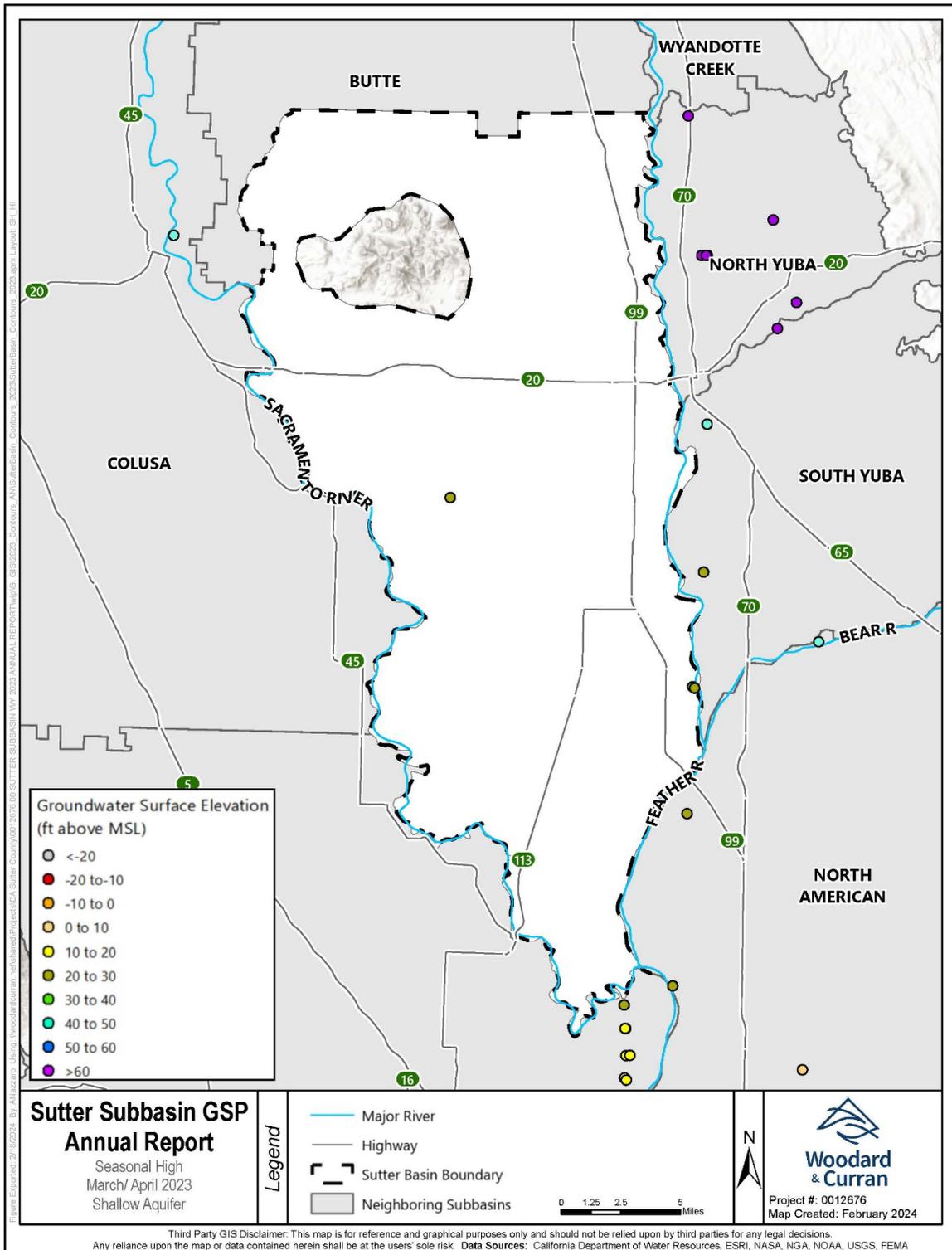


Figure 3-4: Groundwater Level Monitoring Network Wells, AZ-3

**Figure 3-5** through **Figure 3-8** present contour maps of groundwater levels for seasonal high conditions (March and April 2023) for each aquifer zone during WY 2023. Data from representative monitoring wells were supplemented with publicly available data sources to develop the contour maps. Insufficient data are available for the Shallow AZ for March and April 2023, therefore **Figure 3-5** only shows wells with available groundwater elevation measurements during this period. Only one Shallow AZ well with March and April 2023 data is available, located approximately in the center of the Subbasin, with an elevation of 29 feet above mean sea level (MSL). Based on available data from March and April 2023, groundwater elevations ranged from approximately 20 to 70 feet above MSL in AZ-1 (**Figure 3-6**), from approximately 16 to 71 feet above MSL in AZ-2 (**Figure 3-7**), and from approximately 16 to 70 feet above MSL in AZ-3 (**Figure 3-8**). Groundwater levels are slightly elevated compared to WY 2021 and WY 2022 conditions due to wet conditions throughout the Sacramento Valley in WY 2023, following dry conditions from WY 2020 through WY 2022. As previously noted, annual groundwater fluctuations are observed throughout the Sutter Subbasin due to irrigation demands and subsequent wet season recharge but there is little to no variation in groundwater elevations by water year type. Groundwater flow is in the general north to south direction in AZ-1, AZ-2, and AZ-3.

**Figure 3-9** through **Figure 3-12** present contour maps of groundwater levels for seasonal low conditions (September and October 2023) for each aquifer zone during WY 2023. Data from representative monitoring wells were supplemented with publicly available data sources to develop the contour maps. Insufficient data are available for the Shallow AZ for September and October 2023, therefore **Figure 3-9** shows only wells with available groundwater elevation measurements during this period. Only one Shallow AZ well with September and October 2023 data is available, located approximately in the center of the Subbasin, with an elevation of 29 feet above MSL. Based on available data from September and October 2023, groundwater elevations ranged from approximately 15 to 68 feet above MSL in AZ-1 (**Figure 3-10**), from approximately 16 to 64 feet above MSL in AZ-2 (**Figure 3-11**), and from approximately 11 to 59 feet above MSL in AZ-3 (**Figure 3-12**). Groundwater levels are slightly elevated compared to WY 2021 and WY 2022 conditions due to wet conditions throughout the Sacramento Valley in WY 2023 following dry conditions from WY 2020 through WY 2022. As previously noted, annual groundwater fluctuations are observed throughout the Sutter Subbasin due to irrigation demands and subsequent wet season recharge but there is little to no variation in groundwater elevations by water year type. Groundwater flow is in the general north to south direction in AZ-1, AZ-2, and AZ-3.



**Figure 3-5: Seasonal High Groundwater Levels in Shallow AZ, March and April 2023**

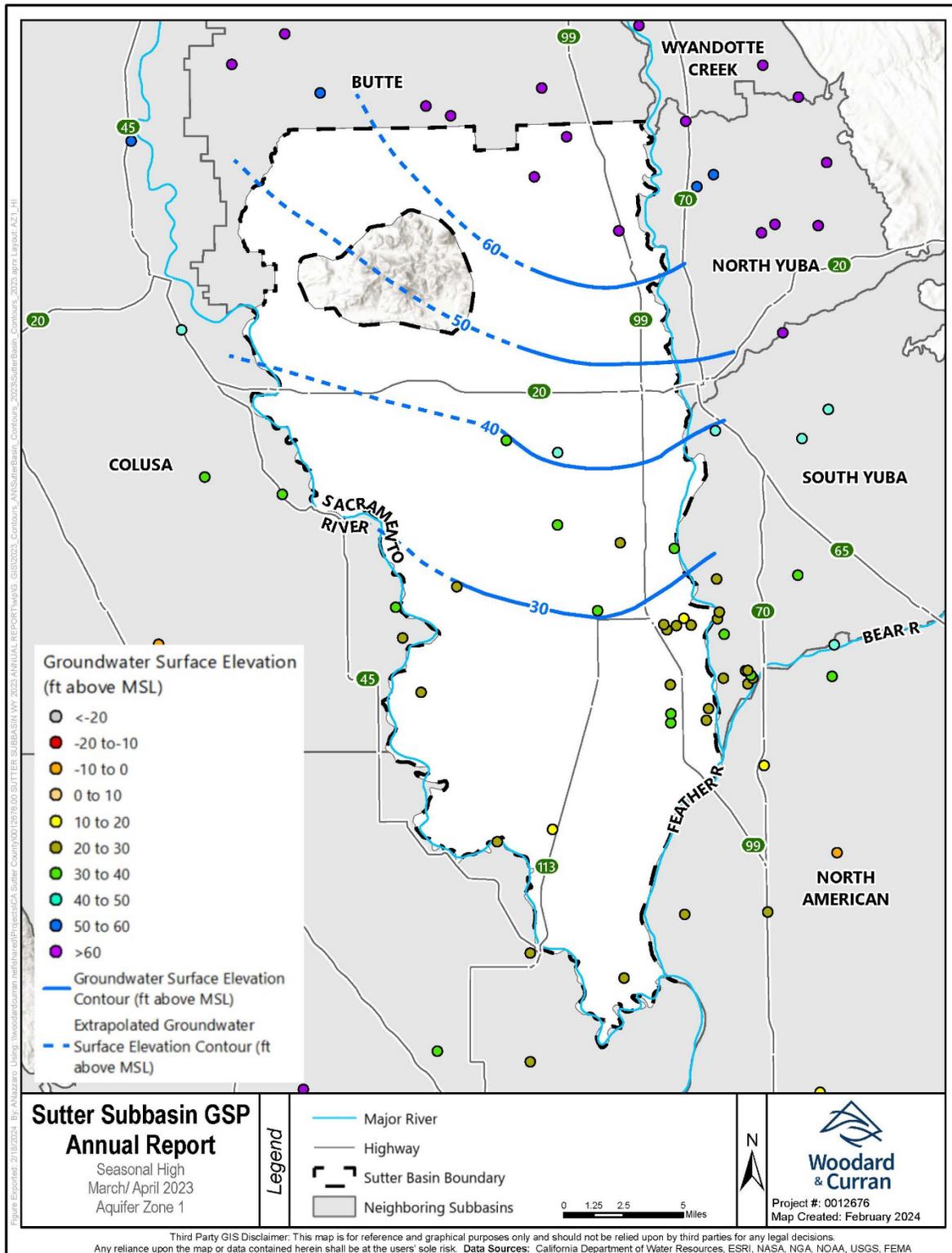


Figure 3-6: Seasonal High Groundwater Levels in AZ-1, March and April 2023

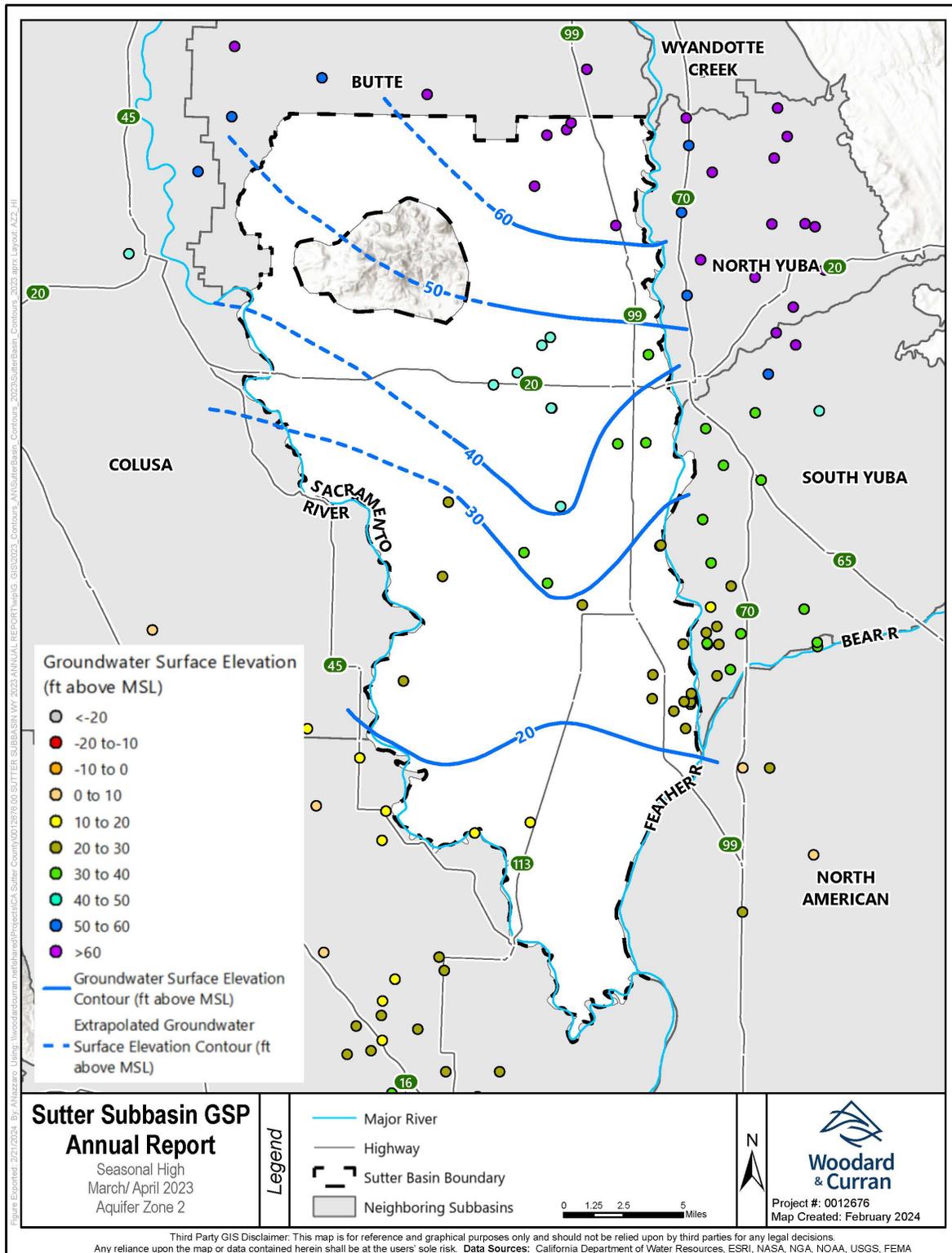


Figure 3-7: Seasonal High Groundwater Levels in AZ-2, March and April 2023

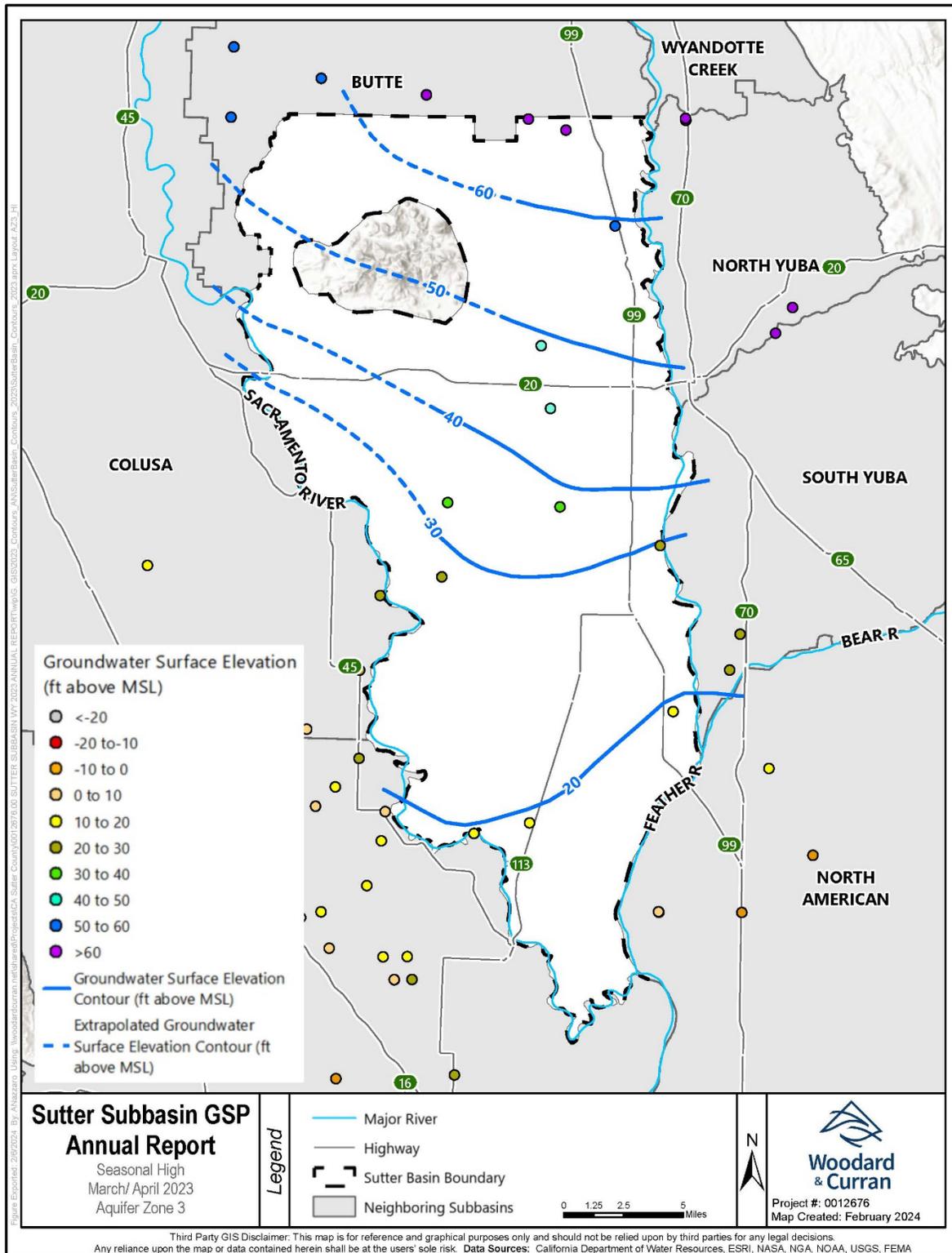
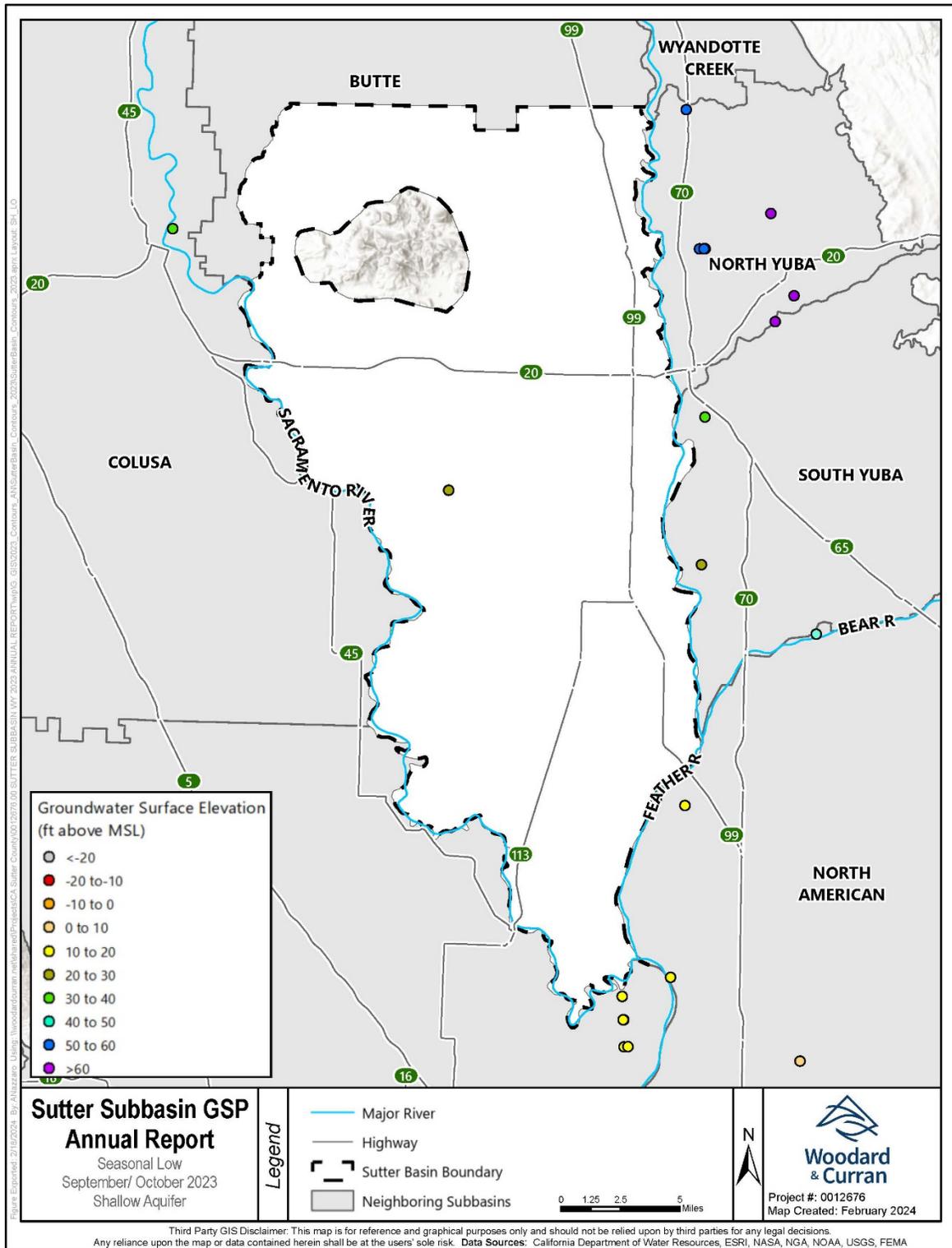
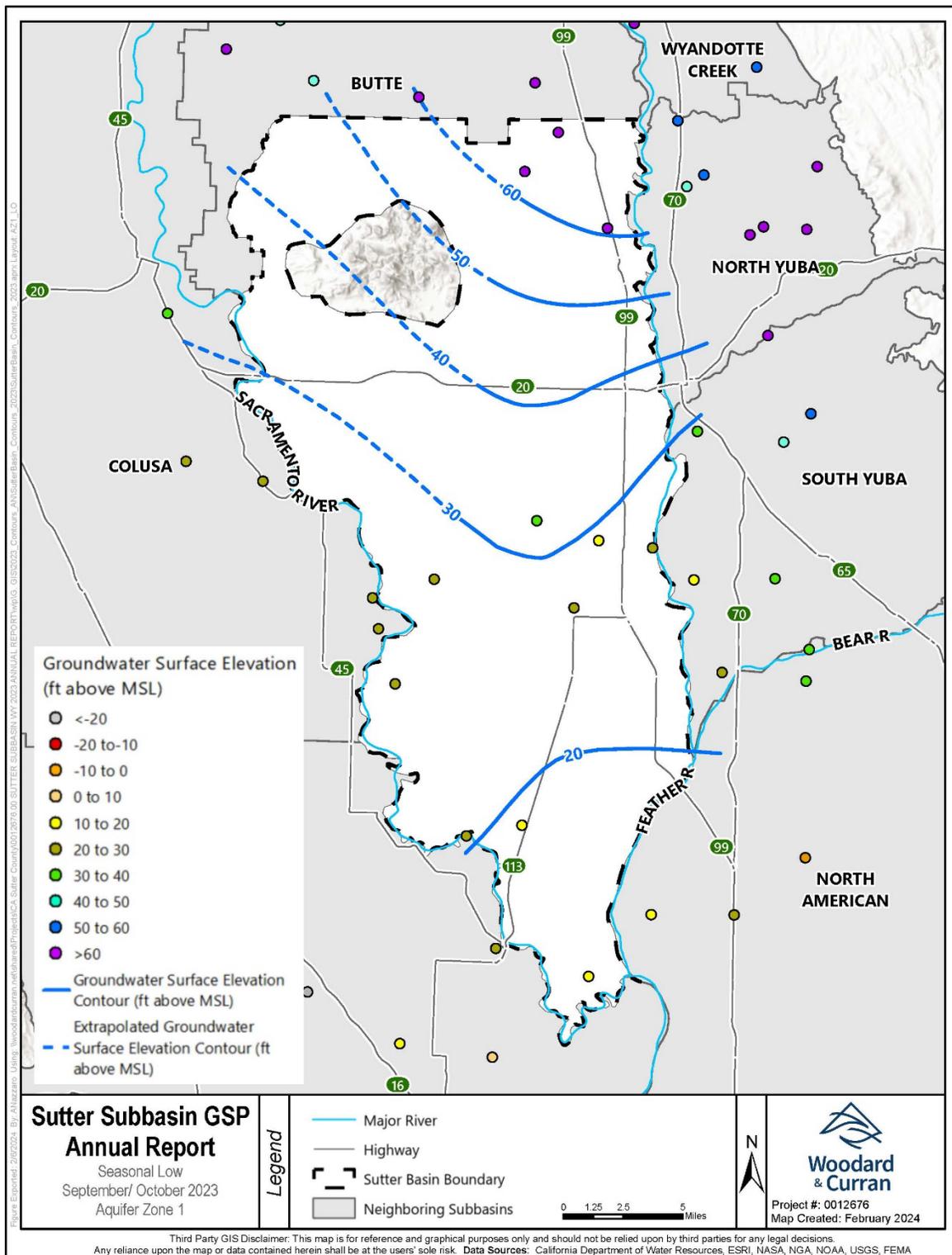


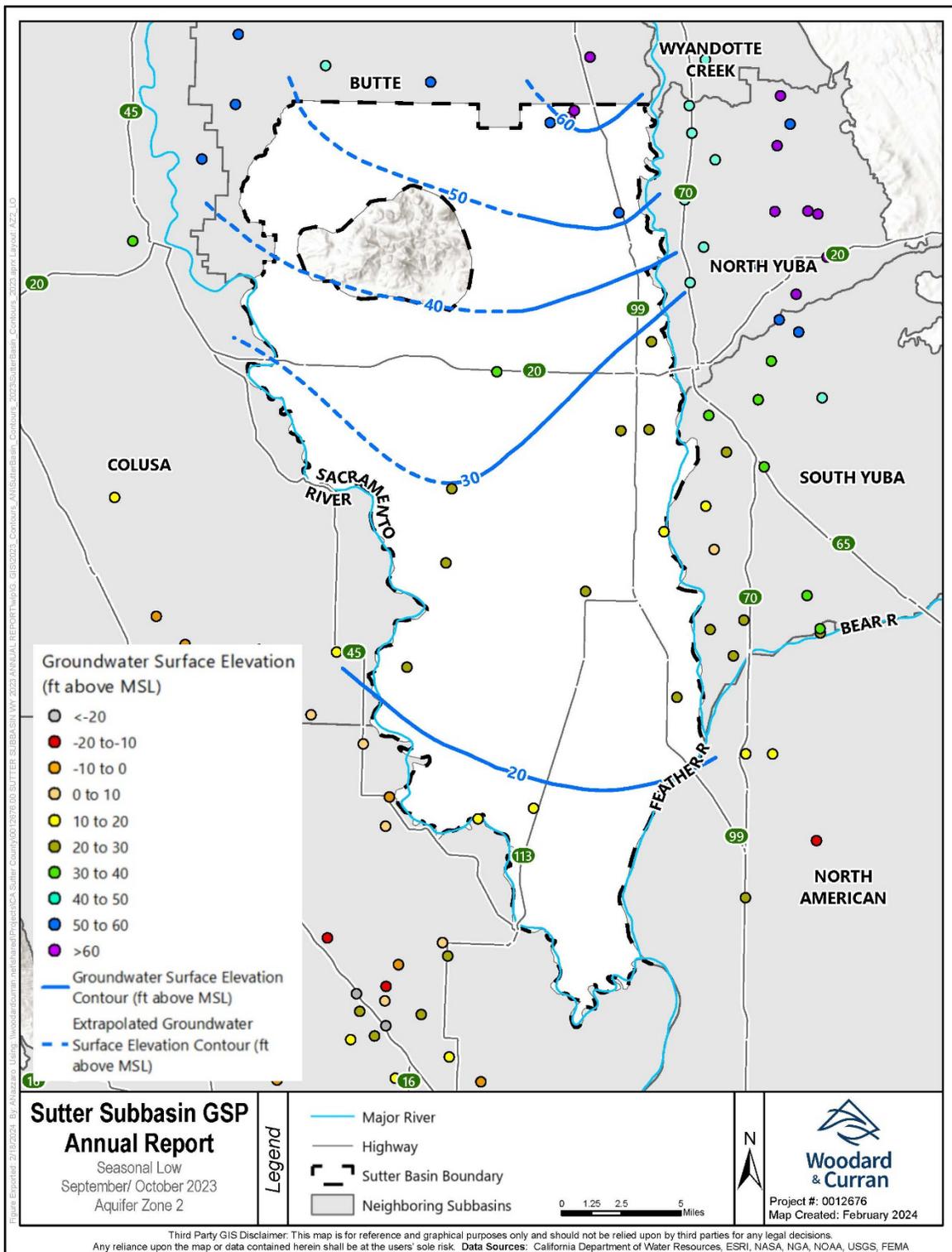
Figure 3-8: Seasonal High Groundwater Levels in AZ-3, March and April 2023



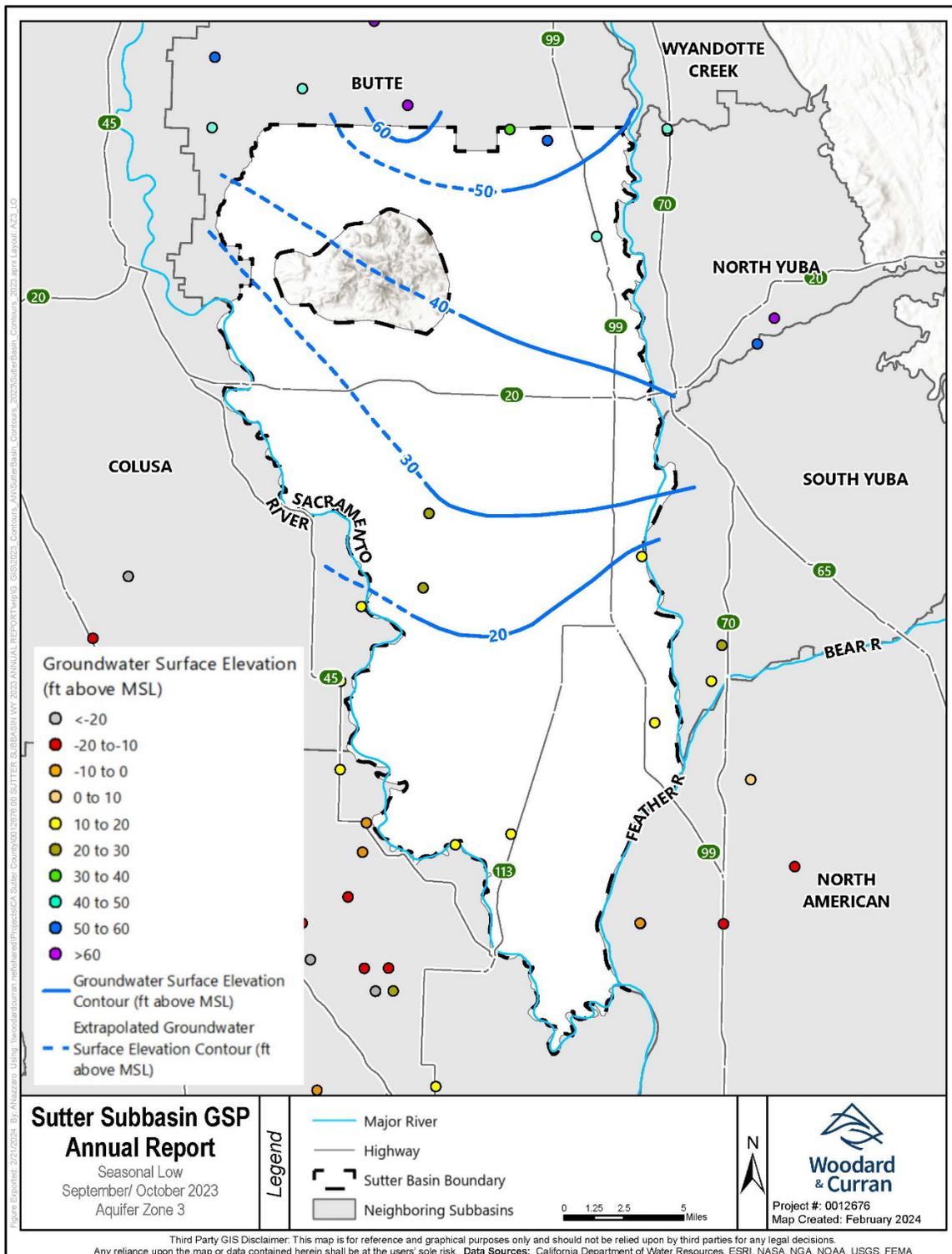
**Figure 3-9: Seasonal Low Groundwater Levels in Shallow AZ, September and October 2023**



**Figure 3-10: Seasonal Low Groundwater Levels in AZ-1, September and October 2023**



**Figure 3-11: Seasonal Low Groundwater Levels in AZ-2, September and October 2023**



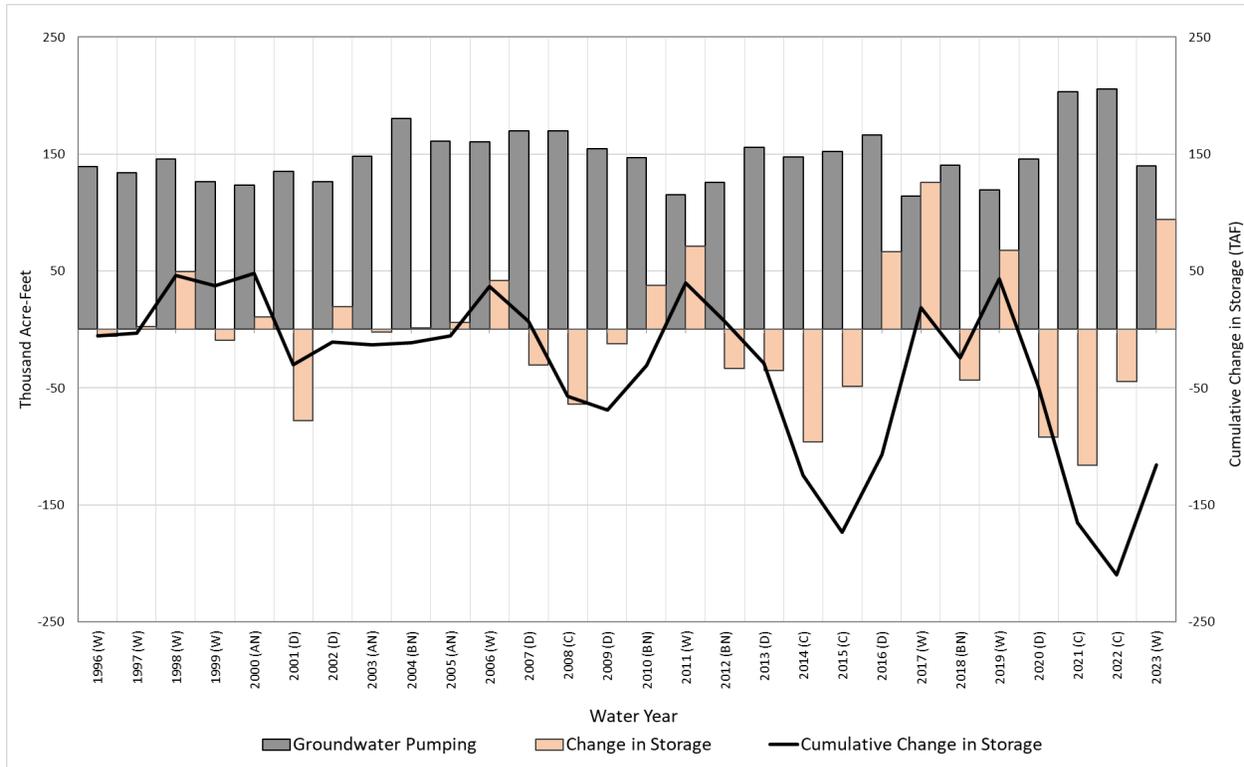
**Figure 3-12: Seasonal Low Groundwater Levels in AZ-3, September and October 2023**

## 3.2 Groundwater Storage

The groundwater storage sustainability indicator is monitored using groundwater levels as proxy by the representative monitoring network identified in **Section 3.1**. C2VSimFG-Sutter, used to develop the water budgets in the Sutter Subbasin GSP, is used as a tool jointly with groundwater level monitoring (hydrographs) to estimate changes in groundwater storage in the Subbasin.

**Figure 3-13** shows the annual and cumulative change in storage along with annual groundwater pumping from WY 1996 to WY 2023 for the Sutter Subbasin. In WY 2023, the Sutter Subbasin saw an increase in storage of approximately 94,000 AF since WY 2022, reflecting the wetter conditions of WY2023 (**Table 3-1**). This change in storage represents approximately 0.2% of the total estimated 49 million acre-feet (MAF) of groundwater in storage.

**Figure 3-14** shows the change in groundwater storage in the Sutter Subbasin between October 1, 2022 to September 30, 2023, estimated using C2VSimFG-Sutter. On a C2VSimFG-Sutter element basis, groundwater storage is estimated to have increased by up to 1.12 feet (or AF/acre) across almost the entire Subbasin. A small area of storage decrease (up to 0.13 feet) occurred in the northeastern corner of the Subbasin. The areas of the greatest storage increase occurred directly south of the Sutter Buttes as well as along the eastern and southwestern boundaries of the Subbasin. Though change in storage varied on an element basis, there was an overall net increase in groundwater storage in the Sutter Subbasin during WY 2023.



**Figure 3-13: Historical Modeled Change in Annual Storage with Groundwater Pumping and Year Type**

**Table 3-1: WY 2023 Change in Groundwater Storage**

Principal Aquifer Name	Change in Storage (AF)	Calculation Method
Principal Aquifer	+94,000	Change in groundwater storage for the fresh groundwater layers is estimated using the C2VSimFG-Sutter model. This estimated value is what balances the water budget after inflows and outflows are accounted for in the groundwater system. Through a systematic sensitivity analysis, the range of impacts of uncertainties on model calculations are quantified. Knowledge of this range of uncertainties can assist in providing flexibility in decisions that rely on model results.
<b>TOTAL</b>	<b>+94,000</b>	<b>-</b>

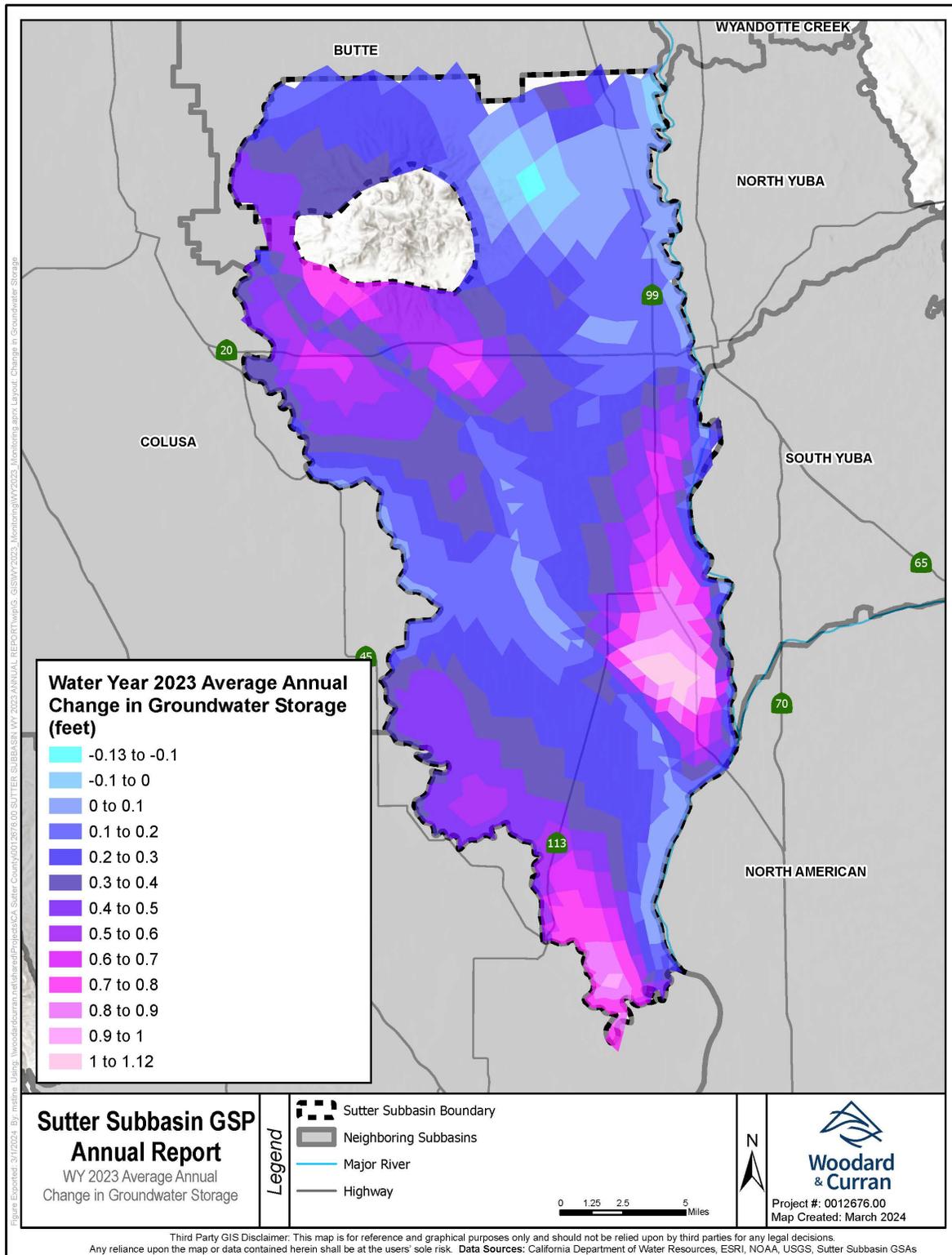
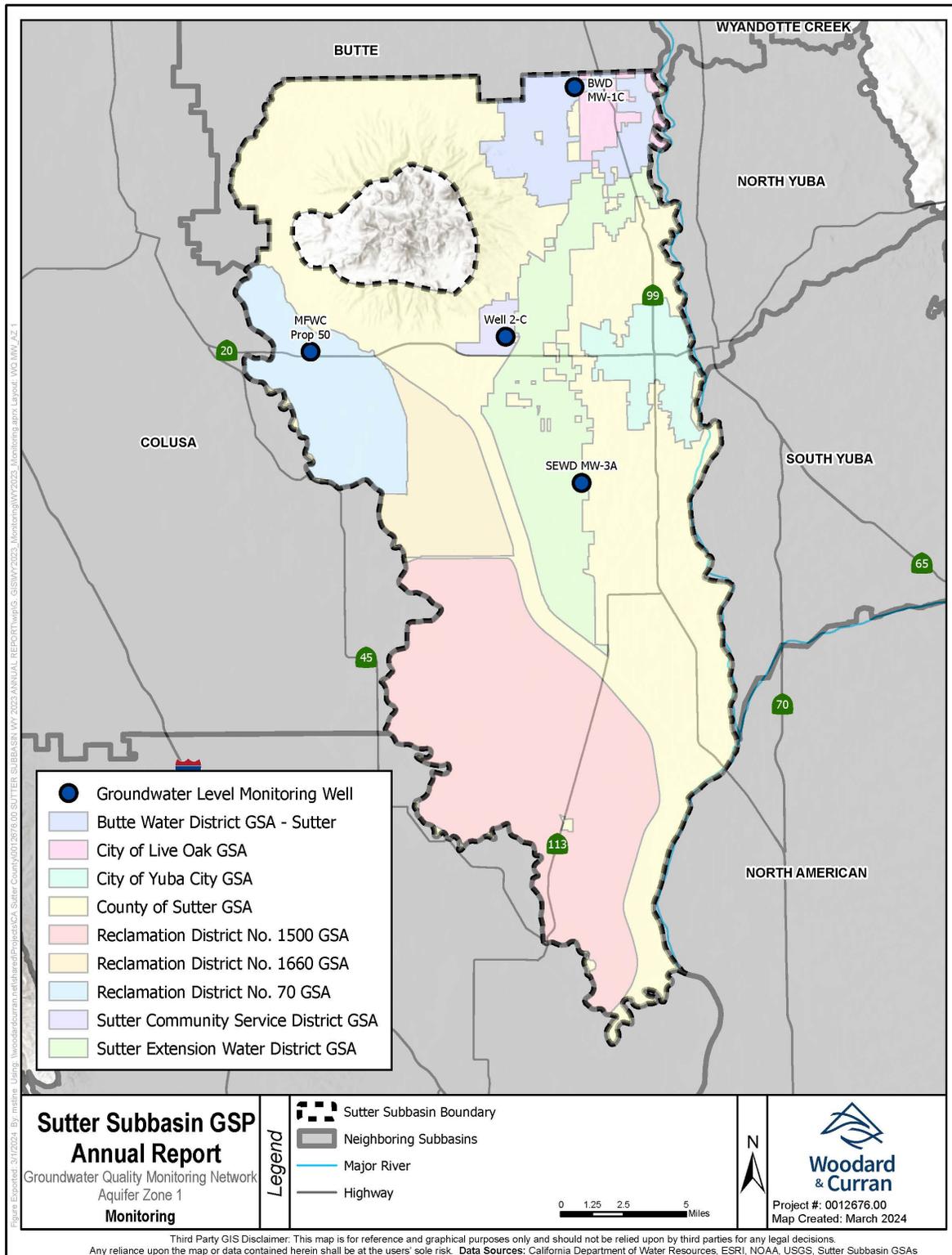


Figure 3-14: WY 2023 Change in Groundwater Storage

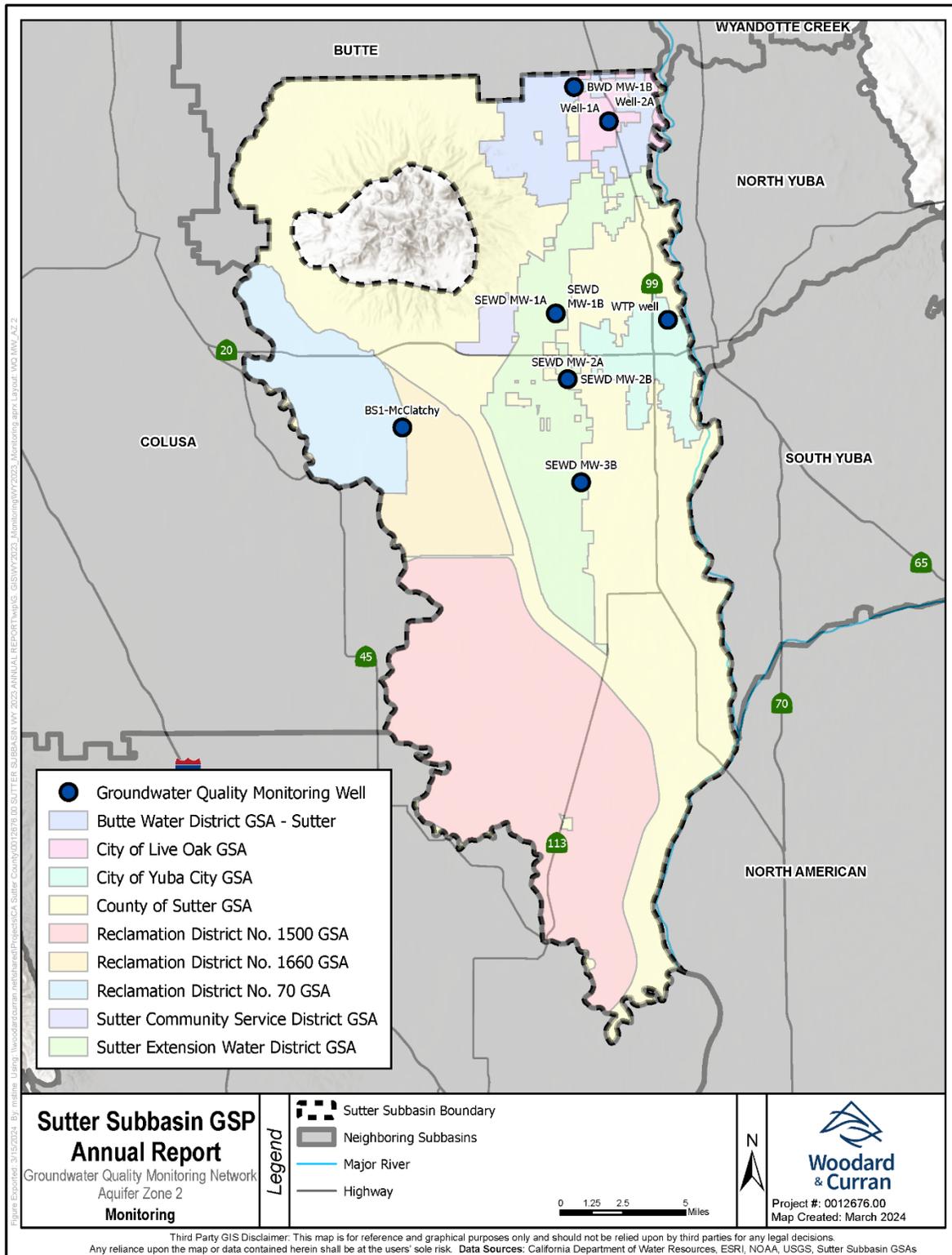
### 3.3 Groundwater Quality

**Figure 3-15** through **Figure 3-17** show the location of representative monitoring wells for the degraded water quality sustainability indicator by aquifer zone. The representative groundwater quality monitoring network has been reassessed since adoption of the Sutter Subbasin GSP due to concerns over the long-term ability to monitor the majority of wells previously comprising the network. The Sutter Subbasin Groundwater Management Coordination Committee agreed during its May 30, 2023 meeting that each GSA would propose a minimum of one (1) groundwater quality monitoring well. The Sutter Subbasin GSAs are currently in the process of refining the representative groundwater quality monitoring network, and subsequent revisions that allow for more spatial coverage of the Subbasin will be documented in future annual reports. Groundwater quality monitoring at representative monitoring wells was scheduled to take place between July and October 2023 for TDS and nitrate as N.

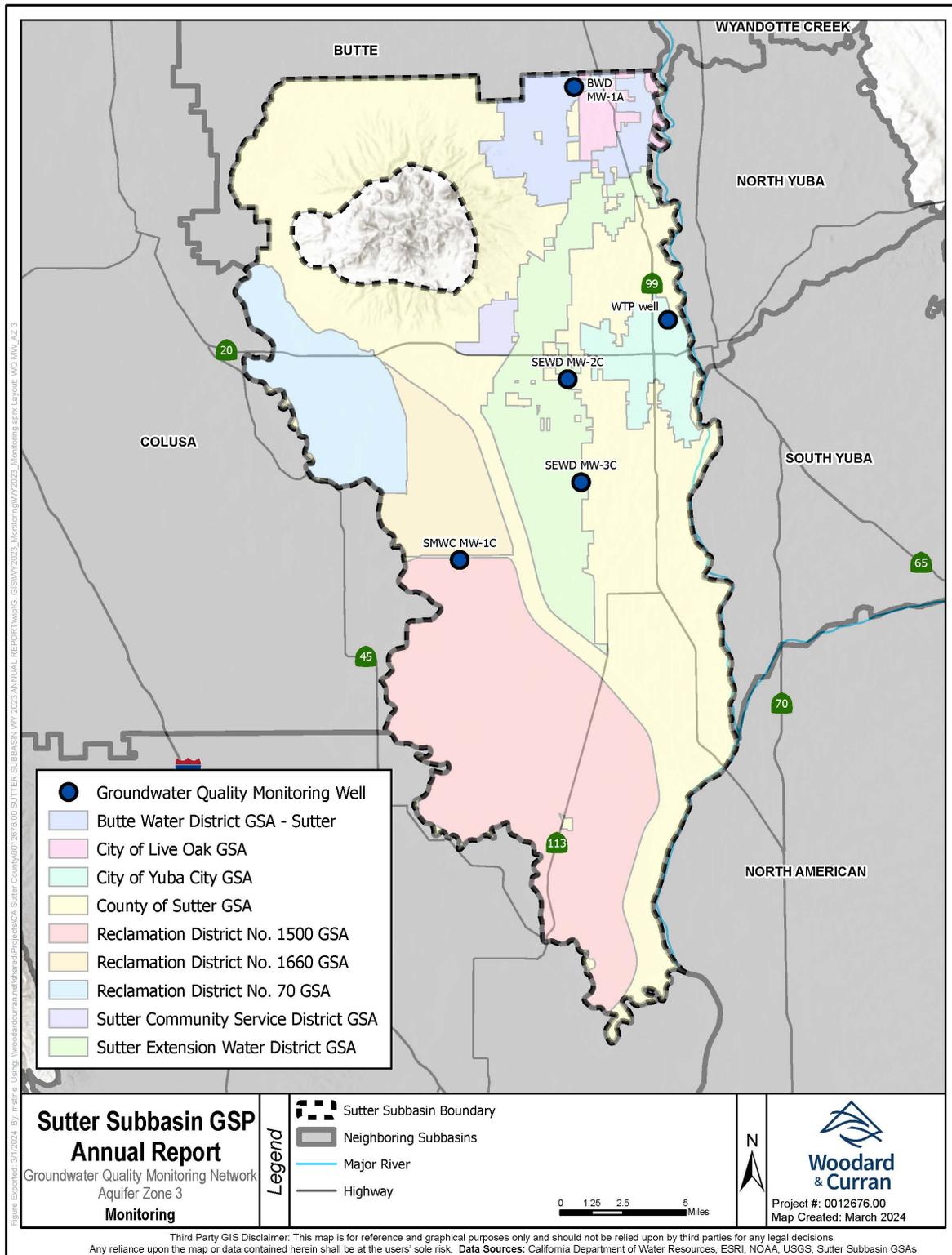
**Table 3-2** shows the current representative groundwater quality monitoring network and WY 2023 sampling results. Out of the 18 wells currently in the representative groundwater quality monitoring network, 8 wells were sampled for TDS and nitrate as N during the designated monitoring period of July through October. Nine wells were sampled for TDS and one well was sampled for nitrate as N during WY 2023 but outside of the designated monitoring period. One well was not sampled for TDS, and 9 wells were not sampled for nitrate as N during WY 2023. Of the samples collected during WY 2023, all nitrate as N samples were below the primary MCL of 10 mg/L, with the exception of Local ID Well-2A within the City of Live Oak, and all TDS samples were below the SMCL of 1,000 mg/L, with the exception of Local ID SEWD MW-3C which was above the SMCL for TDS but collected prior to the designated sampling period. Insufficient data are available to determine if an undesirable result occurred, and the addition of WY 2024 sampling results will be used to determine if undesirable results are occurring relative to groundwater quality.



**Figure 3-15: Groundwater Quality Monitoring Network Wells, AZ-1**



**Figure 3-16: Groundwater Quality Monitoring Network Wells, AZ-2**



**Figure 3-17: Groundwater Quality Monitoring Network Wells, AZ-3**

**Table 3-2: WY 2023 Representative Groundwater Quality Monitoring Network and Sampling Results**

Site Code	State Well Number	Local ID / Other ID	Aquifer Zone	Overlying GSA	Status	Well Use	Depth (ft bgs)	Screen Interval (ft bgs)	Sample Date	TDS Result (mg/L)	Nitrate as N Result (mg/L)
390682N1216901W001	14N02E13A003M	SEWD MW-3A	AZ-1	Sutter Extension WD GSA	Active	Observation	115	90 - 110	5/3/2023	230	-
392970N1216907W003	17N02E25J003M	BWD MW-1C	AZ-1	Butte WD GSA	Active	Observation	127	70 - 90	8/8/2023	210	Not detected
-	-	Well 2-C	AZ-1	Sutter CSD GSA	Active	Public Supply	120	90 - 120	7/10/2023	-	7.5
391456N1218904W001	-	MFWC Prop 50	AZ-1	Reclamation District No. 70 GSA	Active	Irrigation	320	125 - 155	8/30/2023	670	0.49
390682N1216901W002	14N02E13A004M	SEWD MW-3B	AZ-2	Sutter Extension WD GSA	Active	Observation	245	210 - 240	5/3/2023	260	-
391658N1217070W001	15N02E12E001M	SEWD MW-1A	AZ-2	Sutter Extension WD GSA	Active	Observation	173	148 - 168	5/2/2023	310	-
391658N1217070W002	15N02E12E002M	SEWD MW-1B	AZ-2	Sutter Extension WD GSA	Active	Observation	266	240 - 260	5/2/2023	220	-
391279N1216989W001	15N02E24P001M	SEWD MW-2A	AZ-2	Sutter Extension WD GSA	Active	Monitoring	254	204 - 244	5/2/2023	250	-
391279N1216989W002	15N02E24P002M	SEWD MW-2B	AZ-2	Sutter Extension WD GSA	Active	Monitoring	379	354 - 374	5/2/2023	270	-
391012N1218222W001	-	BS1-McClatchy	AZ-2	Reclamation District No. 70 GSA	Active	Irrigation	370	-	8/30/2023	480	0.25
392970N1216907W002	17N02E25J002M	BWD MW-1B	AZ-2	Butte WD GSA	Active	Observation	370	320 - 360	8/8/2023	180	Not detected
-	-	Well-1A / 5110001-011	AZ-2	City of Live Oak GSA	Active	Public Supply	292	-	10/24/23	430	7.60
-	-	Well-2A / 5110001-013	AZ-2	City of Live Oak	Active	Public Supply	210	-	10/24/23	510	12.1
391613N1216236W001	-	WTP well	AZ-2 and AZ-3	City of Yuba City GSA	Active	Public Supply	-	370 - 390; 453 - 473	10/4/2023 (TDS) 1/31/23 (nitrate as N)	140	0.10
390682N1216901W003	14N02E13A005M	SEWD MW-3C	AZ-3	Sutter Extension WD GSA	Active	Observation	585	550 - 580	5/3/2023	1,200	-
391658N1217070W003	15N02E12E003M	SEWD MW-1C	AZ-3	Sutter Extension WD GSA	Active	Observation	559	524 - 554	5/2/2023	170	-
391279N1216989W003	15N02E24P003M	SEWD MW-2C	AZ-3	Sutter Extension WD GSA	Active	Monitoring	488	438 - 478	5/2/2023	160	-
392970N1216907W001	17N02E25J001M	BWD MW-1A	AZ-3	Butte WD GSA	Active	Observation	591	486 - 586	8/8/2023	220	0.5

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### 3.4 Land Subsidence

**Figure 3-18** shows the location of representative monitoring sites for the land subsidence sustainability indicator as identified in the Sutter Subbasin GSP. This monitoring network relies on the Sacramento Valley Subsidence Network and is supplemented annually by publicly available data. Developed in 2008 by DWR, the U.S. Bureau of Reclamation (USBR), and other State and local entities, the Sacramento Valley Subsidence Network consists of 339 monuments, 22 of which are located in the Sutter Subbasin and included in the Subbasin's land subsidence monitoring network. The Sacramento Valley Subsidence Network was monitored at 5-year intervals, with the last survey taking place in 2017.

Since development of the GSP, DWR has discontinued monitoring its Sacramento Valley Subsidence Network and no 2022 survey was performed. The GSAs will evaluate alternative methods for monitoring for subsidence and will re-establish a new representative monitoring network; however, in the interim, the Subbasin will use publicly accessible Interferometric Synthetic Aperture Imagery (InSAR), along with any other publicly available land surface measurements, to evaluate conditions relative to established numeric SMC.

Between October 2022 and October 2023, vertical displacement ranging from -0.1 to +0.1 feet was observed throughout the Sutter Subbasin, as shown in **Figure 3-19**. Sutter Subbasin GSAs will continue to monitor available land subsidence data and confirm no negative impacts of land subsidence are reported on critical infrastructure as a result of groundwater pumping.

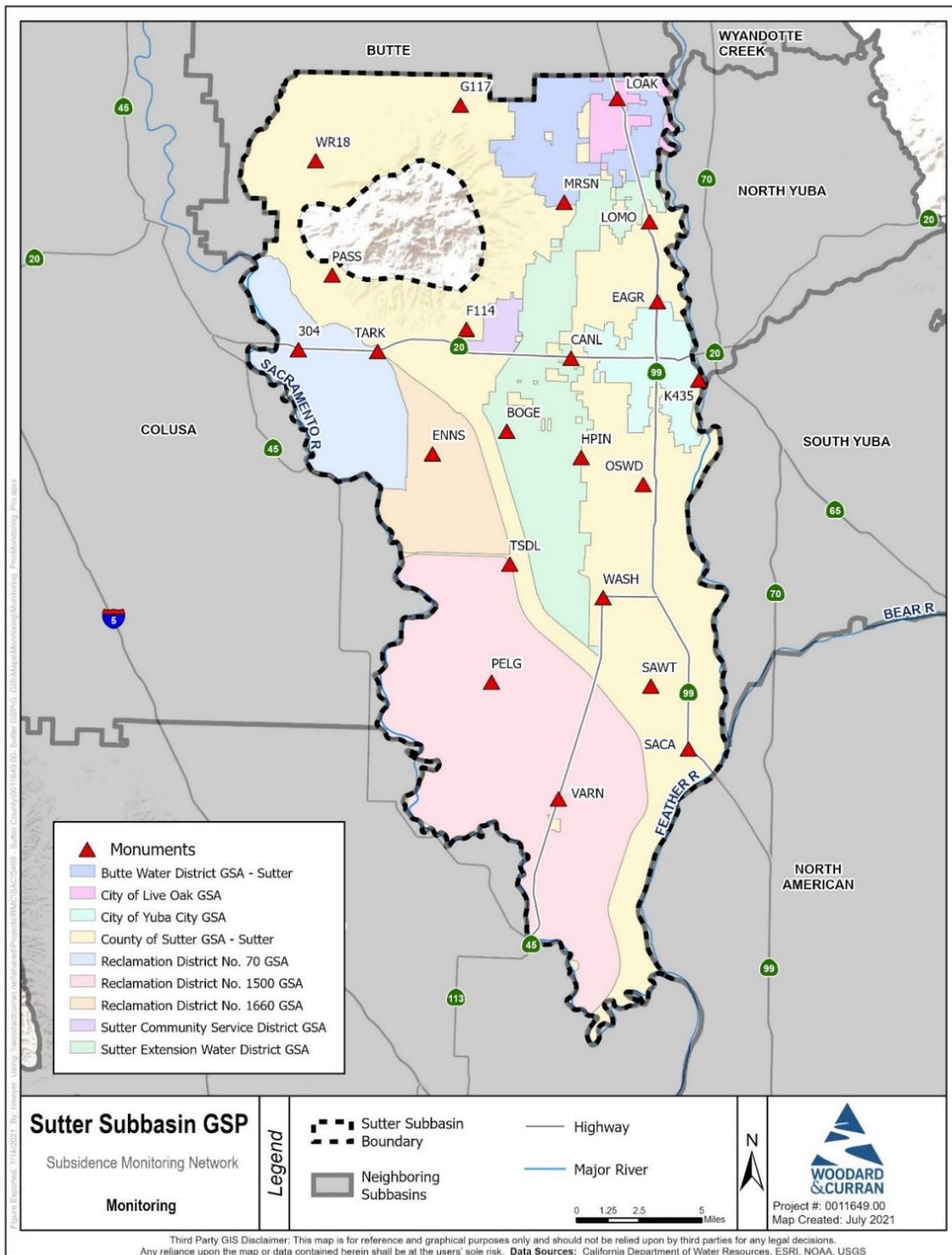
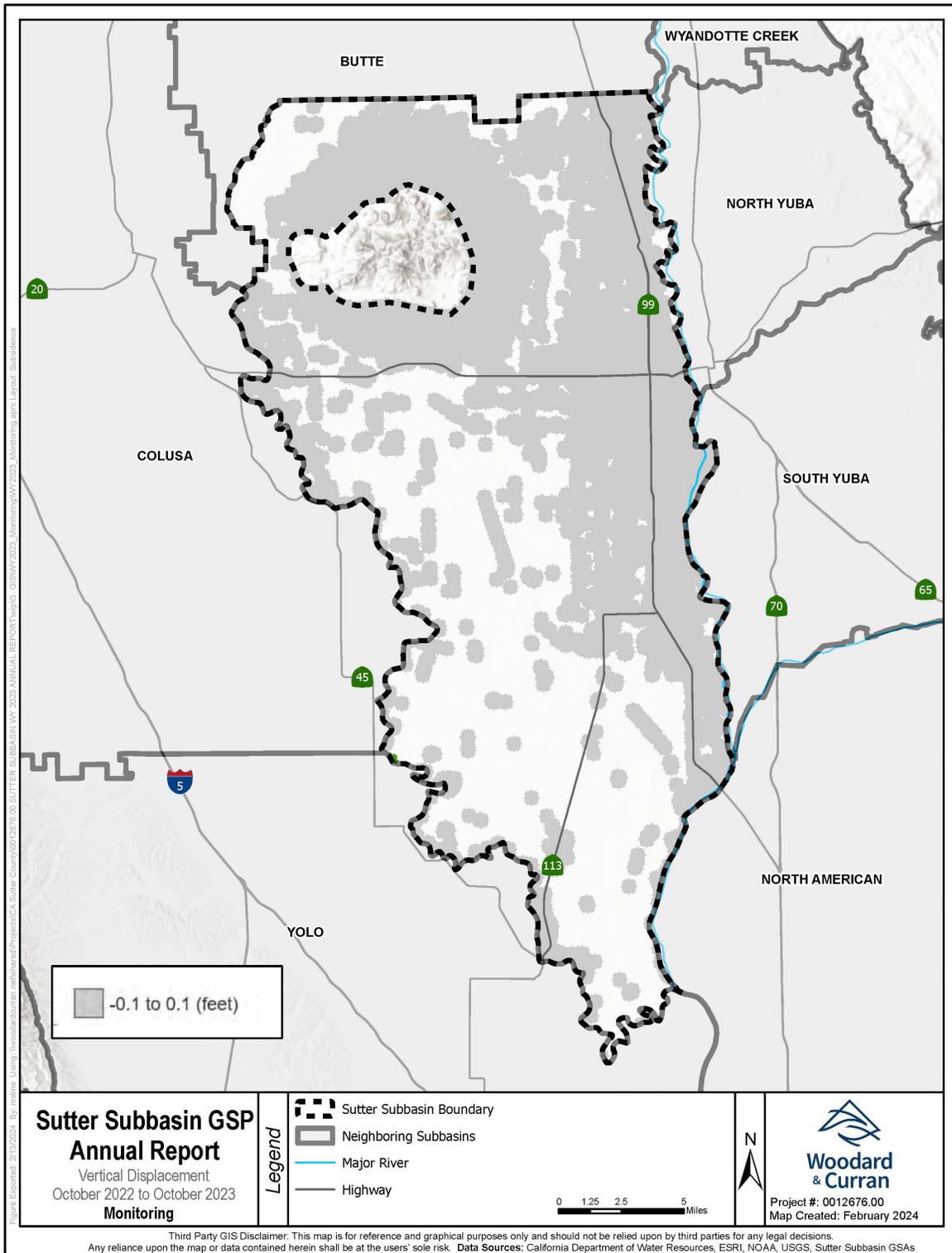


Figure 3-18: Subsidence Monitoring Network



**Figure 3-19: Vertical Displacement in the Sutter Subbasin, October 2022 to October 2023**

### 3.5 Groundwater-Surface Water Interaction

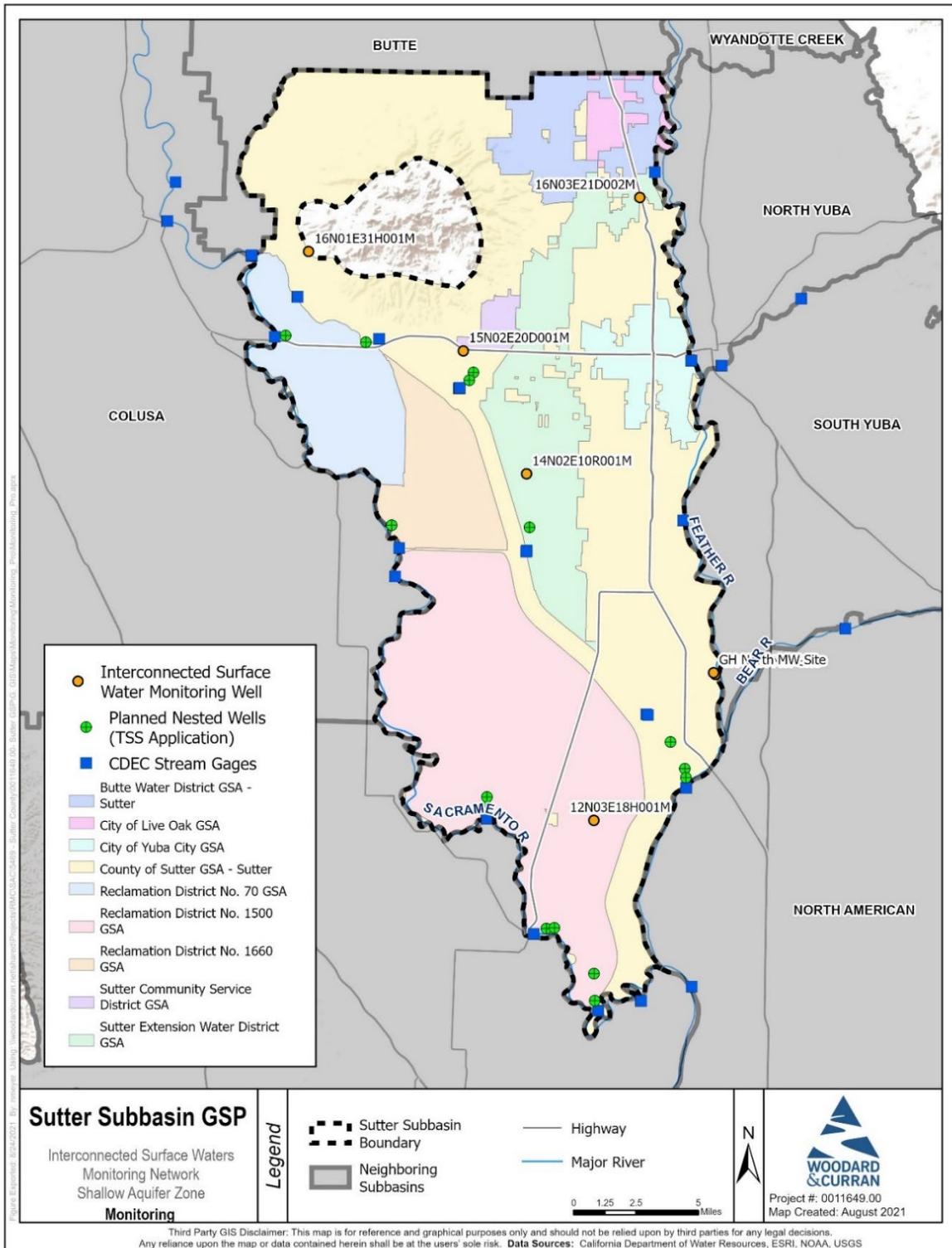
**Figure 3-20** through **Figure 3-23** show the location of representative monitoring wells identified in the Sutter Subbasin GSP for the depletions of interconnected surface water sustainability indicator by aquifer zone. Groundwater levels will be used as proxy and monitored at these wells during seasonal high (March through April) and seasonal low (September through October) conditions.

The minimum thresholds at representative monitoring locations were established to be protective of significant and unreasonable impacts to identified interconnected surface waters, which include the Sacramento and Feather Rivers and Sutter Bypass.

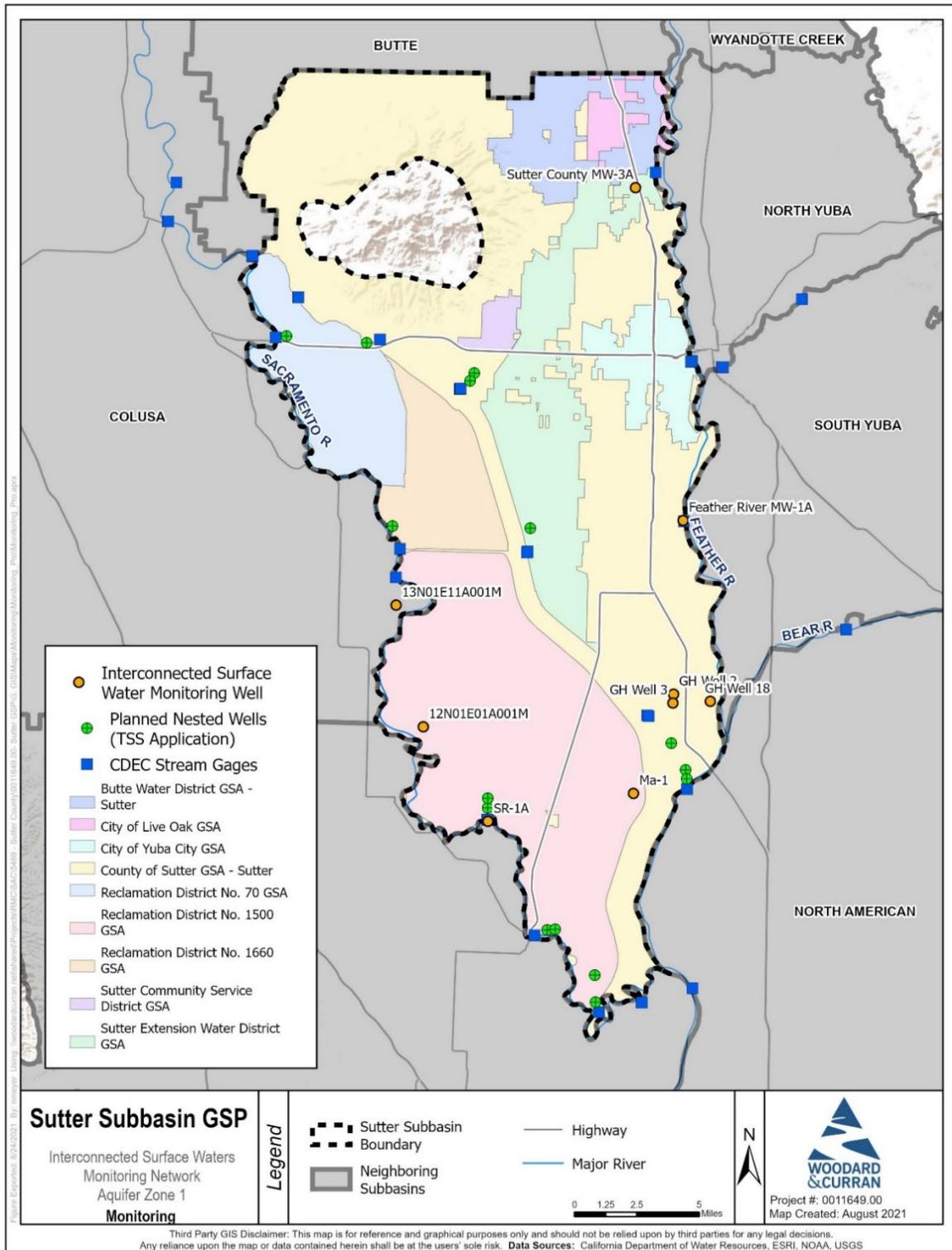
Hydrographs for the representative wells in the interconnected surface water monitoring network are included in **Appendix B**. During WY 2023, similar patterns are observed as in previous water years with many wells operating within their respective operating range or above the measurable objective, where interim milestones are set equal to the measurable objective as a means of maintaining currently sustainable conditions.

Minimum threshold exceedances were observed at two wells during WY 2023: Local IDs SR-1A and GH Well 18. Local ID SR-1A exceeded the minimum threshold during January 2023, where conditions throughout the remainder of WY 2023 were above the measurable objective or within the operating range. Local ID GH Well 18 exceeded the minimum threshold in October 2022, where conditions were above the measurable objective by early calendar year 2023. Recent downward trends are observed in the following wells and will be monitored to ensure minimum threshold exceedances are not observed: Local IDs (or State Well Numbers) Feather River MW-1A, Sutter County MW-3B, Feather River MW-1C, Feather River MW-1D, Sutter County MW-3C, Sutter County MW-3D, and Sutter County MW-3E.

Undesirable results for the depletions of interconnected surface water sustainability indicator occur when 25% of representative monitoring locations across all aquifer zones drop below the minimum threshold criteria concurrently over two consecutive seasonal high water level measurements. No minimum threshold exceedances were observed during the seasonal high monitoring period (March through April) in either WY 2022 or WY 2023. Therefore, an undesirable result for the depletions of interconnected surface water sustainability indicator was not observed in WY 2023.



**Figure 3-20: Interconnected Surface Water Monitoring Network Sites, Shallow AZ**



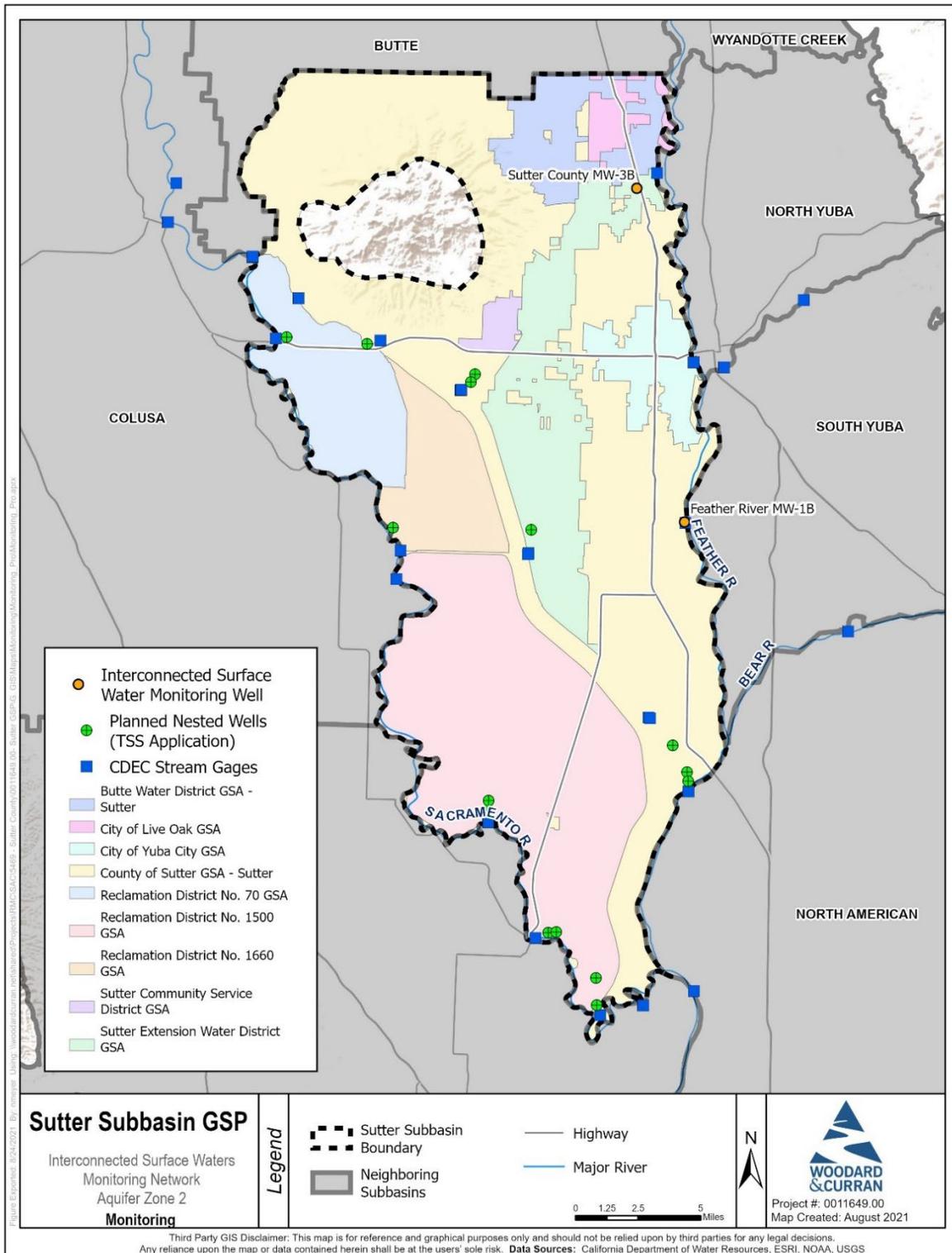
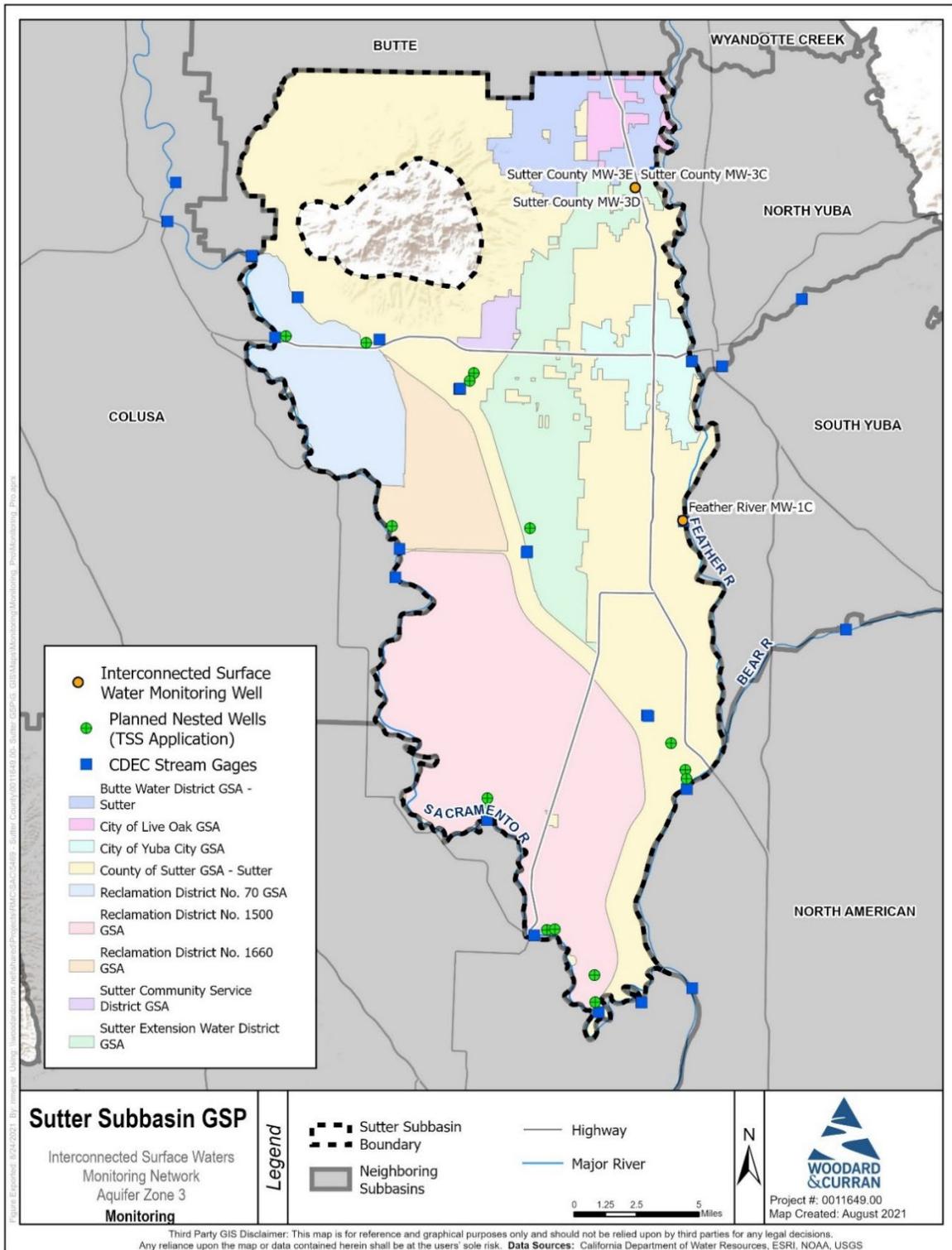


Figure 3-22: Interconnected Surface Water Monitoring Network Sites, AZ-2



**Figure 3-23: Interconnected Surface Water Monitoring Network Sites, AZ-3**

## 3.6 Total Water Use

### 3.6.1 Groundwater Use

Groundwater extraction data are available only for a limited number of metered wells in the Sutter Subbasin, with the remainder of extraction information estimated using C2VSimFG-Sutter. Metered data are available from City of Live Oak GSA and Sutter Community Services District GSA. Agricultural, private domestic, and other groundwater extractions in the Subbasin are largely unmetered and are estimated by the overlying GSA and using C2VSimFG-Sutter, which bases water use on crop type, hydrologic data (precipitation and evapotranspiration), irrigation efficiency, and population information.

**Figure 3-24** shows the general location and volume of groundwater pumping within the Subbasin by C2VSimFG-Sutter element for WY 2023. The majority of the Subbasin experienced very little groundwater pumping (less than 1 AF/acre or foot). Groundwater pumping greater than 1 foot (up to 4.1 AF/acre or feet) occurred along the eastern boundary of the Subbasin and generally around the Sutter Buttes. **Figure 3-13** shows groundwater pumping from WY 1996 through WY 2023 in the Sutter Subbasin as estimated by C2VSimFG-Sutter.

The following WY 2023 groundwater extraction data, shown in **Table 3-3**, are a combination of direct measurements and estimates from each of the nine GSAs within the Sutter Subbasin. Measurement accuracies and estimates vary by GSA and on a site-by-site basis. Measurement methods also vary across the nine GSAs and largely consists of self-reported groundwater extraction volumes and estimates from C2VSimFG-Sutter. **Table 3-4** shows the groundwater extraction measurement methods and accuracy by volume in the Sutter Subbasin during WY 2023.

In WY 2023, total groundwater use in the Sutter Subbasin was estimated at 124,800 AF across all water use sectors, as shown in **Table 3-3**. The sustainable yield estimate for the Sutter Subbasin is 182,000 AF. Groundwater pumping in WY 2023 was approximately 57,200 AF less than the sustainable yield. Sustainable yield is a long-term value due to conjunctive water management in the Sutter Subbasin, where years where the sustainable yield is exceeded are balanced by years with reduced pumping and increased recharge (during wetter periods) so the long-term average remains at or below the sustainable yield.

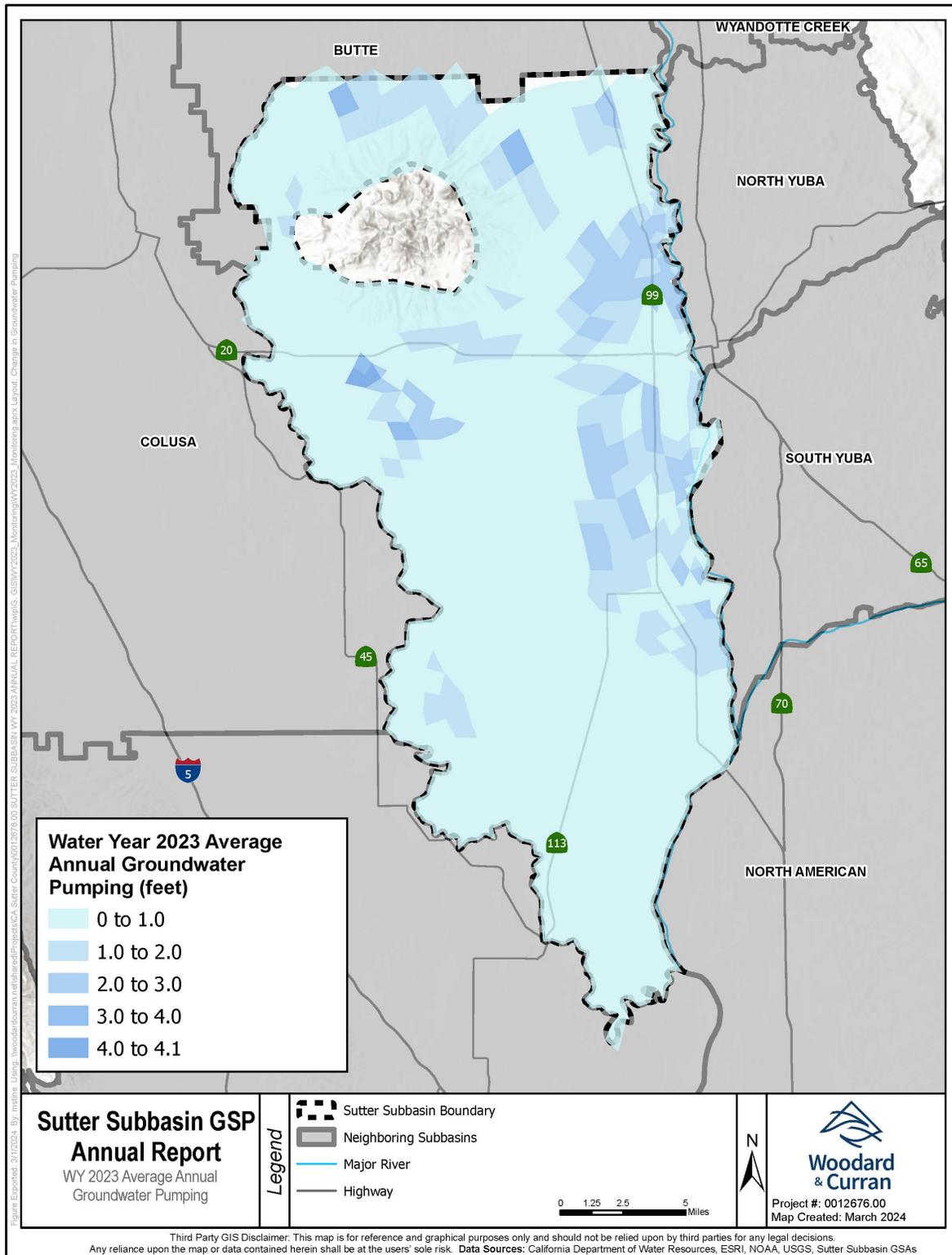


Figure 3-24: WY 2023 Groundwater Pumping

**Table 3-3: WY 2023 Groundwater Water Extraction**

<b>Groundwater Extraction (Acre-Feet)</b>			
<b>Water Use Sector</b>	<b>WY 2023 Total</b>	<b>Measurement Method (Direct or Estimate)</b>	<b>Measurement Accuracy (%)</b>
Urban/Domestic/Municipal	9,100	Estimate	N/A
Industrial	200	Direct	90-100%
Agricultural	113,900	Estimate	N/A
Managed Wetlands	1,600	Estimate	N/A
Managed Recharge	0	Estimate	N/A
Native Vegetation	0	Estimate	N/A
Other: Groundwater Substitution Transfers	0	Direct	N/A
<b>Total</b>	<b>124,800</b>	<b>Estimate</b>	<b>N/A</b>

**Table 3-4: WY 2023 Groundwater Extraction Volume Measurement Methods and Accuracy**

<b>Groundwater Extraction Volume (AF)</b>	<b>Measurement Type</b>	<b>Method</b>	<b>Accuracy</b>	<b>Accuracy Description</b>
2,100	Direct	Meters	90-100%	Meter accuracy is 90-100%
0	-	Electrical Records	-	-
7,000	Estimate	Land Use	Other	Accuracy is unknown
108,300	Estimate	Groundwater Model	Other	Accuracy is unknown
7,400	Estimate	Other: Weir stick calculations	10-20%	Accuracy ranges from 10 to 20%

### 3.6.2 Surface Water Use

Surface water supply data are available from purveyors in the Subbasin (Butte Water District GSA, City of Yuba City GSA, Reclamation District 70 GSA, Reclamation District 1500 GSA, Reclamation District 1660 GSA, and Sutter Extension Water District GSA) and include predominantly agricultural uses with surface water also supplied by the City of Yuba City for urban use and managed wetlands within Sutter Extension Water District. The remaining surface water supply is estimated by C2VSimFG-Sutter for Sutter County GSA. The City of Live Oak GSA and Sutter Community Services District did not receive surface water supplies in WY 2023.

The following WY 2023 surface water supply data, shown in **Table 3-5**, are a combination of direct measurements and estimates from each of the nine GSAs within the Sutter Subbasin. Total surface water use during WY 2023 is estimated as 547,500 AF. **Figure 3-25** shows surface water supply by source for WY 2023 in the Sutter Subbasin.

**Table 3-5: WY 2023 Surface Water Supply**

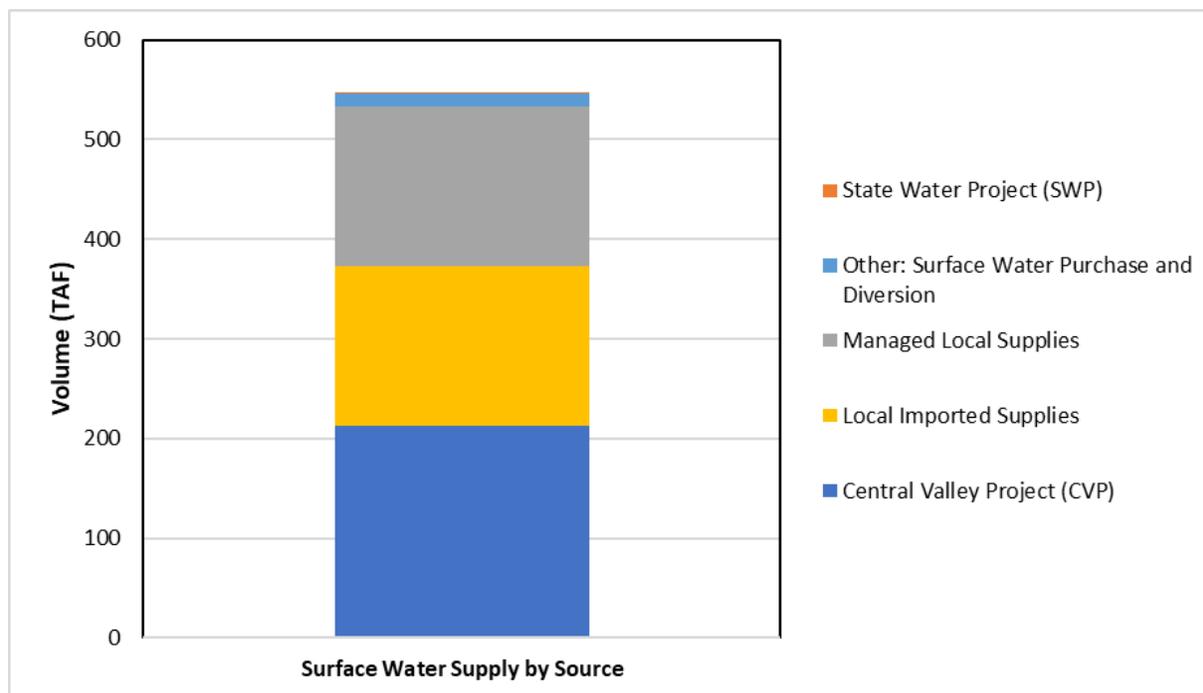
Surface Water Supply (Acre-Feet)		
Surface Water Source	WY 2023 Total	Methods Used to Determine
Central Valley Project (CVP)	212,300	Meters
State Water Project (SWP)	1,600	Meters
Colorado River Project	0	-
Managed Local Supplies <sup>1,2</sup>	160,400	Meters
Local Imported Supplies <sup>3</sup>	160,900	Meters, Groundwater Model
Recycled Water	0	-
Desalination	0	-
Other: Surface Water Purchase and Diversion <sup>4</sup>	12,300	Meters
<b>Total</b>	<b>547,500</b>	<b>-</b>

<sup>1</sup> 111,000 AF reported by Sutter Extension Water District (SEWD) and 38,353 AF reported by Butte Water District (BWD) is conveyed through SWP facilities but is not considered SWP water. SEWD and BWD hold diversion agreements with DWR to transport water from the Feather River using SWP facilities for both diversion and storage.

<sup>2</sup> Includes creeks and other surface water bodies, such as the Sacramento and Feather Rivers and Sutter Bypass.

<sup>3</sup> Waters imported from a nearby watershed outside of the Sutter Subbasin, not waters diverted originally from the CVP or SWP.

<sup>4</sup> Surface water purchased by City of Yuba City from North Yuba Water District and diverted by City of Yuba City under two appropriate water rights issued by State Water Resources Control Board (Licenses 13855 and 18558). Also includes 495 AF of SWP water sold by the City of Yuba City to San Geronio Pass Water Agency.



**Figure 3-25: WY 2023 Surface Water Supply by Source**

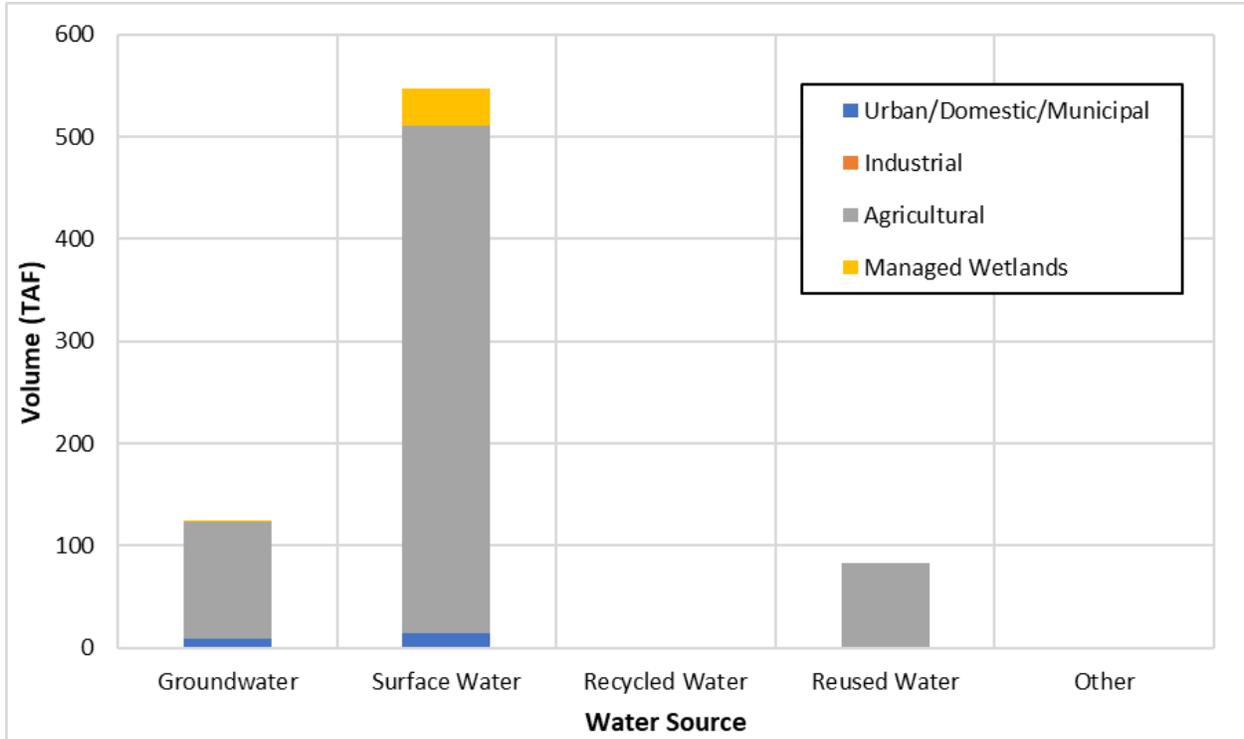
### 3.6.3 Total Water Use

Total water use is the sum of groundwater use and surface water use. Total water use during WY 2023 is estimated as 755,600 AF for the Sutter Subbasin (**Table 3-6**). Measurement methods vary across the nine GSAs and largely consists of self-reported volumes. **Table 3-6** is a summation of data from each GSA for the entire Sutter Subbasin and presents a variety of methods for data calculation and estimation. **Figure 3-26** shows total water use by sector and source in the Sutter Subbasin during WY 2023. These data are also a combination of direct measurements and estimates from each GSA. Groundwater pumping accounts for approximately 20% of total water use in the Subbasin, while surface water supplies account for approximately 80% during WY 2023.

**Table 3-6: WY 2023 Total Water Use**

<b>Summary of Total Water Use (Acre-Feet)</b>				
<b>Total Water Use</b>	<b>WY 2023 Total</b>	<b>Measurement Method (Direct or Estimate)</b>	<b>Methods Used to Determine</b>	<b>Measurement Accuracy (%)</b>
<b>Urban/Domestic/Municipal</b>				
Groundwater	9,100	Direct and Estimate	Meters, Groundwater Model	N/A
Surface Water	14,100	Direct and Estimate	Meters, Groundwater Model	N/A
Recycled Water	0	N/A	N/A	N/A
Reused Water	0	N/A	N/A	N/A
Other	0	N/A	N/A	N/A
<i>Total</i>	<i>23,200</i>	<i>Estimate</i>	<i>N/A</i>	<i>N/A</i>
<b>Industrial</b>				
Groundwater	200	Direct	Meters	90-100%
Surface Water	500	Direct	Meters	90-100%
Recycled Water	0	N/A	N/A	N/A
Reused Water	0	N/A	N/A	N/A
Other	0	N/A	N/A	N/A
<i>Total</i>	<i>700</i>	<i>Direct</i>	<i>Meters</i>	<i>90-100%</i>
<b>Agricultural</b>				
Groundwater	113,900	Estimate	Land Use, Groundwater Model, Weir stick calculations	N/A
Surface Water	496,400	Direct and Estimate	Meters, Groundwater Model	N/A
Recycled Water	0	N/A	N/A	N/A
Reused Water	83,300	Direct	Other	Varies from 0 to 20%
Other	0	N/A	N/A	N/A
<i>Total</i>	<i>693,600</i>	<i>Estimate</i>	<i>N/A</i>	<i>N/A</i>

<b>Summary of Total Water Use (Acre-Feet)</b>				
<b>Total Water Use</b>	<b>WY 2023 Total</b>	<b>Measurement Method (Direct or Estimate)</b>	<b>Methods Used to Determine</b>	<b>Measurement Accuracy (%)</b>
<b>Managed Wetlands</b>				
Groundwater	1,600	Estimate	Land Use, Groundwater Model	N/A
Surface Water	36,500	Direct and Estimate	Meters, Groundwater Model	N/A
Recycled Water	0	N/A	N/A	N/A
Reused Water	0	N/A	N/A	N/A
Other	0	N/A	N/A	N/A
<i>Total</i>	<i>38,100</i>	<i>Estimate</i>	<i>N/A</i>	<i>N/A</i>
<b>Managed Recharge</b>				
Groundwater	0	N/A	N/A	N/A
Surface Water	0	N/A	N/A	N/A
Recycled Water	0	N/A	N/A	N/A
Reused Water	0	N/A	N/A	N/A
Other	0	N/A	N/A	N/A
<i>Total</i>	<i>0</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
<b>Native Vegetation</b>				
Groundwater	0	N/A	N/A	N/A
Surface Water	0	N/A	N/A	N/A
Recycled Water	0	N/A	N/A	N/A
Reused Water	0	N/A	N/A	N/A
Other	0	N/A	N/A	N/A
<i>Total</i>	<i>0</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
<b>Other</b>				
Groundwater	0	N/A	N/A	N/A
Surface Water	0	N/A	N/A	N/A
Recycled Water	0	N/A	N/A	N/A
Reused Water	0	N/A	N/A	N/A
Other	0	N/A	N/A	N/A
<i>Total</i>	<i>0</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
<b>Total</b>	<b>755,600</b>	<b>Estimate</b>	<b>N/A</b>	<b>N/A</b>



**Figure 3-26: WY 2023 Total Water Use by Sector and Source**

### 3.6.4 C2VSim-Sutter Model Update

C2VSimFG-Sutter integrated flow model was originally developed and calibrated to simulate historical groundwater conditions from WYs 1996 to 2015. The model was updated with publicly available data for this annual report to reflect more recent data and hydrologic conditions. The update for WY 2016-2022 was covered in the previous annual report; the following only discusses the update of data for WY 2023.

#### Data Sources

Data retrieved from the following publicly available sources:

- Precipitation-Elevation Regressions on Independent Slopes Model (PRISM) Climate Group, Oregon State University
- United States Geological Survey stream flows
- California Irrigation Management Information System (CIMIS) evapotranspiration, DWR

#### Updated Components

The above data sources provided the necessary data to allow the historical model to be updated to reflect recent conditions. The following components of the model were updated within the Sutter Subbasin based on recent data:

**Evapotranspiration:** Evapotranspiration was updated within Sutter Subbasin for WY 2023 based on potential evapotranspiration (ET<sub>p</sub>) data collected at the three (3) CIMIS stations closest to the Subbasin. Actual evapotranspiration estimates during the extended period were projected in proportion to observed changes in potential evapotranspiration.

**Population:** Population in Sutter Subbasin is assumed to grow at the same rate as it did during the last 12 years of the historical simulation for WY 2023.

**Per Capita Water Use:** Per capita water use is assumed to remain constant at 2015 estimations for WY 2023.

**Precipitation:** Rainfall data for the model area are derived from the PRISM (Precipitation-Elevation Regressions on Independent Slopes Model) database used in the DWR's CALSIMETAW (California Simulation of Evapotranspiration of Applied Water) model. The database contains daily precipitation data from October 1, 1921 on a four-kilometer grid throughout the model area. C2VSimFG-Sutter has monthly rainfall data defined for every model element in order to preserve the spatial distribution of the monthly rainfall. Each of the model elements was mapped to the nearest available PRISM reference nodes, uniformly distributed across the model domain. The PRISM dataset is available online from Oregon State University through a partnership with the NRCS National Water and Climate Center (Oregon State University, 2024).

**Streamflow:** Monthly inflow to the Sutter Subbasin were updated for Sacramento River, Feather River, Honcut Creek, Yuba River, and Bear River. Sources of data included USGS (USGS, 2024) and CDEC (CDEC, 2024).

## **Results**

Evaluation of WY 2023 shows that the Sutter Subbasin experienced, on an average and net basis, 301,000 AF of inflows and 207,000 AF of outflows, leading to an annual increase of groundwater in storage of 94,000 AF. This change in storage represents approximately 0.2% of the total 49 MAF of groundwater estimated to be in storage in the Sutter Subbasin. Deep percolation from the root zone, primarily from surface water provided by the agricultural water agencies, is the largest contributor of groundwater inflow (189,000 AFY), followed by recharge from unlined canals or reservoirs and ungauged watersheds (37,000 AFY), boundary flows from surrounding groundwater subbasins and the Sutter Buttes (75,000 AFY), and subsidence (less than 400 AFY)<sup>1</sup>.

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<sup>1</sup> Subsidence is considered an inflow to the groundwater system as a result of land compaction freeing up previously inaccessible water held by clays and releasing this water for beneficial use. Less than 400 AFY in subsidence inflow to the groundwater system is equal to approximately 0.01 inches (or 0.001 feet) of subsidence on average across the Sutter Subbasin in WY 2023, which is consistent with InSAR data presented in **Figure 3-19** showing subsidence between -0.1 and 0.1 feet across the Subbasin.

Groundwater production (140,000 AFY)<sup>1</sup> and loss to streams (67,000 AFY) account for the outflows from the Sutter Subbasin.

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<sup>1</sup> Note: Groundwater production estimated from C2VSimFG-Sutter for WY 2023 differs from **Table 3-3**, as C2VSimFG-Sutter calculates groundwater demand using land use methods and **Table 3-3** includes both direct and estimated groundwater pumped as reported by the Sutter Subbasin GSAs.

## 4. GROUNDWATER SUBSTITUTION TRANSFERS

**Table 4-1** includes updates to Table 2-4 in the Sutter Subbasin GSP (January 2022) to include final groundwater substitution transfer volumes for WYs 2021 and 2022 as well as revised groundwater substitution transfer volumes back to WY 2009 for Sutter Extension Water District, Butte Water District, and Garden Highway Mutual Water Company. Additionally, WY 2009 through 2022 groundwater substitution transfer volumes are reported in **Table 4-1** for the following entities that were not reported in the Sutter Subbasin GSP (January 2022): Tule Basin Farms; Tudor Mutual Water Company; Sutter Mutual Water Company; Pelger Mutual Water Company; Pelger Road 1700; Henle Family, LP; and Windswept Land & Livestock. During WY 2024, the Sutter Subbasin GSAs will work on developing a Subbasin-wide methodology for evaluating and approving groundwater substitution transfers and updates will be provided in subsequent annual reports. No GWS transfers occurred in the Sutter Subbasin in WY 2023.

The Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report (EIS/EIR) prepared by USBR and San Luis & Delta-Mendota Water Authority (September 2019) evaluates water transfers conducted by Central Valley Project (CVP) contractors located south of the Sacramento-San Joaquin Delta (Delta) or in the San Francisco Bay Area that would be conveyed through the Delta using CVP or State Water Project (SWP) pumps or facilities owned by other agencies in the San Francisco Bay Area. USBR facilitates transfers proposed by buyers and sellers. San Luis & Delta-Mendota Water Authority, consisting of federal and exchange water service contractors in western San Joaquin Valley, San Benito, and Santa Clara Counties, helps to negotiate transfers in years when its member agencies could experience shortages. The EIS/EIR addresses the transfer of water to CVP contractors from CVP and non-CVP sources of supply that must be conveyed through the Delta using CVP, SWP, and local facilities, and identifies the following entities within the Sutter Subbasin as potential groundwater substitution transfer participants:

- Burrough Farms (Windswept Land & Livestock)
- Cranmore Farms (Pelger Road 1700)
- Giusti Farms
- Henle Family Ltd. Partnership
- Pelger Mutual Water Company
- Sutter Mutual Water Company
- Butte Water District
- Garden Highway Mutual Water Company

- Gilsizer Slough Ranch
- Goose Club Farms and Teichert Aggregates
- Tule Basin Farms

The EIS/EIR (September 2019) also analyzes the total upper limit of groundwater substitution transfers (in AF) proposed by the entities listed above at 74,170 AF between April and September each year, far exceeding the total historical transfers in any given year reported in **Table 4-1** (maximum of 33,447 in calendar year 2021).

Groundwater substitution transfer participants within the Sutter Subbasin must receive written concurrence from the overlying GSA identifying that the proposed transfer is consistent with the Subbasin's GSP. The GSA will make this determination based on items relevant to a proposed groundwater substitution transfer such as the available details for the proposed transfer, current groundwater conditions, quantities contained in **Table 4-1**, analyses and requirements identified in the Long-term Water Transfers EIS/EIR (September 2019), and any other relevant information, as applicable.

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**Table 4-1: Groundwater Substitution Transfers in Sutter Subbasin in Acre-Feet per Year, 2009 through 2022  
(Revised Table 2-4 from GSP)**

Water Year	Sutter Extension Water District	Butte Water District	Garden Highway Mutual Water Company	Tule Basin Farms	Tudor Mutual Water Company	Sutter Mutual Water Company	Pelger Mutual Water Company	Pelger Road 1700	Henle Family, LP	Windswept Land and Livestock	Total Water Transfers
2009	3,103	4,102	2,730	3,417	-	-	1,640	-	-	-	<b>14,992</b>
2010	2,870	3,847	4,082	3,520	-	-	-	-	-	-	<b>14,319</b>
2011	-	-	-	-	-	-	-	-	-	-	-
2012	-	-	-	-	-	-	-	-	-	-	-
2013	2,863	3,839	3,855	2,802	-	-	1,730	-	-	-	<b>15,089</b>
2014	4,106	5,350	3,791	-	-	-	3,975	-	-	-	<b>17,222</b>
2015	1,738	-	-	-	-	-	3,992	1,803	-	-	<b>7,533</b>
2016	-	-	-	-	-	-	-	-	-	-	-
2017	-	-	-	-	-	-	-	-	-	-	-
2018	3,611	4,324	4,807	3,050	-	-	-	-	-	-	<b>15,792</b>
2019	-	-	-	-	-	-	-	-	-	-	-
2020	2,653	2,655	5,546	2,830	-	5,322	1,599	1,977	220	655	<b>23,457</b>
2021	3,491	3,825	1,817	-	-	16,239	3,750	2,391	501	1,433	<b>33,447</b>
2022	3,279	4,113	2,756	-	250	-	-	-	-	-	<b>10,398</b>
2023	-	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>27,714</b>	<b>32,055</b>	<b>29,384</b>	<b>15,619</b>	<b>250</b>	<b>21,561</b>	<b>16,686</b>	<b>6,171</b>	<b>721</b>	<b>2,088</b>	<b>152,249</b>

Note: Values based on final transfer quantities (post-baseline and pre-depletions).

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## 5. REFERENCES

- California Department of Water Resources (DWR). 2024. *California Data Exchange Center*. Available at: <https://cdec.water.ca.gov/>.
- Oregon State University. 2024. *PRISM Climate Group*. Available at: <http://prism.oregonstate.edu>.
- Sutter Subbasin Groundwater Sustainability Agencies. January 2022. *Sutter Subbasin Groundwater Sustainability Plan*. Available at: <https://sgma.water.ca.gov/portal/gsp/preview/112>. Accessed: March 3, 2022.
- United States Bureau of Reclamation and San Luis & Delta-Mendota Water Authority. September 2019. Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report, Final. Available at: [https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc\\_ID=40932](https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=40932). Accessed: March 6, 2023.
- United States Geological Survey (USGS). 2024. *National Water Information System*. Available at: <https://waterdata.usgs.gov/nwis>.
- Wood Rodgers. 2012. *Sutter County Groundwater Management Plan*. Available at: <https://www.suttercounty.org/home/showpublisheddocument/824/637474371331570000>. Accessed: March 3, 2022.

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# A P P E N D I X A

## GSP Implementation Progress



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Project/Management Action Name	Project/Management Action Type	Proponent	Brief Description	Project Status
<p><b>Ongoing and Planned Projects and Management Actions:</b> Projects and Management Actions in this category are planned to be completed prior to 2042. The expected yield of these projects and management actions are expected to support GSAs in achieving the GSP sustainability goal and responding to changing conditions in the Subbasin.</p>				
System Modernization	Improved Water Management	Butte Water District	<p>Upgrade and modernize system infrastructure to improve system operability and efficiency, reduce operational spillage, and enhancing the timing of farm deliveries. Modernization improvements to District infrastructure will include:</p> <ol style="list-style-type: none"> <li>1. Improvements at canal headings to improve water level control, flow control, flow measurement, Supervisory Control and Data Acquisition (SCADA), and automation/measurement</li> <li>2. Improvements at customer delivery turnouts to improve delivery flexibility and steadiness</li> </ol>	Project awarded SGM Grant Program SGMA Implementation – Round 2 grant funding in September 2023; Awaiting grant agreement finalization between Sutter County and DWR
System Modernization	Improved Water Management	Sutter Extension Water District	<p>Upgrade and modernize system infrastructure to improve system operability and efficiency, reduce operational spillage, and enhance the timing of farm deliveries. Modernization improvements to District infrastructure will include:</p>	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports

Project/Management Action Name	Project/Management Action Type	Proponent	Brief Description	Project Status
			<ol style="list-style-type: none"> <li>1. Improvements at canal headings</li> <li>2. Improvements to upstream water level control</li> <li>3. Improvements to spill structures</li> <li>4. Real-time monitoring through the establishment of a SCADA system.</li> </ol>	
Boundary Flow and Primary Spill Measurement and Drainage Recovery Projects	Improved Water Management	Butte Water District	Install measurement and monitoring equipment at boundary outflow and spillage sites to allow real-time monitoring and adjustment to upstream operations. Real-time monitoring will be implemented through the establishment of a District SCADA system.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Boundary Flow and Primary Spill Measurement and Drainage Recovery Projects	Improved Water Management	Sutter Extension Water District	Install measurement and monitoring equipment at boundary outflow and spillage sites to allow real-time monitoring and adjustment to upstream operations. Real-time monitoring will be implemented through the establishment of a District SCADA system.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Dual Source Irrigation Systems	In-Lieu Recharge	Butte Water District	Incentivize the use of irrigation systems capable of using both	Project awarded SGM Grant Program SGMA Implementation –

Project/Management Action Name	Project/Management Action Type	Proponent	Brief Description	Project Status
			<p>surface water and groundwater. These systems will increase use of surface water and on-farm recharge of surface water, and offset groundwater pumping.</p>	<p>Round 2 grant funding in September 2023; Awaiting grant agreement finalization between Sutter County and DWR</p>
<p>Multi-Benefit Recharge</p>	<p>Direct Recharge</p>	<p>Multi-Agency/GSA</p>	<p>A multi-benefit recharge program will provide groundwater recharge through normal farming operations while also providing critical wetland habitat for waterbirds migrating along the Pacific Flyway. Fields with soil and cropping conditions conducive to groundwater recharge will be flooded and maintained with shallow depths. Water will be sourced from existing water rights contracts, depending on availability. GSAs may also consider financial compensation for participation to offset field preparation, irrigation, and water costs.</p>	<p>Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports</p>
<p>Grower Education</p>	<p>Improved Water Management</p>	<p>Multi-Agency/GSA</p>	<p>A grower education and outreach program is proposed as a management action for the Sutter Subbasin. The program will provide growers with educational</p>	<p>Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports</p>

Project/Management Action Name	Project/Management Action Type	Proponent	Brief Description	Project Status
			resources that help them to plan and implement on-farm practices that simultaneously support groundwater sustainability and maintain or improve agricultural productivity.	
Installation of Additional Shallow Groundwater Monitoring Wells	Additional Data Monitoring	Multi-Agency/GSA	Install 15 shallow monitoring wells in key areas of the Subbasin to support monitoring of interconnected surface water, particularly near the Sutter Bypass.	A Technical Support Services (TSS) application has been submitted and approved by DWR. Sutter County will be working with DWR on the identification of well locations and will begin outreach to landowners for permission to install wells.
Sutter Subbasin Well Permit Application Approval Process	Improved Water Management	Subbasin GSAs	A Subbasin-wide process is being developed for reviewing and verifying permit applications for new wells and modifications to existing wells to ensure their use does not impact the Subbasin’s ability to reach its sustainability goal.	A Subbasin-wide approach approved by GSAs in WY 2023
Sutter Subbasin Groundwater Transfer Approval Process	Improved Water Management	Subbasin GSAs	A Subbasin-wide process is being developed for reviewing and approving proposed groundwater substitution transfers to ensure that it does not impact the	Process development is currently under way.

Project/Management Action Name	Project/Management Action Type	Proponent	Brief Description	Project Status
			Subbasin’s ability to reach its sustainability goal.	
<p><b>Projects and Management Actions to be Implemented As Needed:</b> Projects and Management Actions in this category are proposed as potential projects that GSAs may wish to implement, as needed, to support ongoing sustainability, to adapt to changing conditions in the Subbasin, and to achieve other water management objectives.</p>				
Removal of Bottlenecks on the Sutter-Butte Main Canal	In-Lieu Recharge	Butte Water District	Increased ability to meet irrigation and environmental water needs using available surface water.	Initial in-house planning and study started in WY 2022; Planning and studying still on-going in WY 2023
Improved Delivery Service to Pressurized Irrigation Systems	In-Lieu Recharge	Butte Water District	Increased ability to meet irrigation water needs using available surface water.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Wetlands Water Management	Wildlife Habitat Improvement	Central Valley Joint Venture	Securing firm water supplies to wetlands refuges within the Subbasin.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Advanced Treatment and Water Recycling	Direct and In-Lieu Recharge	City of Yuba City	Conduct a feasibility study for constructing a Recycled Water Facility and analyze the possibility of implementing advanced treatment and water recycling at the City’s Wastewater Treatment Facility (WWTF) for direct and in-lieu recharge.	Awarded \$250,000 2023 United States Bureau of Reclamation Water SMART: Water Recycling and Desalination Planning grant. The grant will help fund development of a feasibility study for upgrading wastewater treatment facility processes to meet tertiary effluent standards

Project/Management Action Name	Project/Management Action Type	Proponent	Brief Description	Project Status
				and for installing conveyance system for recycled water
Aquifer Storage & Recovery and Second Well	Direct Recharge	City of Yuba City	This project involves investigating the feasibility of and implementing an aquifer storage recovery (ASR) well to store water during wet periods and provide additional groundwater in dry periods.	In March 2022, DWR authorized \$6.3 million in grant funding toward the development of an aquifer storage and recovery (ASR) system for the City of Yuba City; Project design is underway, a draft Basis of Design Report was finalized in early 2024; Drilling tentatively scheduled for 2024 and well equipping planned for 2025.
Backwash Recovery	Surface Water Supply Augmentation	City of Yuba City	Reduce the amount of water being diverted from the Feather River for supply by 0.42 million gallons per day (MGD) (or 475 acre-feet per year) through treatment and distribution of backwash.	Project still in planning phase
Electrical SCADA and Telemetry	Additional Data Monitoring	City of Yuba City	Update the existing 20-year-old SCADA and telemetry for water treatment plant and distribution system to help the City monitor, manage data and control processes more effectively, and improve management of local water supplies.	RFP for consultant to identify electrical instrumentation needs to be posted in 2024

Project/Management Action Name	Project/Management Action Type	Proponent	Brief Description	Project Status
Groundwater Well Rehabilitation	Water Quality Enhancement	City of Yuba City	Rehabilitate three Hillcrest Water Company groundwater wells and install treatment facilities to provide emergency groundwater sources to supplement surface water supplies in low-water years.	The three groundwater wells have been videoed and staff are awaiting final determination about the potential rehabilitation of these wells
New Outfall Diffuser Installation	Water Quality Enhancement	City of Yuba City	Construct a new outfall diffuser from the treatment plant into the Feather River to be able to discharge to the river under all river flows, resulting in 6,600 acre-feet (AF) of treated effluent being placed back into the Feather River for beneficial uses.	An application for Clean Water State Revolving Fund financing was submitted to the State on December 30, 2022; City has completed design for pipeline and diffuser project construction project; SWRCB Division of Financial Assistance staff is reviewing SRF application and project planning documents
Replacement of Sewer Mains	Water Quality Enhancement	City of Yuba City	Replace old and deteriorated sewer lines throughout the City and reduce groundwater quality impacts resulting from leaking sewer lines.	City conducted several small sewer main replacements in 2023; Total main lines replaced add up to less than one mile; City anticipates additional main replacements in 2024
Replacement of Water Distribution Mains	Reduce Groundwater Demand	City of Yuba City	Replace portions of the water distribution close to reaching their end of service life, enabling the City to more effectively control water supply losses due to system	City conducted several small water main replacements in 2023; Total water lines replaced add up to less than one mile; City anticipates an

Project/Management Action Name	Project/Management Action Type	Proponent	Brief Description	Project Status
			leakage and reduce groundwater pumping due to system losses.	increase in water line replacement projects in 2024
Feather River Pump Station Fish Screen Feasibility Study	Wildlife Habitat Improvement	Garden Highway Mutual Water Company	Contribute to wildlife habitat improvement by perform a Feasibility Study which analyzes three fish screen and two non-screen alternatives for Feather River surface water diversion pump station.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Installation of Fish Screens at Sutter Bypass Pumping Plants	Wildlife Habitat Improvement	Multi-Agency/GSA	Install fish screens to prevent entrainment of endangered juvenile salmonids and other fish species.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Rice Field Infiltration Study to Promote FloodMAR Projects	Direct Recharge	Multi-Agency/GSA	Conduct an infiltration study to promote Flood Managed Aquifer Recharge (FloodMAR) projects and determine the feasibility and amount of infiltration a FloodMAR project in rice could provide.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Improved Service to Pressurized Irrigation Systems	In-Lieu Recharge	Sutter Extension Water District	Increased ability to meet irrigation water needs using available surface water.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Removal of Main Canal Bottlenecks	In-Lieu Recharge	Sutter Extension Water District	Increased ability to meet irrigation and environmental water needs using available surface water.	Project status presented in the GSP is up to date; Updates

Project/Management Action Name	Project/Management Action Type	Proponent	Brief Description	Project Status
				regarding activity progress will be included in future Annual Reports
Sunset Project for Integrated Restoration and Efficiency (SPIRE)	Surface Water Supply Augmentation	Sutter Extension Water District	Provide up to 200 cubic feet per second (cfs) increased conveyance capacity from the Thermalito Afterbay to the District, eliminating the need for the Sunset Pumps Dam as well as the Sunset Pumps to augment surface water supply and improve wildlife habitat.	Project no longer moving forward; To be removed as part of the first Periodic Evaluation and Plan Amendment in 2027
<p><b>Projects and Management Actions to be Implemented As Needed to Address Data Gaps:</b> Projects and Management Actions in this category are proposed as potential projects that GSAs may wish to implement, as needed, to support ongoing sustainability, to adapt to changing conditions in the Subbasin, and to achieve other water management objectives that will specifically address data gaps identified in this GSP.</p>				
Investigation of Interactions Between Rivers and Changes in Groundwater Levels	Addressing Additional Data Gaps	Multi-Agency/GSA	Collect additional data to assist in developing appropriate sustainable management criteria for interconnected surface waters and analyzing changes in stream-aquifer interactions.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Investigation of Source of Elevated Salinity within Shallow Aquifer Zone	Addressing Additional Data Gaps	Multi-Agency/GSA	Collect additional data needed to evaluate the source of elevated salinity levels within the shallow aquifer zone.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports

Project/Management Action Name	Project/Management Action Type	Proponent	Brief Description	Project Status
Study of Aquifer Properties	Addressing Additional Data Gaps	Multi-Agency/GSA	Conduct additional aquifer pumping tests to assess aquifer properties in the Sutter Subbasin.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Additional Assessments of Groundwater Recharge Dynamics and Effects	Addressing Additional Data Gaps	Multi-Agency/GSA	Conduct additional aquifer studies to assess the dynamics and effects of groundwater recharge in the Subbasin, particularly those effects of GSP projects.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Analysis of Recharge Rates	Addressing Additional Data Gaps	Multi-Agency/GSA	Conduct additional analyses of recharge rates to assess historical groundwater recharge rates and assess hydraulic connection between different zones in the aquifer system.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Data Collection to Improve the Hydrogeologic Conceptual Model	Addressing Additional Data Gaps	Multi-Agency/GSA	Collect additional data to understand the hydrogeology of the Sutter Subbasin and bolster the hydrogeologic conceptual model.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
AEM Survey of Sutter Buttes	Addressing Additional Data Gaps	Multi-Agency/GSA	Conduct airborne electromagnetic (AEM) survey to improve understanding of the unique geology and hydrogeology of the Sutter Buttes.	Project awarded SGM Grant Program SGMA Implementation – Round 2 grant funding in September 2023; Awaiting grant agreement finalization between Sutter County and DWR

Project/Management Action Name	Project/Management Action Type	Proponent	Brief Description	Project Status
Development of Uniform Criteria for Defining Stratigraphic Zones	Addressing Additional Data Gaps	Multi-Agency/GSA	Develop and recommended a uniform set of criteria for defining stratigraphic zones and for logging cuttings from soil boring drilled in the Subbasin.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Comprehensive Sutter Subbasin Groundwater Quality Evaluation	Addressing Additional Data Gaps	Multi-Agency/GSA	Conduct a comprehensive groundwater quality evaluation for the Sutter Subbasin.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Video Survey RMS Wells with Unknown Construction	Addressing Additional Data Gaps	Multi-Agency/GSA	Conduct video surveys of representative monitoring site (RMS) wells with unknown construction information in order to collect missing information.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Monitoring Well Refinements	Addressing Additional Data Gaps	Multi-Agency/GSA	Refine and improve the Subbasin monitoring network by identifying and adding additional, dedicated monitoring wells of known construction, and by collecting and confirming well construction information.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Sutter Buttes Salinity Monitoring	Addressing Additional Data Gaps	Multi-Agency/GSA	Monitor groundwater salinity (based on electrical conductivity [EC] measurements) at selected locations near the Sutter Buttes on a temporary or permanent basis.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports

Project/Management Action Name	Project/Management Action Type	Proponent	Brief Description	Project Status
Sutter Buttes Water Quality Inter-Basin Working Group	Addressing Additional Data Gaps	Multi-Agency/GSA	Participate in an inter-basin working group focused on collaborative discussions, consensus-building and planning to address groundwater quality matters associated with the unique geology of the Sutter Buttes area.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Groundwater Dependent Ecosystem Mapping Confirmation	Addressing Additional Data Gaps	Multi-Agency/GSA	Conduct an on-ground survey to confirm mapping of groundwater dependent ecosystems (GDEs) to support ongoing investigation and monitoring of the relationship between the health of GDEs, groundwater levels, and access to water supplies.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Well Census	Addressing Additional Data Gaps	Multi-Agency/GSA	Conduct a survey of wells in the Subbasin to identify the location of previously unknown wells, determine their status (e.g., destroyed, active), and/or collect construction information to better inform groundwater use in the Subbasin.	Project status presented in the GSP is up to date; Updates regarding activity progress will be included in future Annual Reports
Land Subsidence Monitoring Evaluation	Addressing Additional Data Gaps	Multi-Agency/GSA	Conduct an assessment of land subsidence data to determine the optimal frequency for ongoing	Project status presented in the GSP is up to date; Updates

Project/Management Action Name	Project/Management Action Type	Proponent	Brief Description	Project Status
			collection and analysis of data relating to inelastic land subsidence.	regarding activity progress will be included in future Annual Reports

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# A P P E N D I X B

## Representative Well Monitoring Network Hydrographs



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**Table B-1: Representative Groundwater Levels Monitoring Network Wells**

Site Code	State Well Number	Local ID / Other ID	Aquifer Zone	Overlying GSA	Status	Well Use	Depth (ft bgs)	Screen Interval (ft bgs)	Minimum Threshold (feet above MSL, NAVD88)	Measurable Objective / Interim Milestone (feet above MSL, NAVD88)
- 4.5	12N02E09B002M	USGS-385431121451401	Shallow	Reclamation District No. 1500 GSA	Active	Unknown	29	-	12.3	20.3
- 3	12N03E18H001M	USGS-385314121401701	Shallow	Reclamation District No. 1500 GSA	Active	Unknown	50	-	13.32	21.32
- 3	14N02E10R001M	USGS-390416121433601	Shallow	Sutter Extension WD GSA	Active	Unknown	44	-	25.09	36.63
390696N1217778W001	14N02E17C001M	Sutter County MW-1A	Shallow	Reclamation District No. 1660 GSA	Active	Observation	60	30 - 50	21.5	29.5
- 3	15N02E20D001M	USGS-390832121463601	Shallow	Sutter County GSA	Active	Unknown	35	-	29.5	37.5
391975N1218937W001 <sup>3</sup>	16N01E31H001M	-	Shallow	Sutter County GSA	Active	Unknown	36	-	29.9	41.46
392328N1216469W001 <sup>3</sup>	16N03E21D002M	-	Shallow	Sutter County GSA	Active	Residential	30	-	44.44	61.53
387859N1216565W001	11N03E20H003M	RD 1500 Karnak	AZ-1	Reclamation District No. 1500 GSA	Active	Industrial	165	135 - 156	10.51	18.51
388761N1217094W001	12N02E23H001M	Sutter County MW-2A	AZ-1	Sutter County GSA	Active	Observation	150	120 - 140	7.58	15.58
389605N1218102W003 <sup>1</sup>	13N01E24G004M	Flood MW-1C (shall)	AZ-1	Reclamation District No. 1500 GSA	Active	Observation	100	70 - 90	13	23.33
390087N1216722W001	13N03E06A001M	Sutter County MW-6A	AZ-1	Sutter County GSA	Active	Observation	65	45 - 55	21.13	29.13
390426N1218166W001 <sup>3</sup>	14N01E24N001M	-	AZ-1	Reclamation District No. 1660 GSA	Active	Irrigation	145	-	23.58	31.58
390682N1216901W001 <sup>2</sup>	14N02E13A003M	SEWD MW-3A	AZ-1	Sutter Extension WD GSA	Active	Observation	115	90 - 110	37.37	45.37
390588N1217004W001	14N02E13L001M	-	AZ-1	Sutter Extension WD GSA	Active	Irrigation	82	68 - 82	15.93	35.8
390176N1217902W001 <sup>3</sup>	14N02E31K001M	-	AZ-1	Reclamation District No. 1500 GSA	Active	Unknown	131	-	19.08	27.08
390244N1217813W001	14N02E32D001M	SMWC MW-1A	AZ-1	Reclamation District No. 1500 GSA	Active	Observation	64	34 - 54	18.34	26.34
390458N1216114W001	14N03E23D003M	Feather River MW-1A	AZ-1	Sutter County GSA	Active	Observation	65	40 - 60	15.78	25.14
391051N1217012W001	15N02E36L001M	-	AZ-1	Sutter Extension WD GSA	Active	Irrigation	150	100 - 150	22.54	41.09
392394N1216509W001	16N03E17J001M	Sutter County MW-3A	AZ-1	Sutter Extension WD GSA	Active	Observation	85	65 - 85	45.8	67.82
392970N1216907W003	17N02E25J003M	BWD MW-1C	AZ-1	Butte WD GSA	Active	Observation	127	70 - 90	60.03	68.03
389453N1216159W001	-	GH Well 2	AZ-1	Sutter County GSA	Active	Irrigation	70	50 - 70	22.09	30.09
391456N1218904W001	-	MFWC Prop 50	AZ-1	Reclamation District No. 70 GSA	Active	Irrigation	320	125 - 155	27.72	35.72
389605N1218102W001 <sup>1</sup>	13N01E24G002M	Flood MW-1A (deep)	AZ-2	Reclamation District No. 1500 GSA	Active	Observation	310	240 - 300	7.2	24.5
389605N1218102W002 <sup>1</sup>	13N01E24G003M	Flood MW-1B (int)	AZ-2	Reclamation District No. 1500 GSA	Active	Observation	160	130 - 160	-7.9	21.89
391078N1216244W002	-	Hillcrest Well #8	AZ-2	City of Yuba City GSA	Inactive	Public Supply	254	-	17.34	33.84
391068N1216464W002	-	Hillcrest Well #9	AZ-2	City of Yuba City GSA	Inactive	Public Supply	190	-	14.35	30.85
390087N1216722W002	13N03E06A002M	Sutter County MW-6B	AZ-2	Sutter County GSA	Active	Observation	175	155 - 165	10.21	26.71
390087N1216722W003	13N03E06A003M	Sutter County MW-6C	AZ-2	Sutter County GSA	Active	Observation	265	245 - 255	9.91	26.41
389452N1215992W001	13N03E26J002M	Sutter County MW-4A	AZ-2	Sutter County GSA	Active	Observation	175	145 - 165	5.09	21.59

Site Code	State Well Number	Local ID / Other ID	Aquifer Zone	Overlying GSA	Status	Well Use	Depth (ft bgs)	Screen Interval (ft bgs)	Minimum Threshold (feet above MSL, NAVD88)	Measurable Objective / Interim Milestone (feet above MSL, NAVD88)
390682N1216901W002 <sup>2</sup>	14N02E13A004M	SEWD MW-3B	AZ-2	Sutter Extension WD GSA	Active	Observation	245	210 - 240	21.16	37.66
390696N1217778W002	14N02E17C002M	Sutter County MW-1B	AZ-2	Reclamation District No. 1660 GSA	Active	Observation	245	205 - 215	12.33	28.83
388761N1217094W002	12N02E23H002M	Sutter County MW-2B	AZ-2	Sutter County GSA	Active	Observation	300	210 - 220	-0.08	16.42
390244N1217813W002	14N02E32D002M	SMWC MW-1B	AZ-2	Reclamation District No. 1500 GSA	Active	Observation	210	170 - 200	10.01	26.51
390458N1216114W002	14N03E23D004M	Feather River MW-1B	AZ-2	Sutter County GSA	Active	Observation	260	235 - 255	-30.19	13
391658N1217070W001	15N02E12E001M	SEWD MW-1A	AZ-2	Sutter Extension WD GSA	Active	Observation	173	148 - 168	15.66	46.28
391658N1217070W002 <sup>1</sup>	15N02E12E002M	SEWD MW-1B	AZ-2	Sutter Extension WD GSA	Active	Observation	266	240 - 260	23.14	39.64
391414N1217442W001	15N02E22D001M	-	AZ-2	Sutter County GSA	Active	Residential	302	-	24	40.5
391279N1216989W001	15N02E24P001M	SEWD MW-2A	AZ-2	Sutter Extension WD GSA	Active	Monitoring	254	204 - 244	24.51	41.01
391279N1216989W002 <sup>1</sup>	15N02E24P002M	SEWD MW-2B	AZ-2	Sutter Extension WD GSA	Active	Monitoring	379	354 - 374	-16.3	29.31
392394N1216509W002	16N03E17J002M	Sutter County MW-3B	AZ-2	Sutter Extension WD GSA	Active	Observation	315	285 - 305	36.89	53.39
392970N1216907W002 <sup>1</sup>	17N02E25J002M	BWD MW-1B	AZ-2	Butte WD GSA	Active	Observation	370	320 - 360	3.9	43.89
391283N1218286W001	-	BS2-Franklin	AZ-2	Reclamation District No. 70 GSA	Active	Irrigation	300	-	16.77	33.27
391613N1216236W001	-	WTP well	AZ-2 and AZ-3	City of Yuba City GSA	Active	Public Supply	-	370 - 390; 453 - 473	21.51	38.01
388761N1217094W003	12N02E23H003M	Sutter County MW-2C	AZ-3	Sutter County GSA	Active	Observation	600	570 - 590	-0.12	16.38
388761N1217094W004	12N02E23H004M	Sutter County MW-2D	AZ-3	Sutter County GSA	Active	Observation	705	655 - 665	-0.41	16.09
389452N1215992W002	13N03E26J003M	Sutter County MW-4B	AZ-3	Sutter County GSA	Active	Observation	445	425 - 435	4.12	20.62
389452N1215992W003	13N03E26J004M	Sutter County MW-4C	AZ-3	Sutter County GSA	Active	Observation	610	590 - 600	2.82	19.32
389452N1215992W004	13N03E26J005M	Sutter County MW-4D	AZ-3	Sutter County GSA	Active	Observation	1005	985 - 995	0.34	16.84
390682N1216901W003 <sup>2</sup>	14N02E13A005M	SEWD MW-3C	AZ-3	Sutter Extension WD GSA	Active	Observation	585	550 - 580	18.52	35.02
390696N1217778W003	14N02E17C003M	Sutter County MW-1C	AZ-3	Reclamation District No. 1660 GSA	Active	Observation	425	395 - 415	5.77	25.72
390696N1217778W004	14N02E17C004M	Sutter County MW-1D	AZ-3	Reclamation District No. 1660 GSA	Active	Observation	755	725 - 745	11.91	28.41
390244N1217813W003	14N02E32D003M	SMWC MW-1C	AZ-3	Reclamation District No. 1500 GSA	Active	Observation	500	460 - 490	8.85	25.35
390458N1216114W003	14N03E23D005M	Feather River MW-1C	AZ-3	Sutter County GSA	Active	Observation	689	664 - 684	11.05	27.55
390458N1216114W004	14N03E23D006M	Feather River MW-1D	AZ-3	Sutter County GSA	Active	Observation	1021	996 - 1016	9.49	25.99
391658N1217070W003 <sup>1</sup>	15N02E12E003M	SEWD MW-1C	AZ-3	Sutter Extension WD GSA	Active	Observation	559	524 - 554	22.91	39.41
391279N1216989W003 <sup>1</sup>	15N02E24P003M	SEWD MW-2C	AZ-3	Sutter Extension WD GSA	Active	Monitoring	488	438 - 478	-13.8	29.8
392394N1216509W003	16N03E17J003M	Sutter County MW-3C	AZ-3	Sutter Extension WD GSA	Active	Observation	430	400 - 420	34.68	51.18
392394N1216509W004	16N03E17J004M	Sutter County MW-3D	AZ-3	Sutter Extension WD GSA	Active	Observation	615	595 - 605	31.78	48.28
392394N1216509W005	16N03E17J005M	Sutter County MW-3E	AZ-3	Sutter Extension WD GSA	Active	Observation	785	765 - 785	31.21	47.71
392970N1216907W001 <sup>1</sup>	17N02E25J001M	BWD MW-1A	AZ-3	Butte WD GSA	Active	Observation	591	486 - 586	10.1	35.01

Site Code	State Well Number	Local ID / Other ID	Aquifer Zone	Overlying GSA	Status	Well Use	Depth (ft bgs)	Screen Interval (ft bgs)	Minimum Threshold (feet above MSL, NAVD88)	Measurable Objective / Interim Milestone (feet above MSL, NAVD88)
392867N1217825W001 <sup>3</sup>	17N02E31A001M	-	AZ-3	Sutter County GSA	Active	Irrigation	540	-	21.35	50.35

<sup>1</sup> Hydrograph appears to be indicative of data points collected while active nearby pumping. See the hydrograph below for context.

<sup>2</sup> Sustainable management criteria numeric value revised since GSP adoption to address discrepancy in the well record due to fluctuating reference point elevation.

<sup>3</sup> No WY 2023 measurements available.

<sup>4</sup> No WY 2023 seasonal high measurements available.

<sup>5</sup> No WY 2023 seasonal low measurements available.

**Table B-2: Representative Depletions of Interconnected Surface Water Monitoring Network Wells**

Site Code	State Well Number	Local ID / Other ID	Aquifer Zone	Overlying GSA	Status	Well Use	Depth (ft bgs)	Screen Interval (ft bgs)	Minimum Threshold (feet above MSL, NAVD88)	Measurable Objective / Interim Milestone (feet above MSL, NAVD88)
- 1	12N03E18H001M	USGS-385314121401701	Shallow	Reclamation District No. 1500 GSA	Active	Unknown	50	-	13.32	21.32
- 1	14N02E10R001M	USGS-390416121433601	Shallow	Sutter Extension WD GSA	Active	Unknown	44	-	25.09	36.63
- 1	15N02E20D001M	USGS-390832121463601	Shallow	Sutter County GSA	Active	Unknown	35	-	29.5	37.5
391975N1218937W001 <sup>1</sup>	16N01E31H001M	-	Shallow	Sutter County GSA	Active	Unknown	36	-	29.9	41.46
392328N1216469W001 <sup>1</sup>	16N03E21D002M	-	Shallow	Sutter County GSA	Active	Residential	30	-	44.44	61.53
389563N1215843W001	-	GH East MW Site	Shallow	Sutter County GSA	Active	Monitoring	40	30 - 40	13.03	21.03
389571N1215858W001	-	GH North MW Site	Shallow	Sutter County GSA	Active	Monitoring	40	30 - 40	14.39	22.39
389233N1218022W001 <sup>1</sup>	12N01E01A001M	-	AZ-1	Reclamation District No. 1500 GSA	Active	Unknown	75	-	15.11	23.11
388813N1217525W001	12N02E21Q001M	SR-1A	AZ-1	None - Yolo Subbasin	Active	Monitoring	68	54 - 64	14.74	22.74
389937N1218240W001	13N01E11A001M	-	AZ-1	None - Colusa Subbasin	Active	Domestic	145	-	18.69	27.5
390458N1216114W001	14N03E23D003M	Feather River MW-1A	AZ-1	Sutter County GSA	Active	Observation	65	40 - 60	15.78	25.14
392394N1216509W001	16N03E17J001M	Sutter County MW-3A	AZ-1	Sutter Extension WD GSA	Active	Observation	85	65 - 85	45.8	67.82
389453N1216159W001	-	GH Well 2	AZ-1	Sutter County GSA	Active	Irrigation	70	50 - 70	22.09	30.09
389398N1216162W001	-	GH Well 3	AZ-1	Sutter County GSA	Active	Irrigation	100	52 - 100	17.04	25.04
389410N1215884W001	-	GH Well 18	AZ-1	Sutter County GSA	Active	Irrigation	150	90 - 100	5.65	19.08
388869N1216445W002 <sup>1</sup>	-	Ma-1	AZ-1	Reclamation District No. 1500 GSA	Active	Irrigation	140	103 - 133	14.36	22.36
390458N1216114W002	14N03E23D004M	Feather River MW-1B	AZ-2	Sutter County GSA	Active	Observation	260	235 - 255	-30.19	13
392394N1216509W002	16N03E17J002M	Sutter County MW-3B	AZ-2	Sutter Extension WD GSA	Active	Observation	315	285 - 305	36.89	53.39
390458N1216114W003	14N03E23D005M	Feather River MW-1C	AZ-3	Sutter County GSA	Active	Observation	689	664 - 684	11.05	27.55
390458N1216114W004	14N03E23D006M	Feather River MW-1D	AZ-3	Sutter County GSA	Active	Observation	1021	996 - 1016	9.49	25.99
392394N1216509W003	16N03E17J003M	Sutter County MW-3C	AZ-3	Sutter Extension WD GSA	Active	Observation	430	400 - 420	34.68	51.18
392394N1216509W004	16N03E17J004M	Sutter County MW-3D	AZ-3	Sutter Extension WD GSA	Active	Observation	615	595 - 605	31.78	48.28
392394N1216509W005	16N03E17J005M	Sutter County MW-3E	AZ-3	Sutter Extension WD GSA	Active	Observation	785	765 - 785	31.21	47.71

<sup>1</sup> No WY 2023 measurements available.

<sup>2</sup> No WY 2023 seasonal high measurements available.

<sup>3</sup> No WY 2023 seasonal low measurements available.

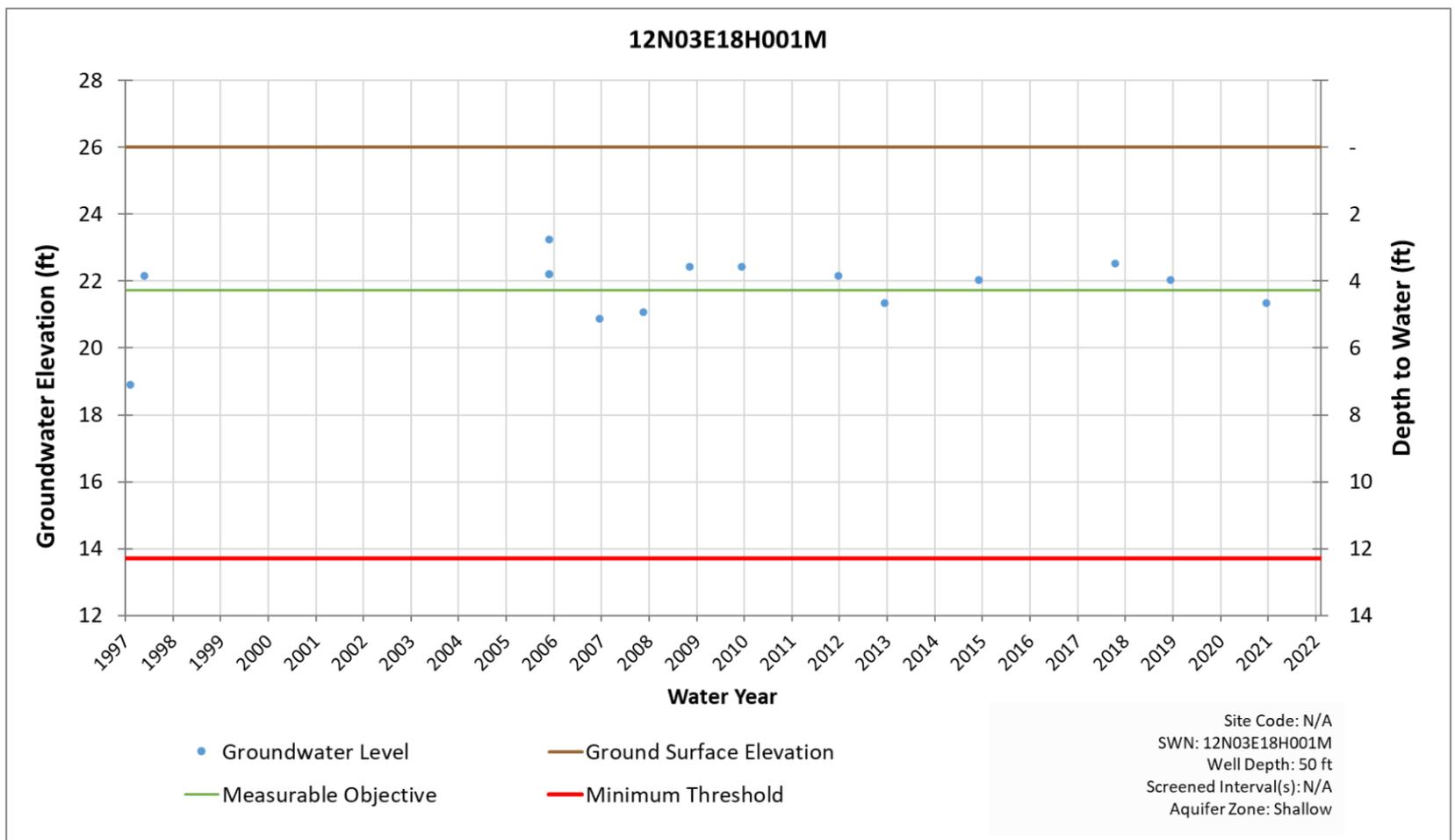
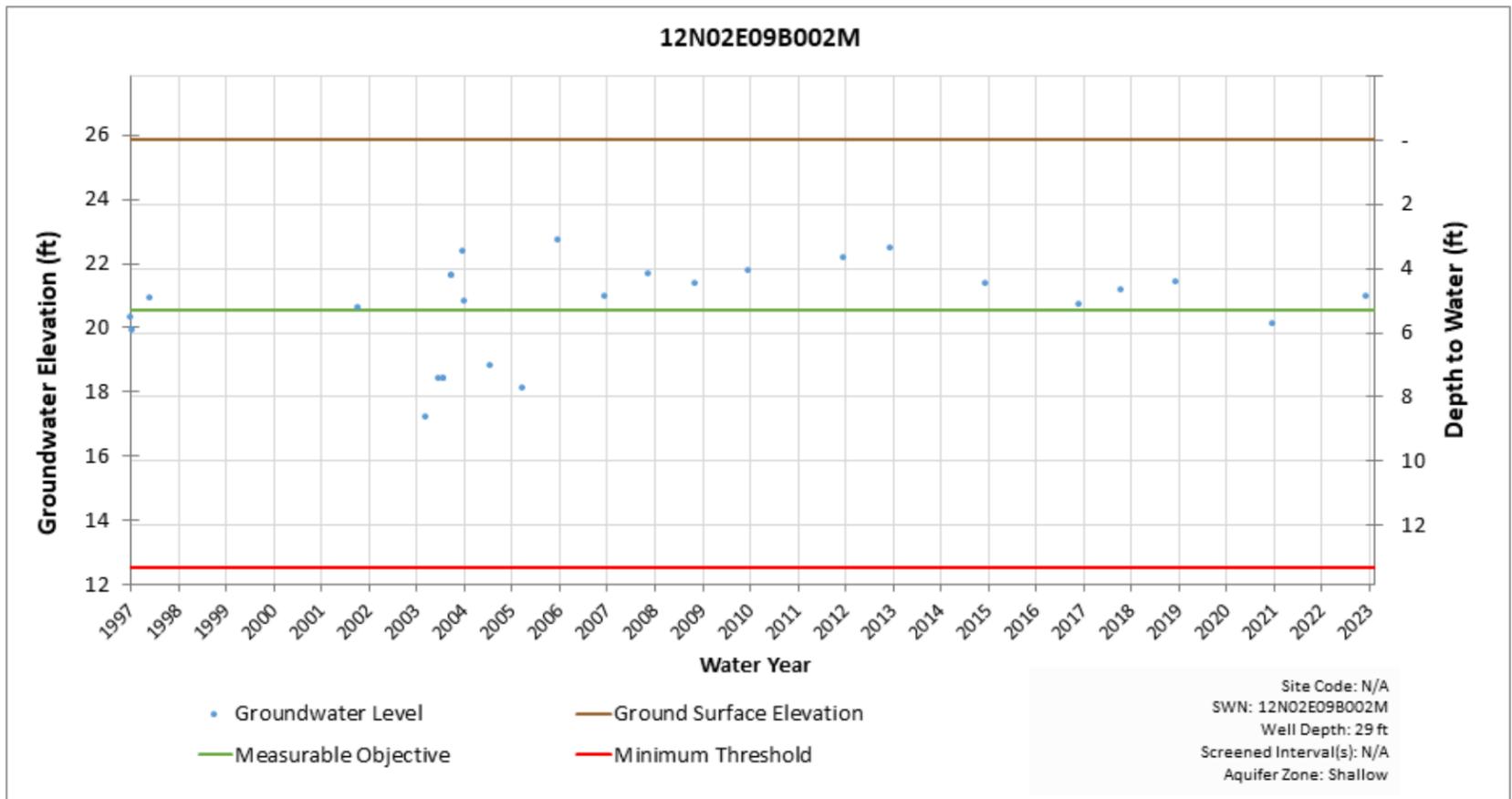
**Table B-3: Sacramento Valley Water Year Hydrologic Classification Index**

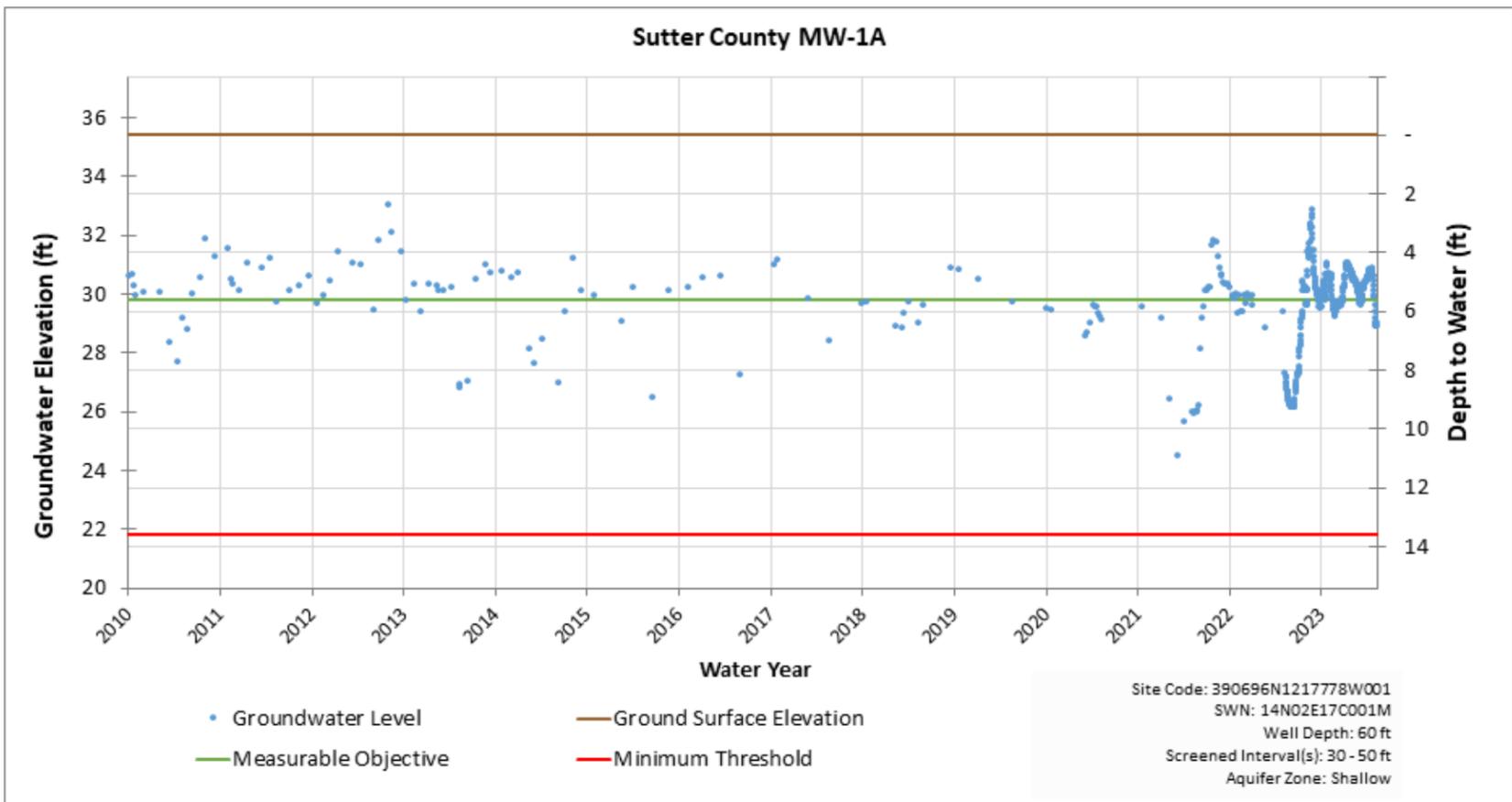
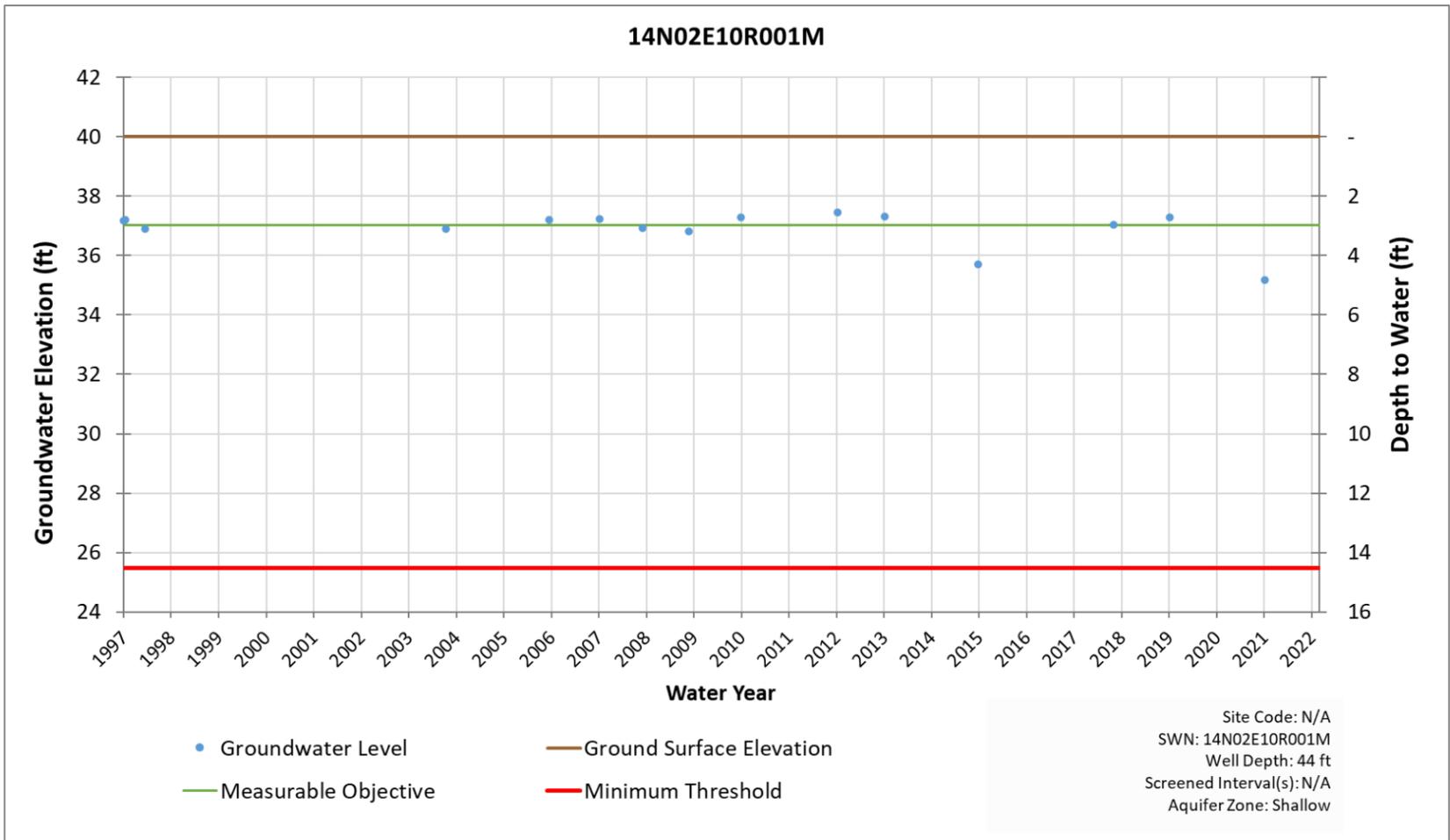
Water Year	Classification
1933	Critically Dry
1934	Critically Dry
1935	Below Normal
1936	Below Normal
1937	Below Normal
1938	Wet
1939	Dry
1940	Above Normal
1941	Wet
1942	Wet
1943	Wet
1944	Dry
1945	Below Normal
1946	Below Normal
1947	Dry
1948	Below Normal
1949	Dry
1950	Below Normal
1951	Above Normal
1952	Wet
1953	Wet
1954	Above Normal
1955	Dry
1956	Wet
1957	Above Normal
1958	Wet
1959	Below Normal
1960	Dry
1961	Dry
1962	Below Normal
1963	Wet
1964	Dry
1965	Wet
1966	Below Normal
1967	Wet
1968	Below Normal
1969	Wet
1970	Wet
1971	Wet
1972	Below Normal
1973	Above Normal
1974	Wet
1975	Wet
1976	Critically Dry
1977	Critically Dry
1978	Above Normal
1979	Below Normal
1980	Above Normal
1981	Dry
1982	Wet
1983	Wet
1984	Wet
1985	Dry
1986	Wet
1987	Dry
1988	Critically Dry
1989	Dry
1990	Critically Dry
1991	Critically Dry
1992	Critically Dry
1993	Above Normal
1994	Critically Dry
1995	Wet
1996	Wet

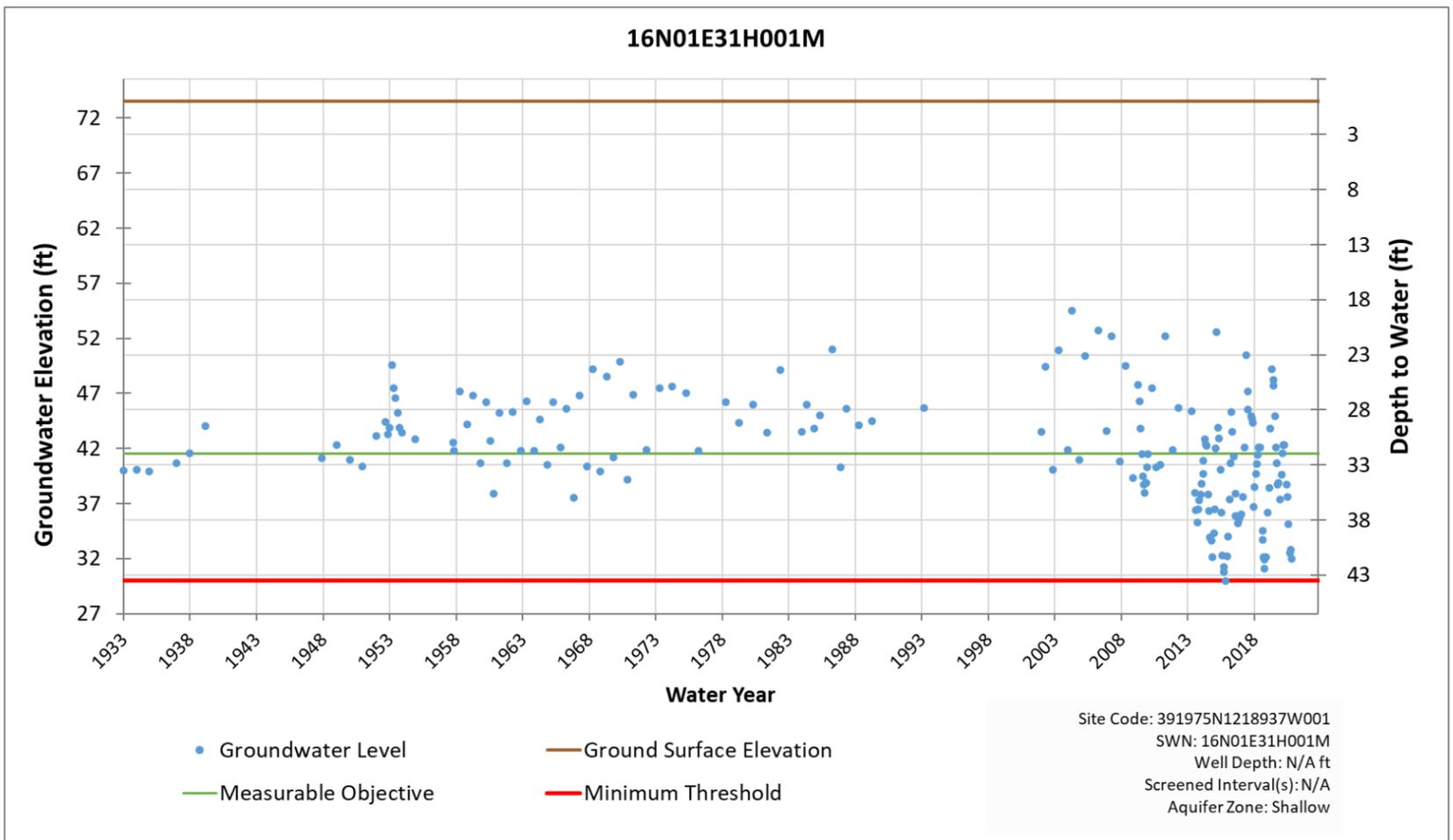
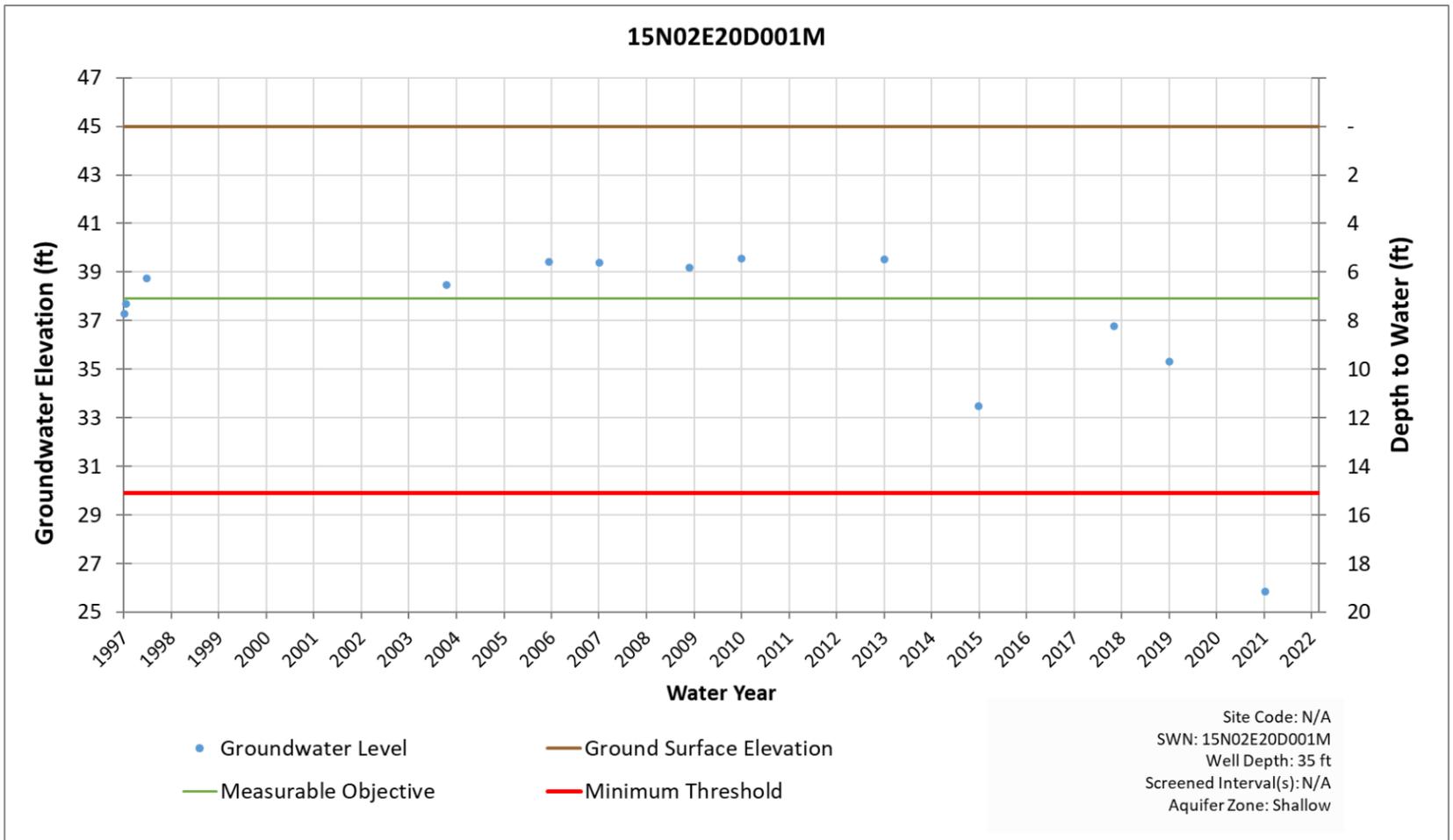
Water Year	Classification
1997	Wet
1998	Wet
1999	Wet
2000	Above Normal
2001	Dry
2002	Dry
2003	Above Normal
2004	Below Normal
2005	Above Normal
2006	Wet
2007	Dry
2008	Critically Dry
2009	Dry
2010	Below Normal
2011	Wet
2012	Below Normal
2013	Dry
2014	Critically Dry
2015	Critically Dry
2016	Below Normal
2017	Wet
2018	Below Normal
2019	Wet
2020	Dry
2021	Critically Dry
2022	Critically Dry
2023	Wet

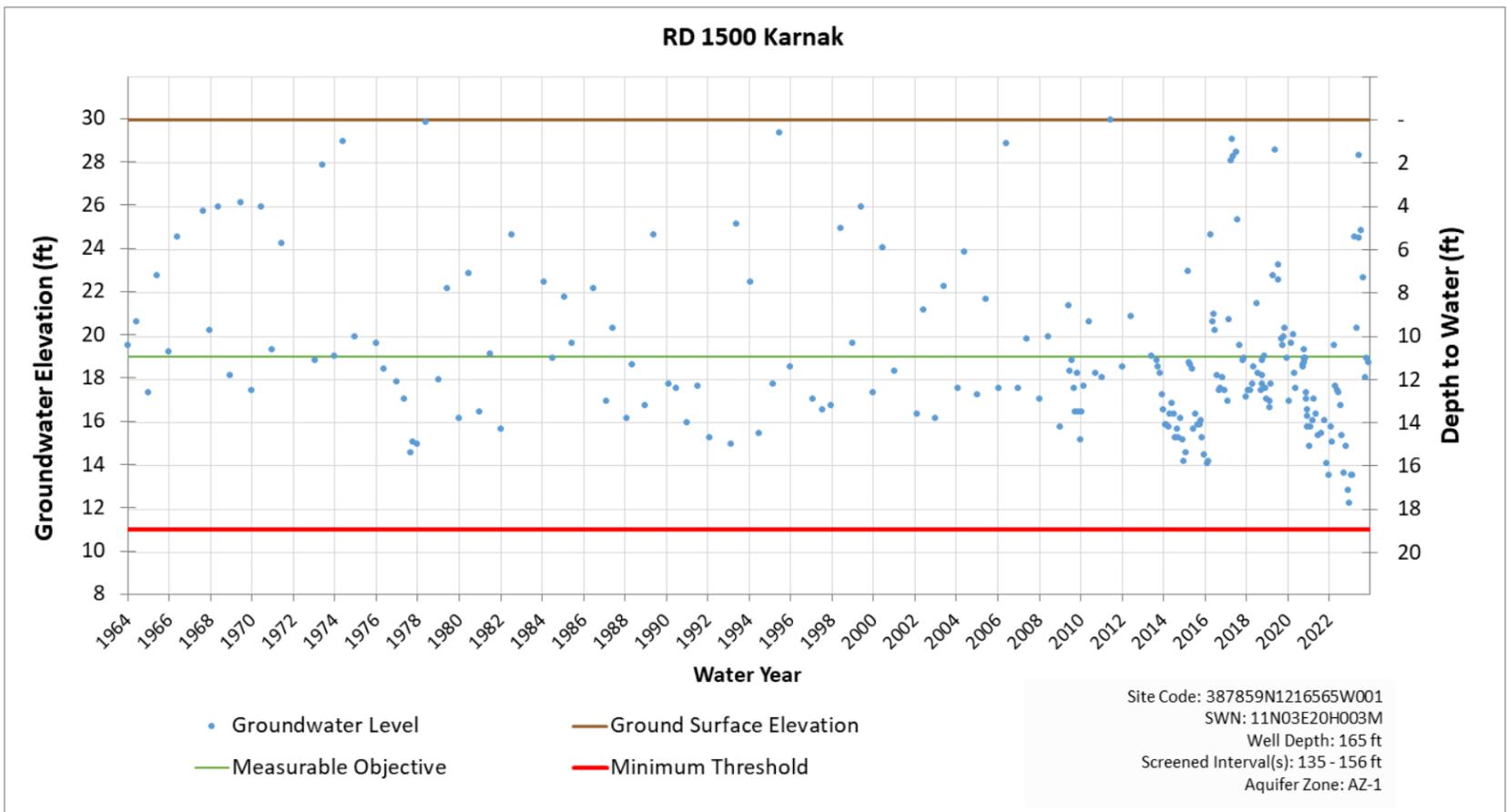
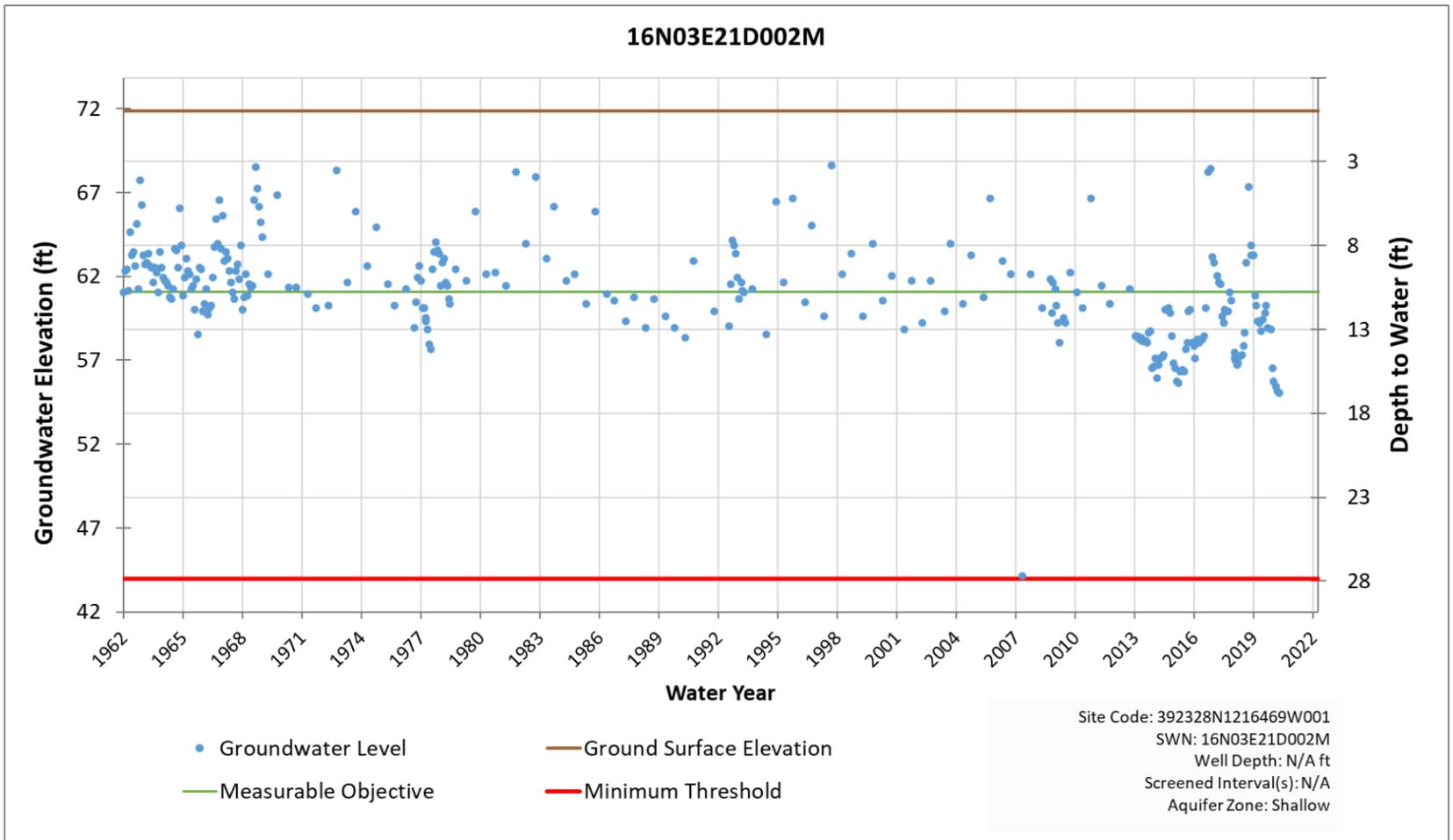
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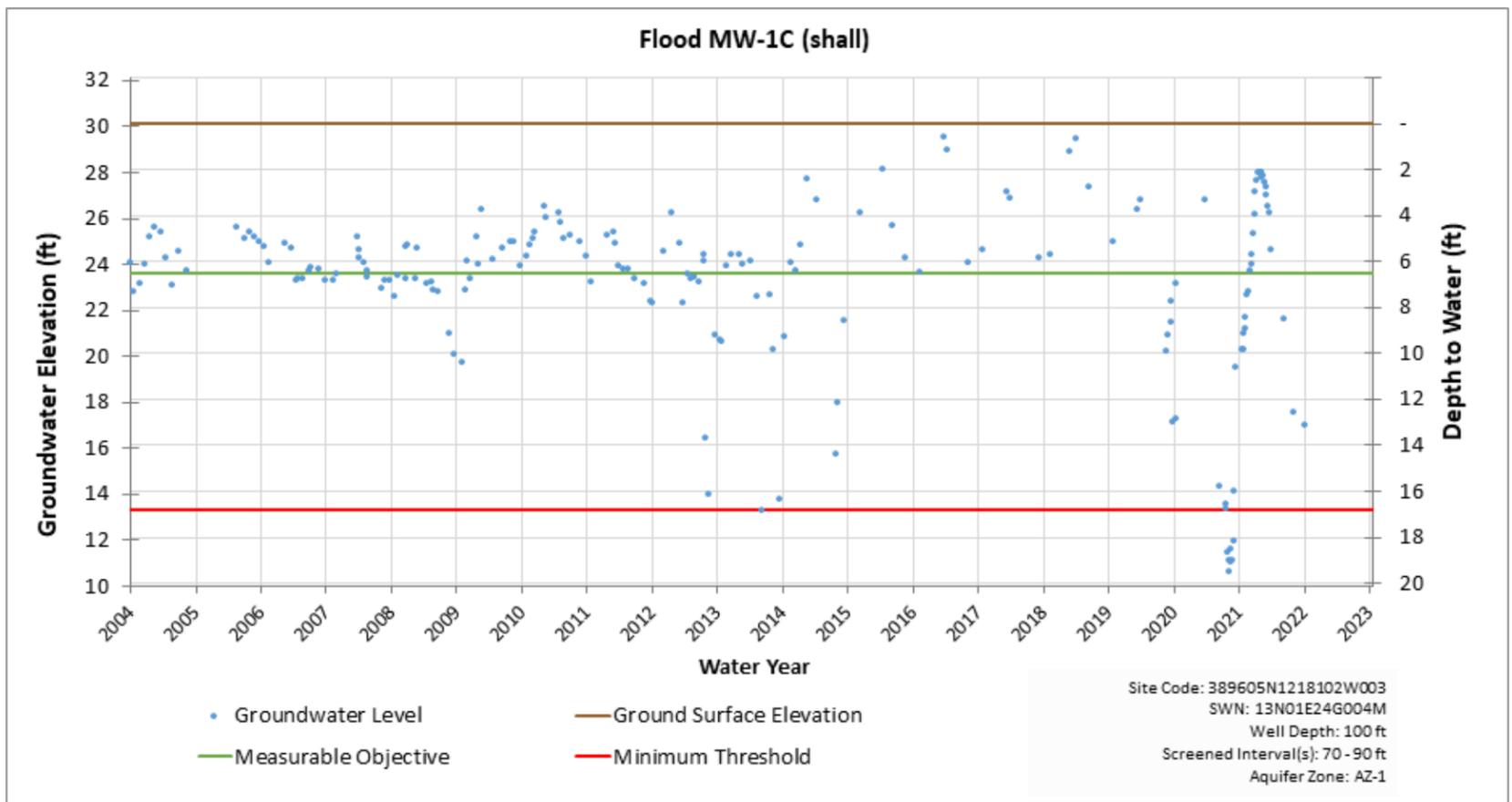
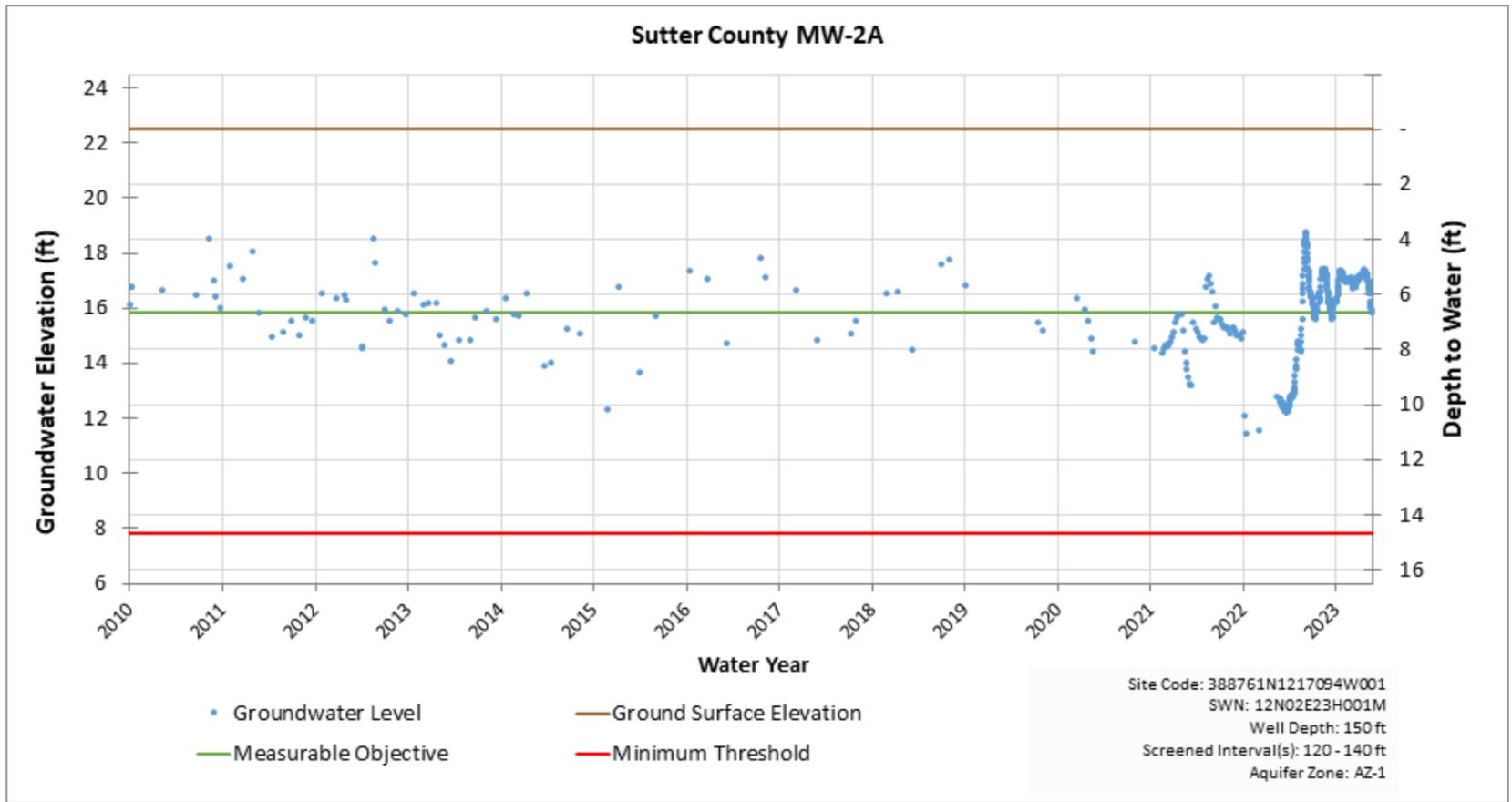
**Representative Groundwater Levels Monitoring Network**

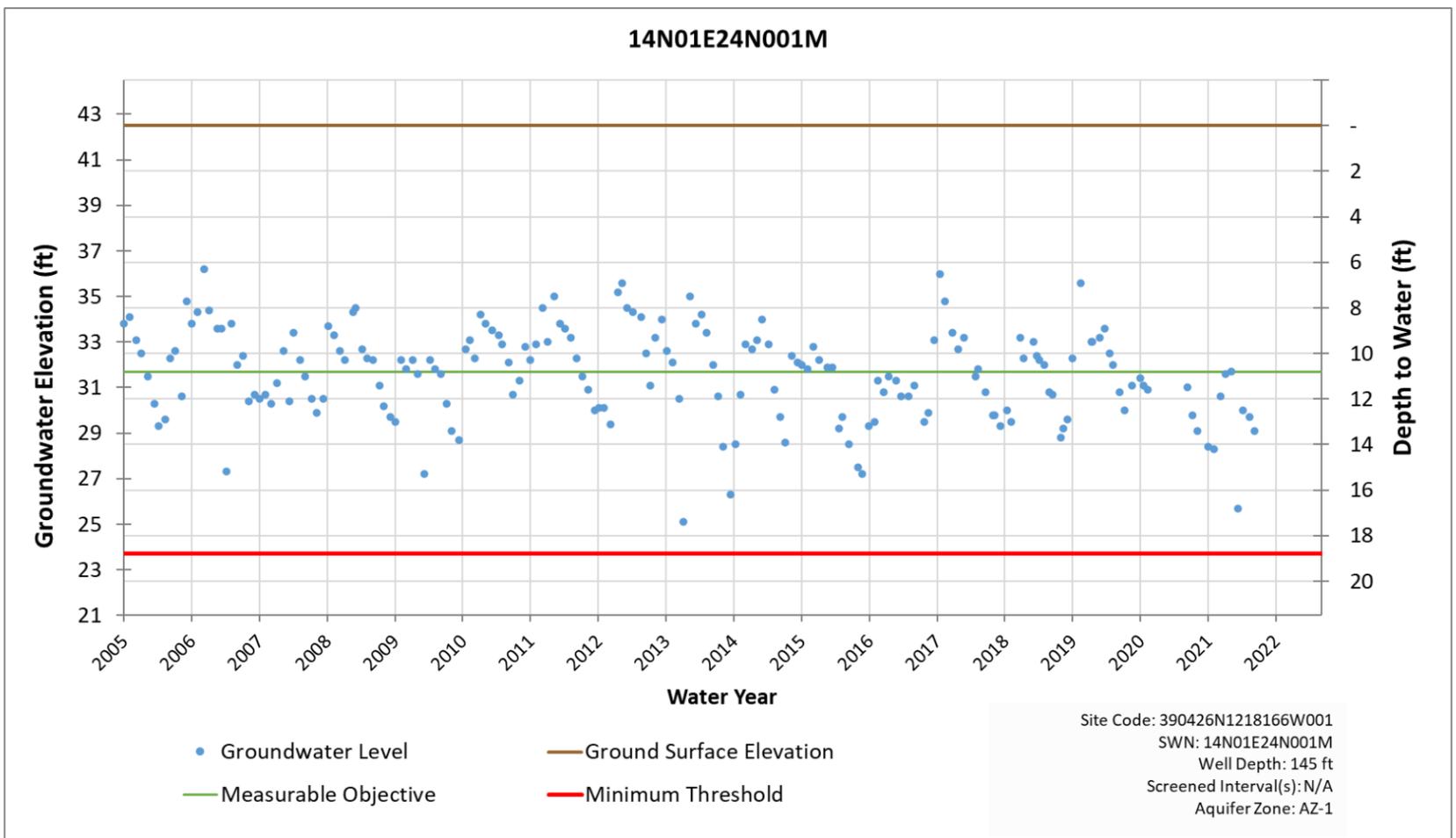
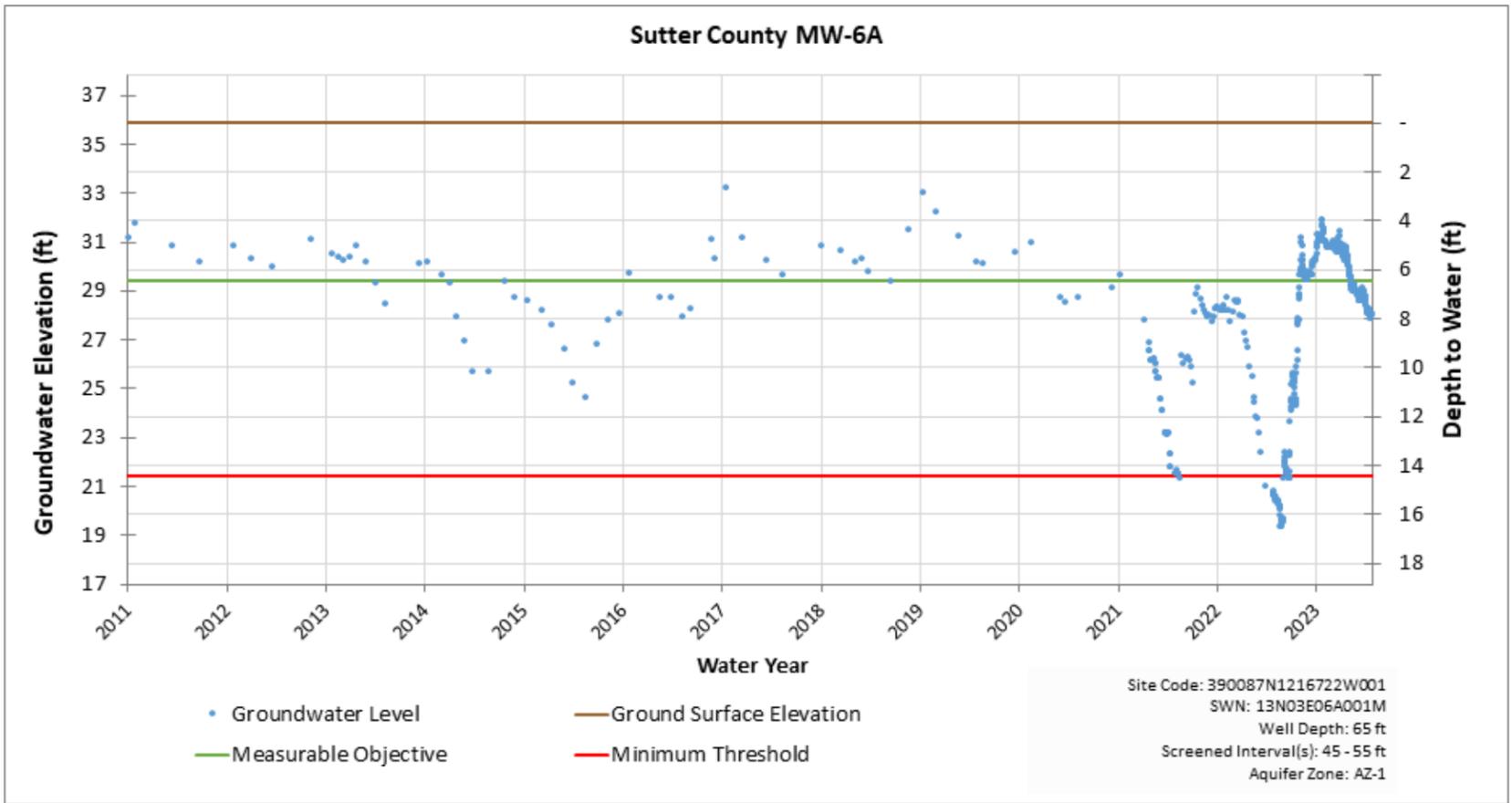


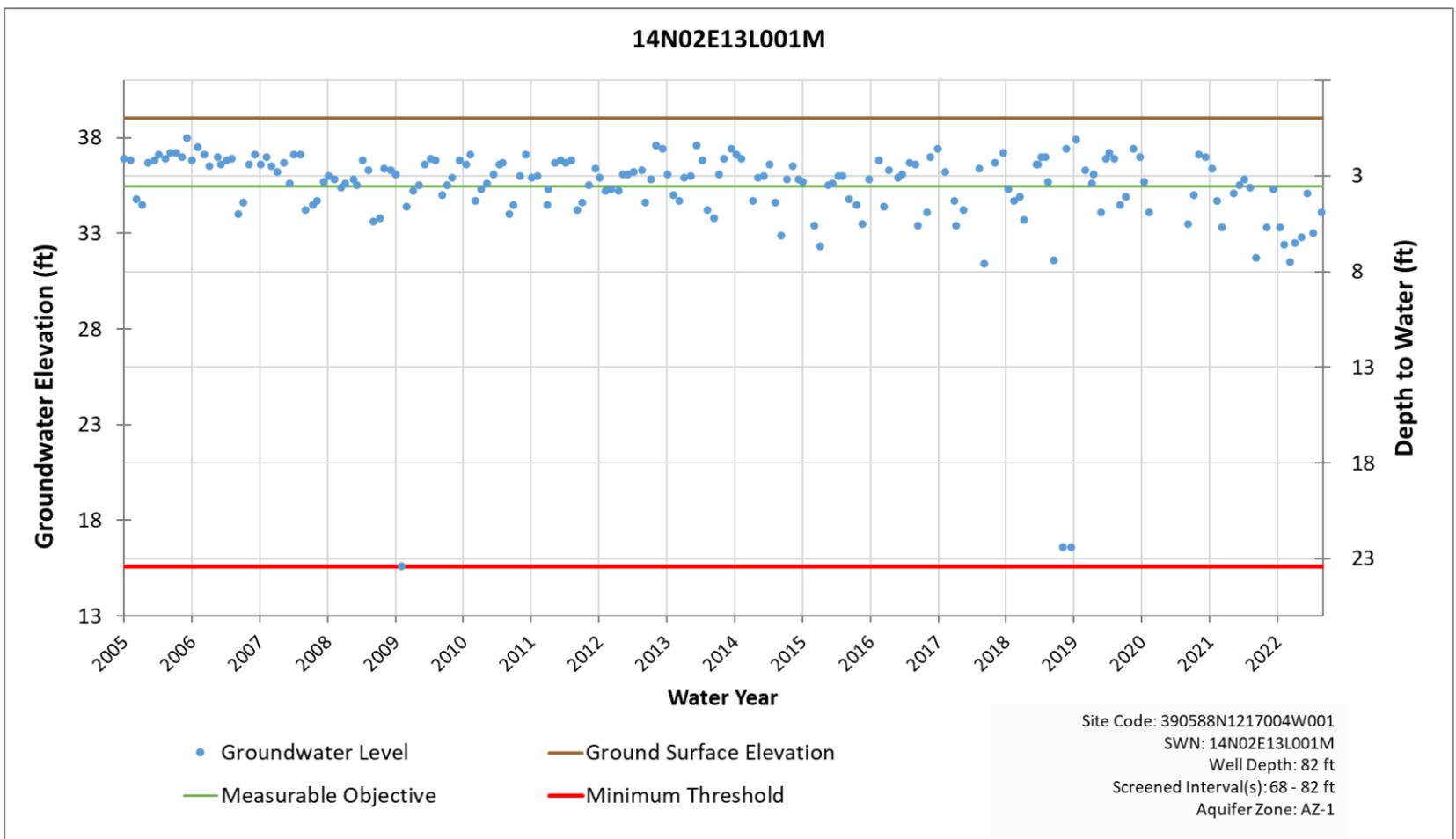
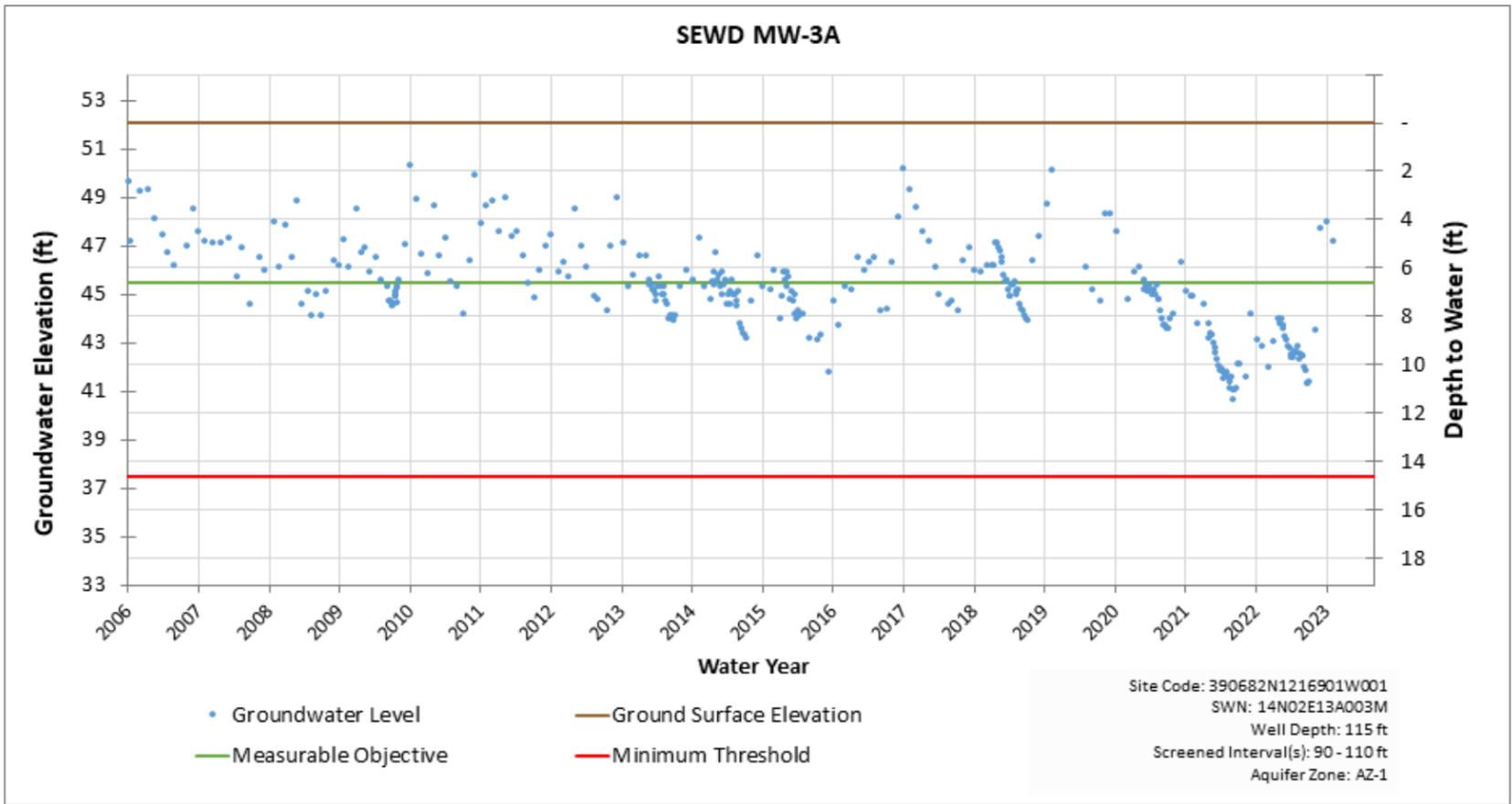


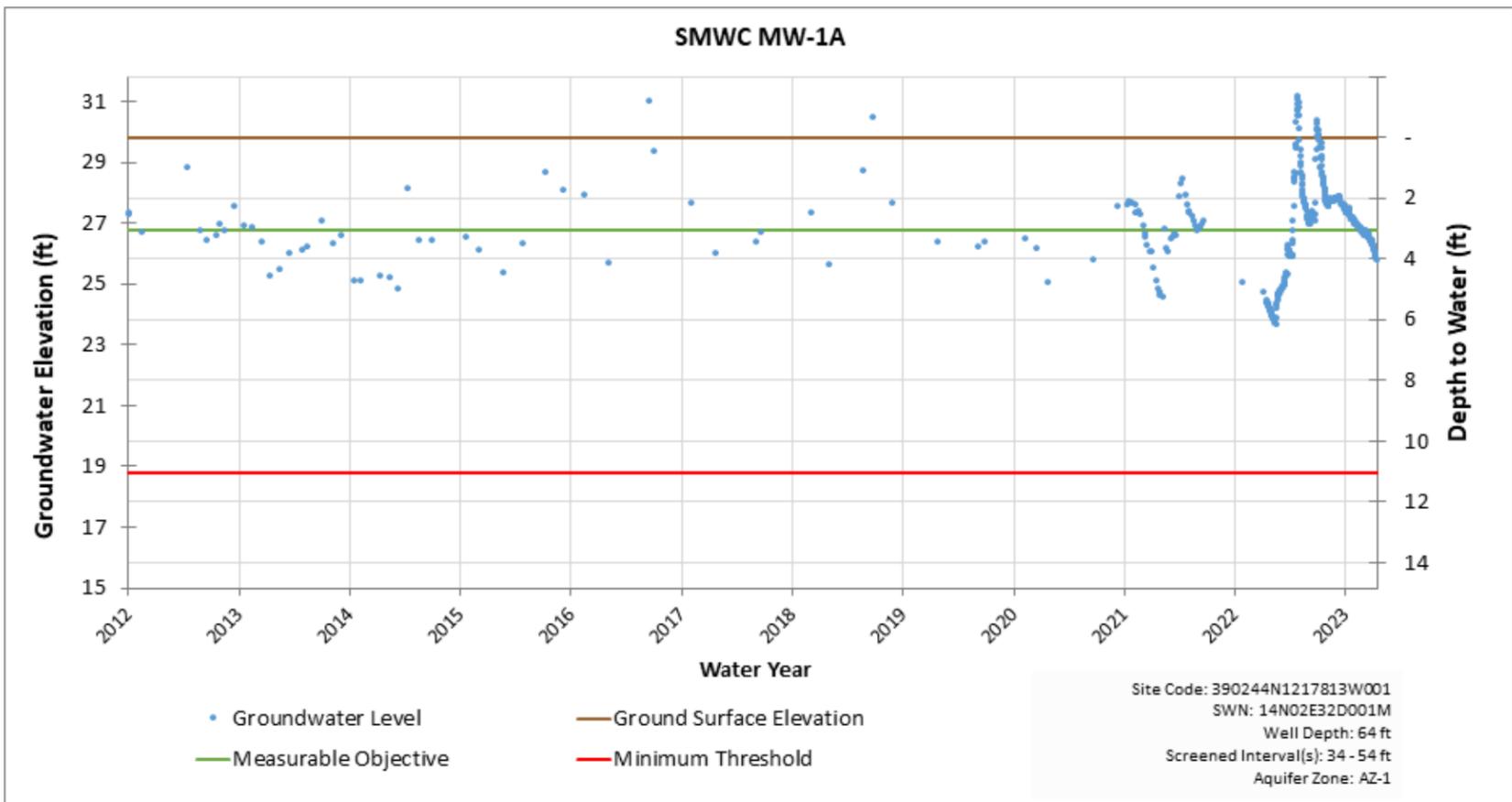
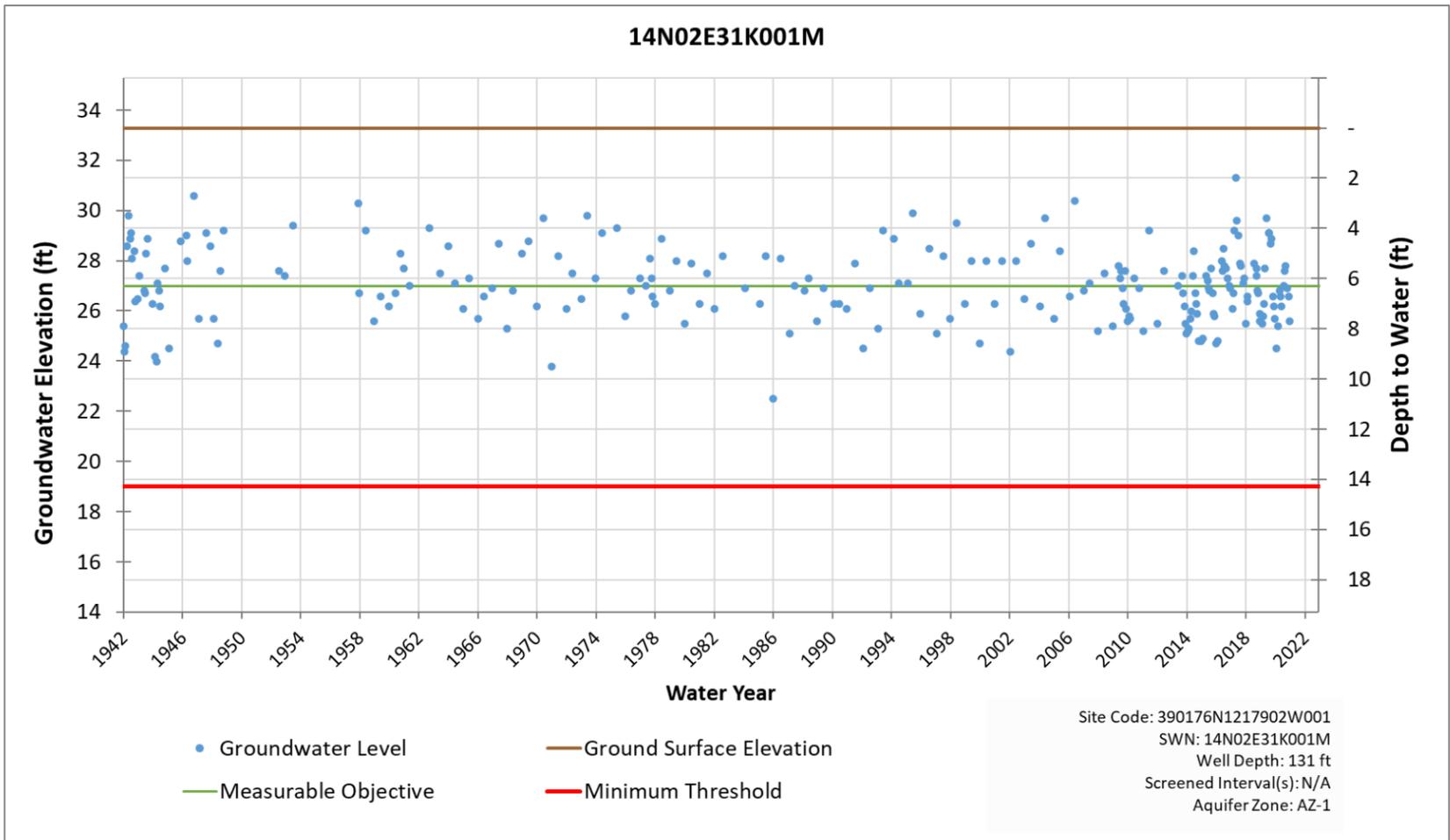


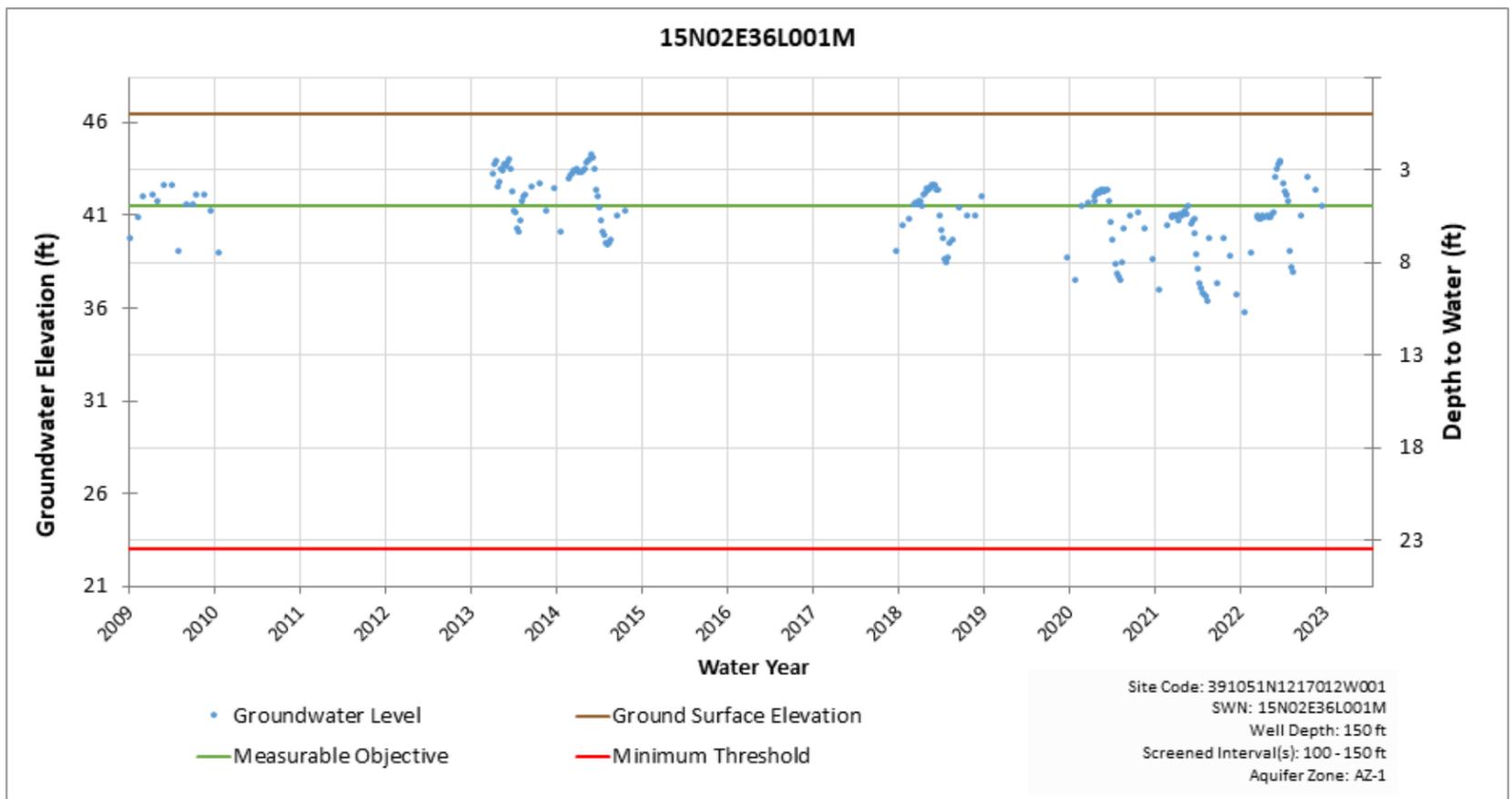
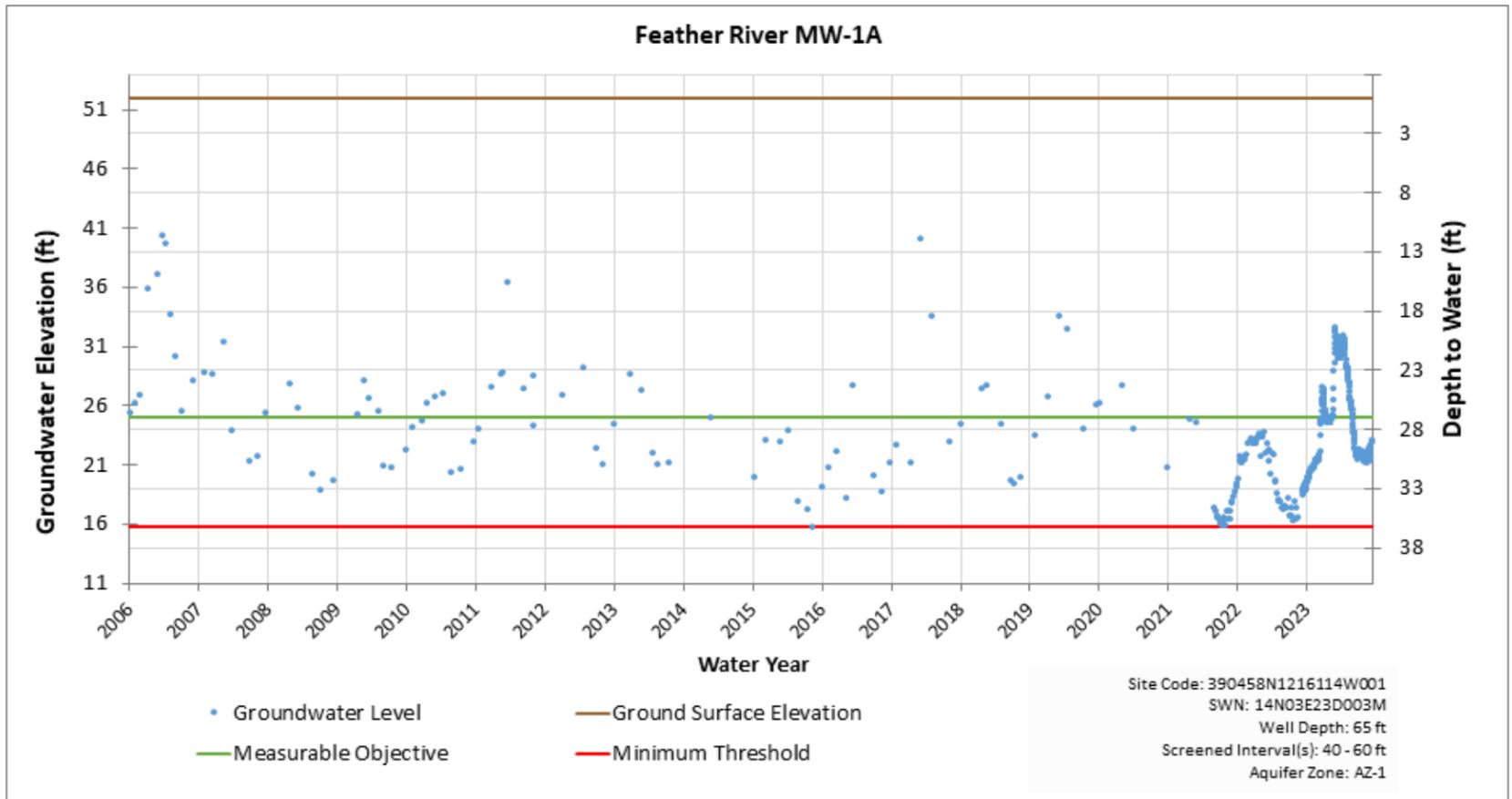


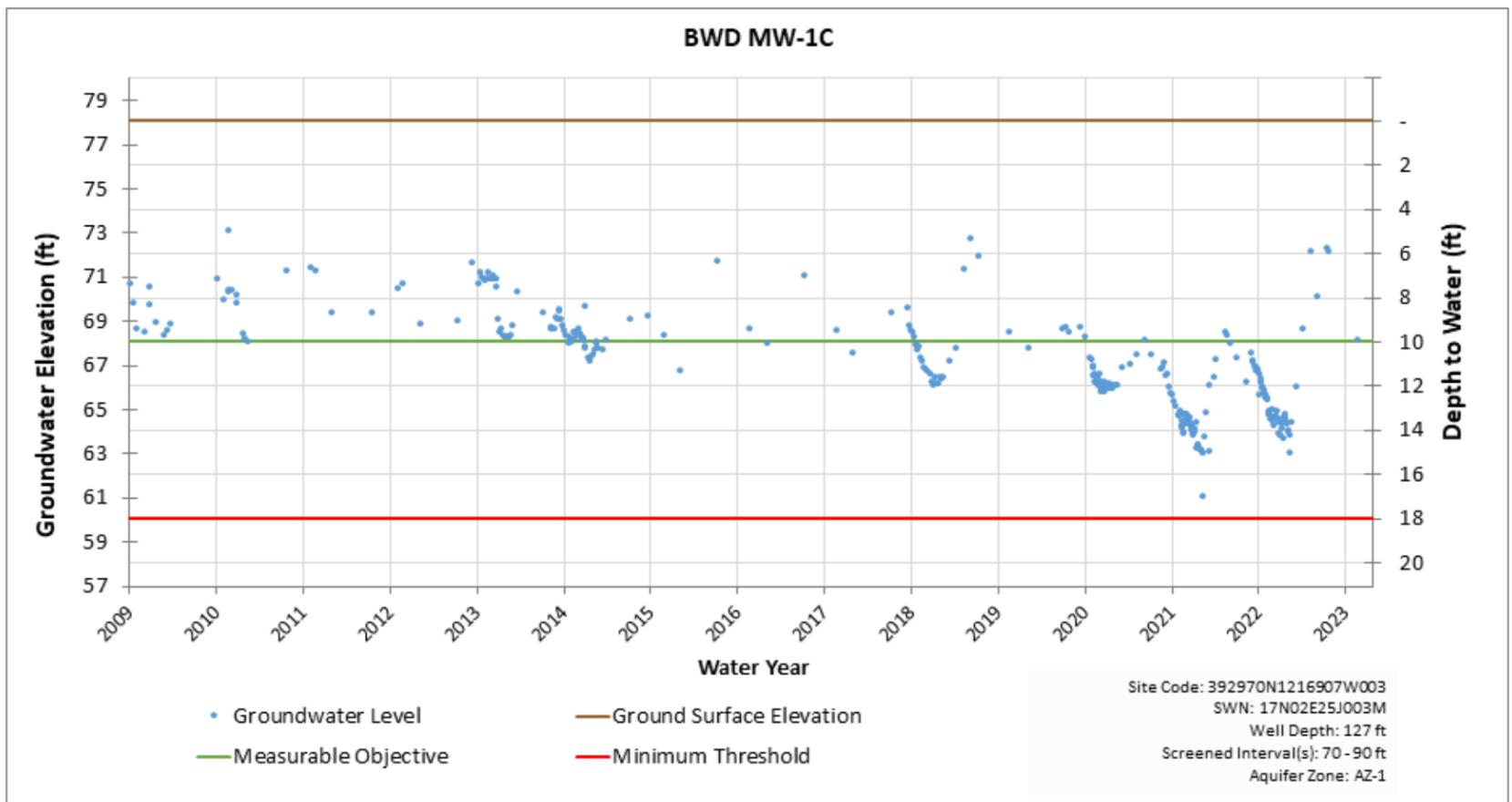
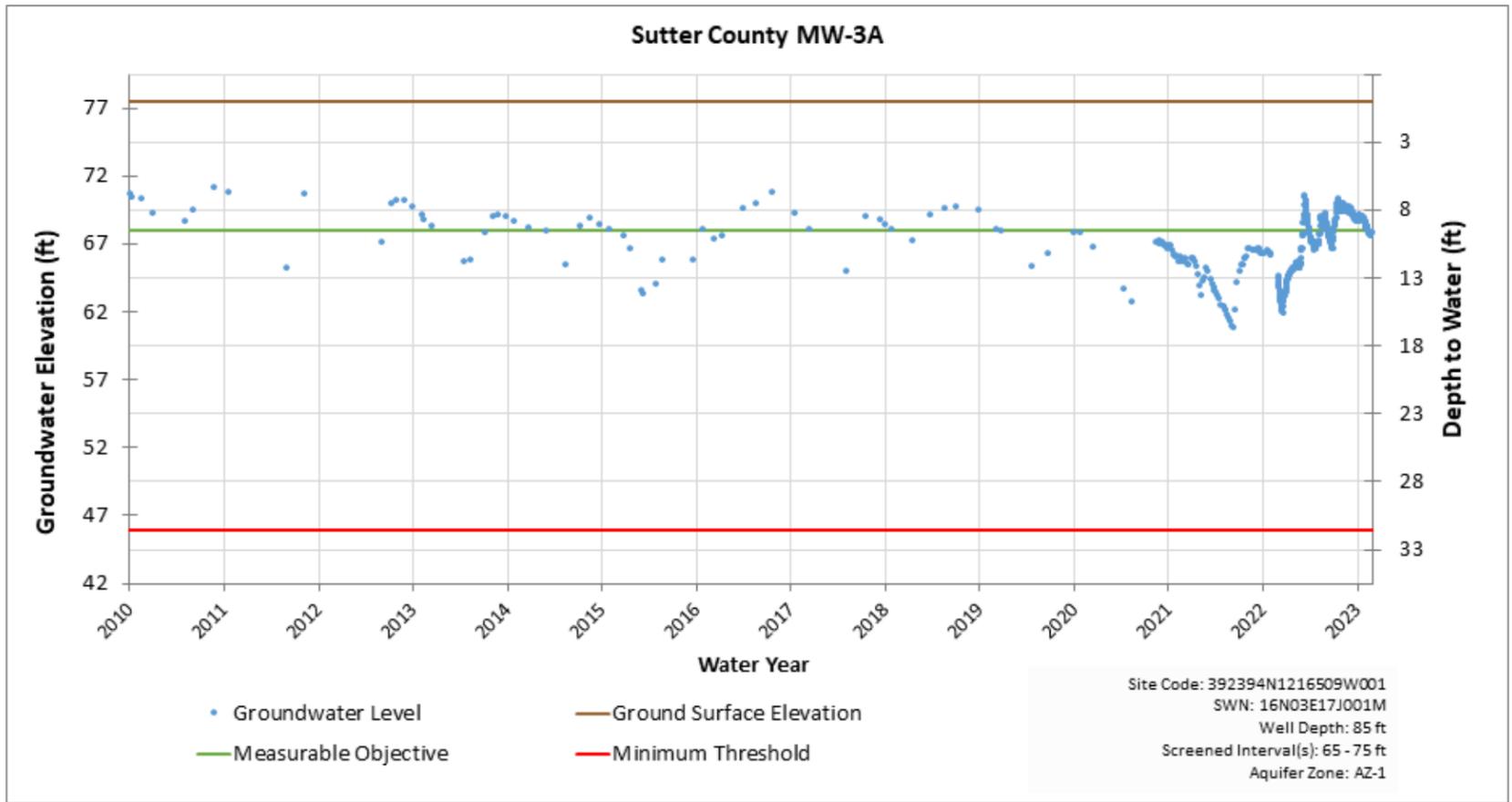


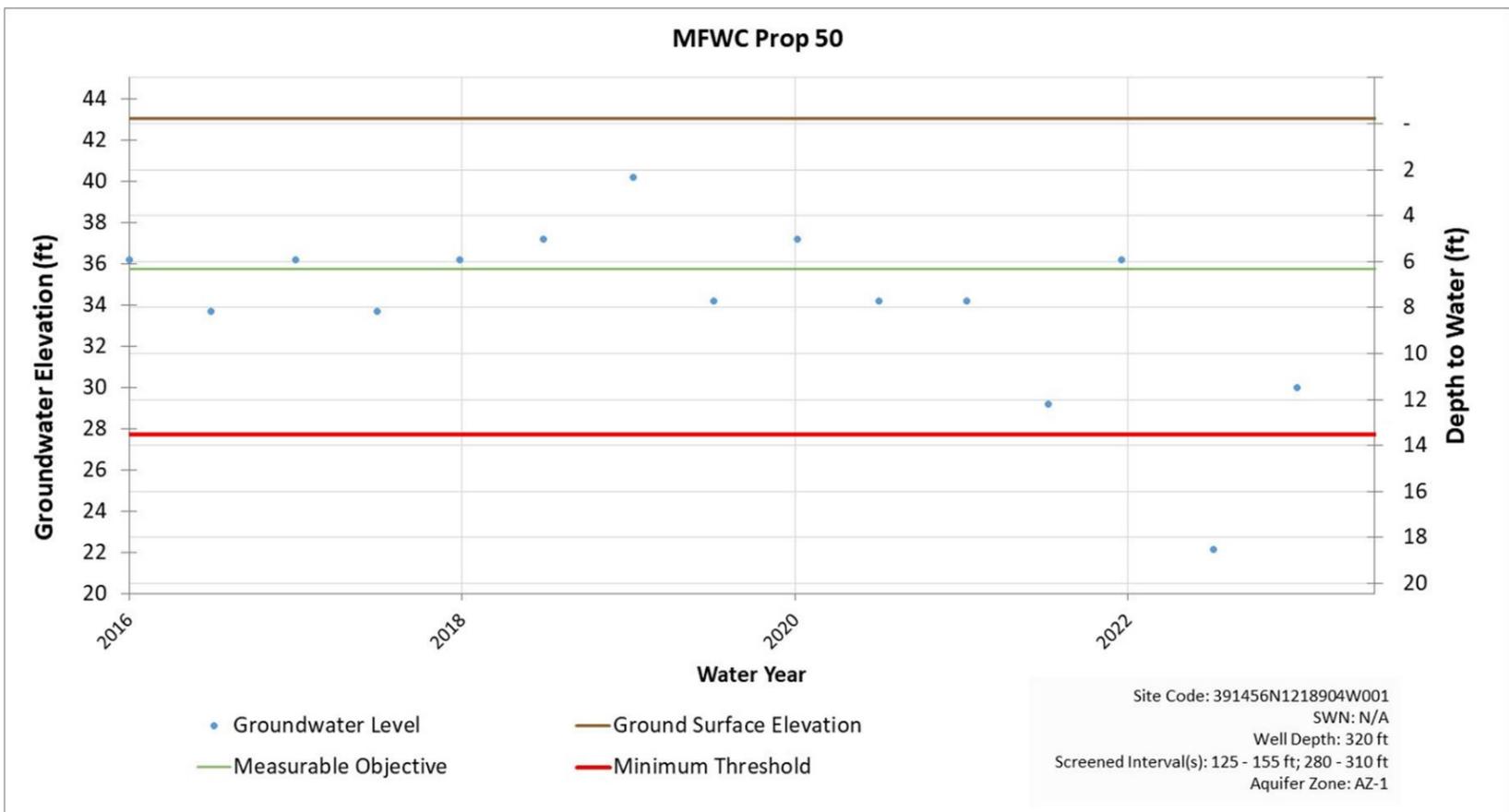
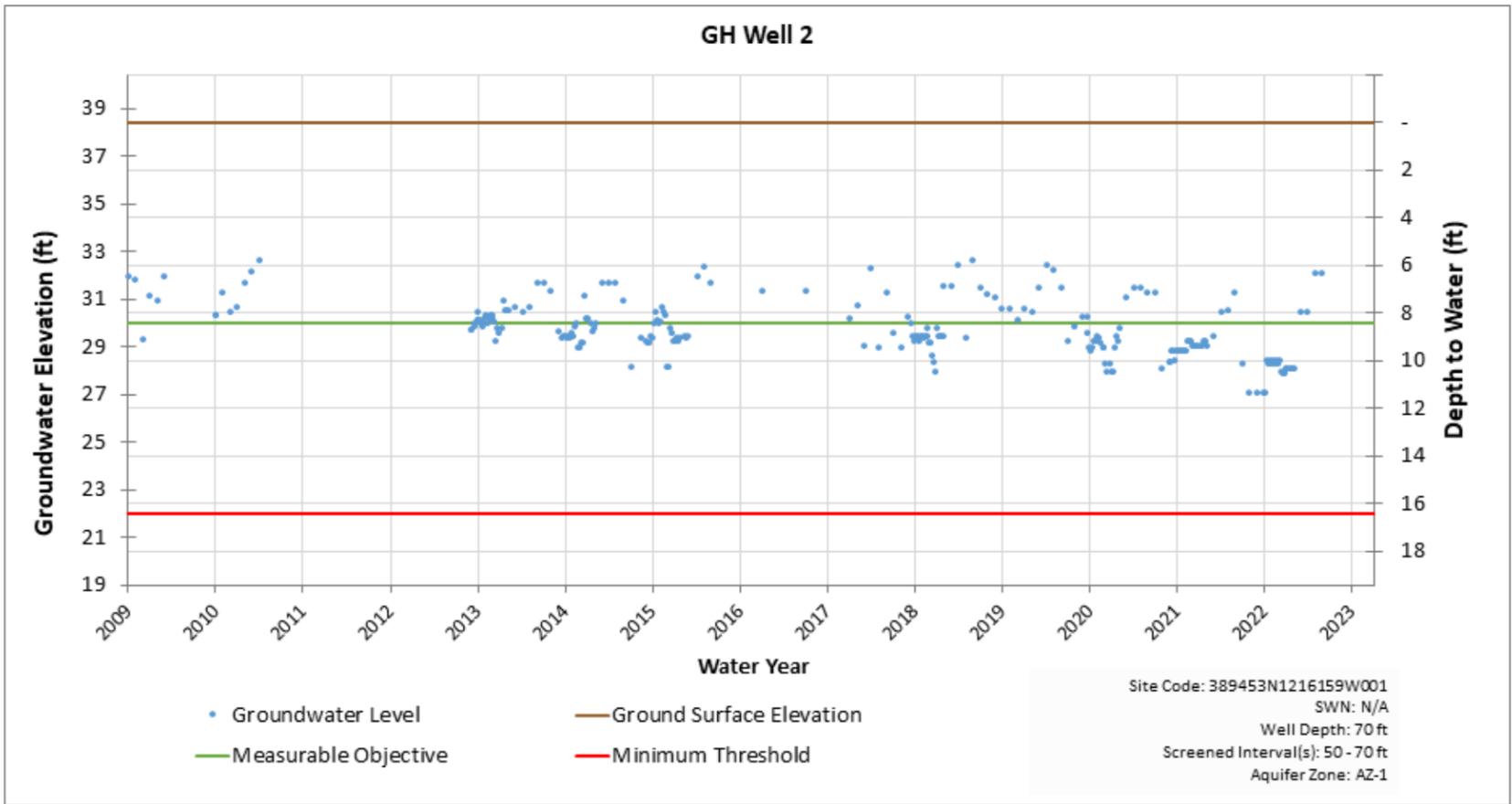


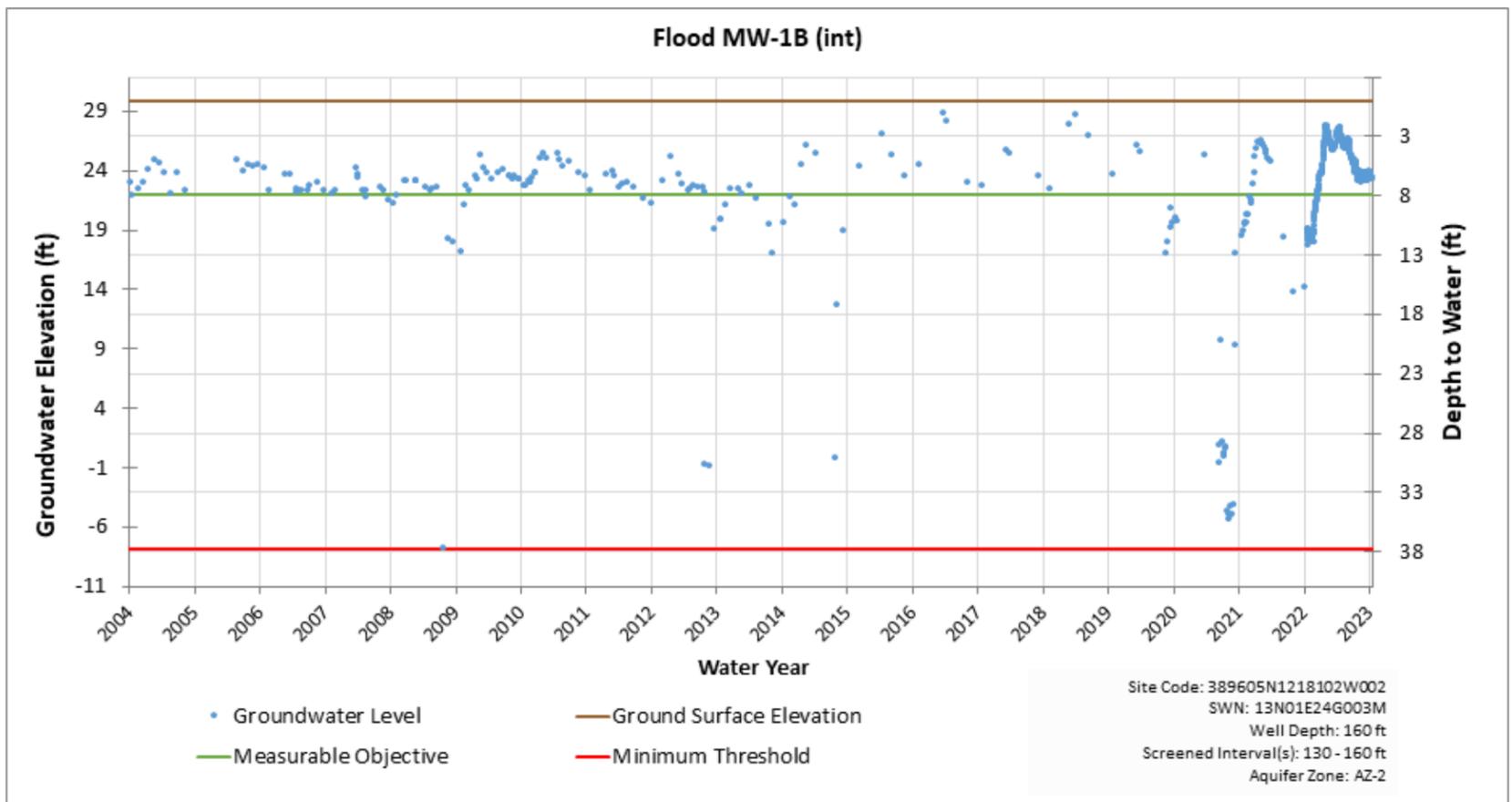
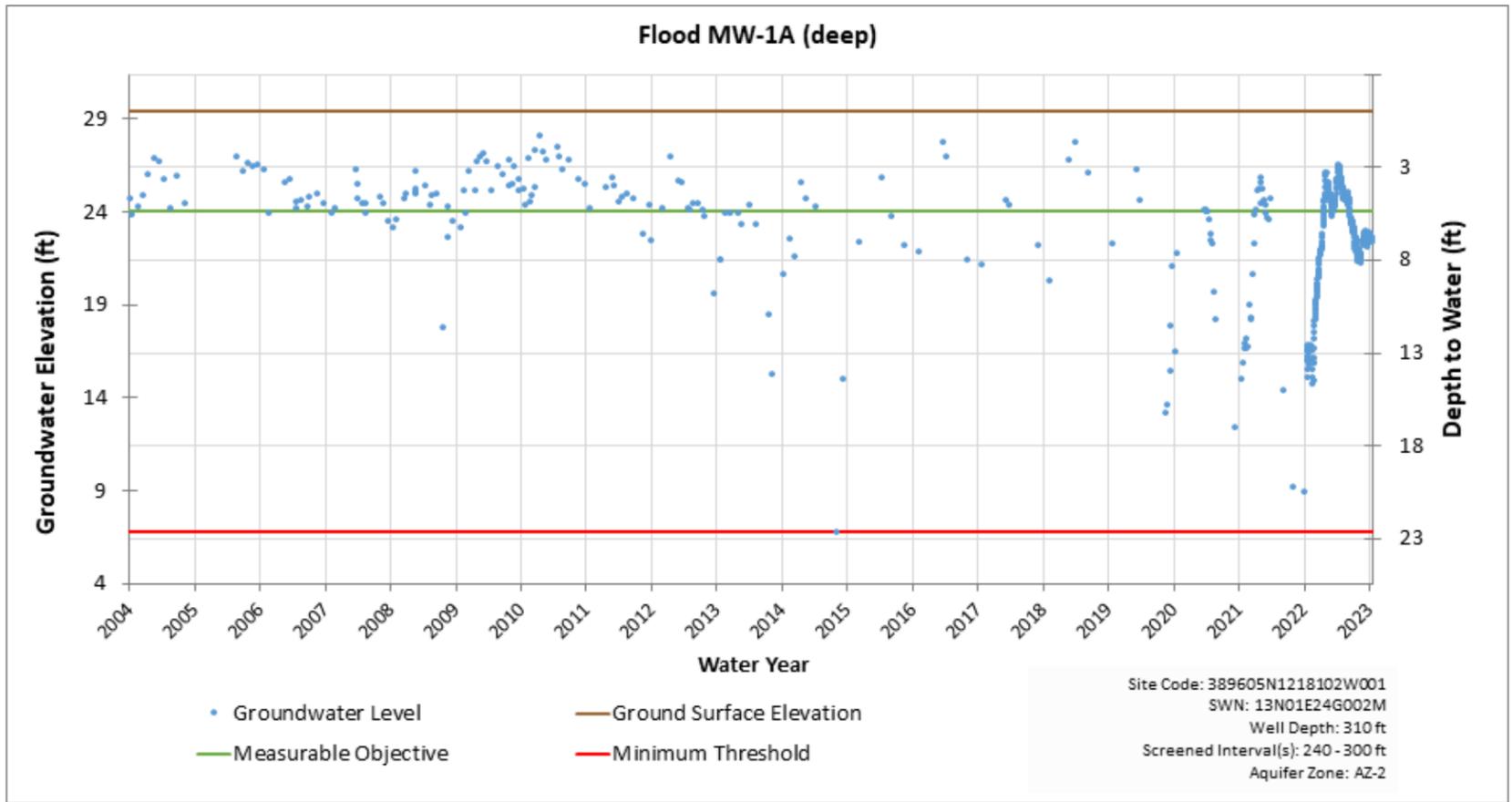


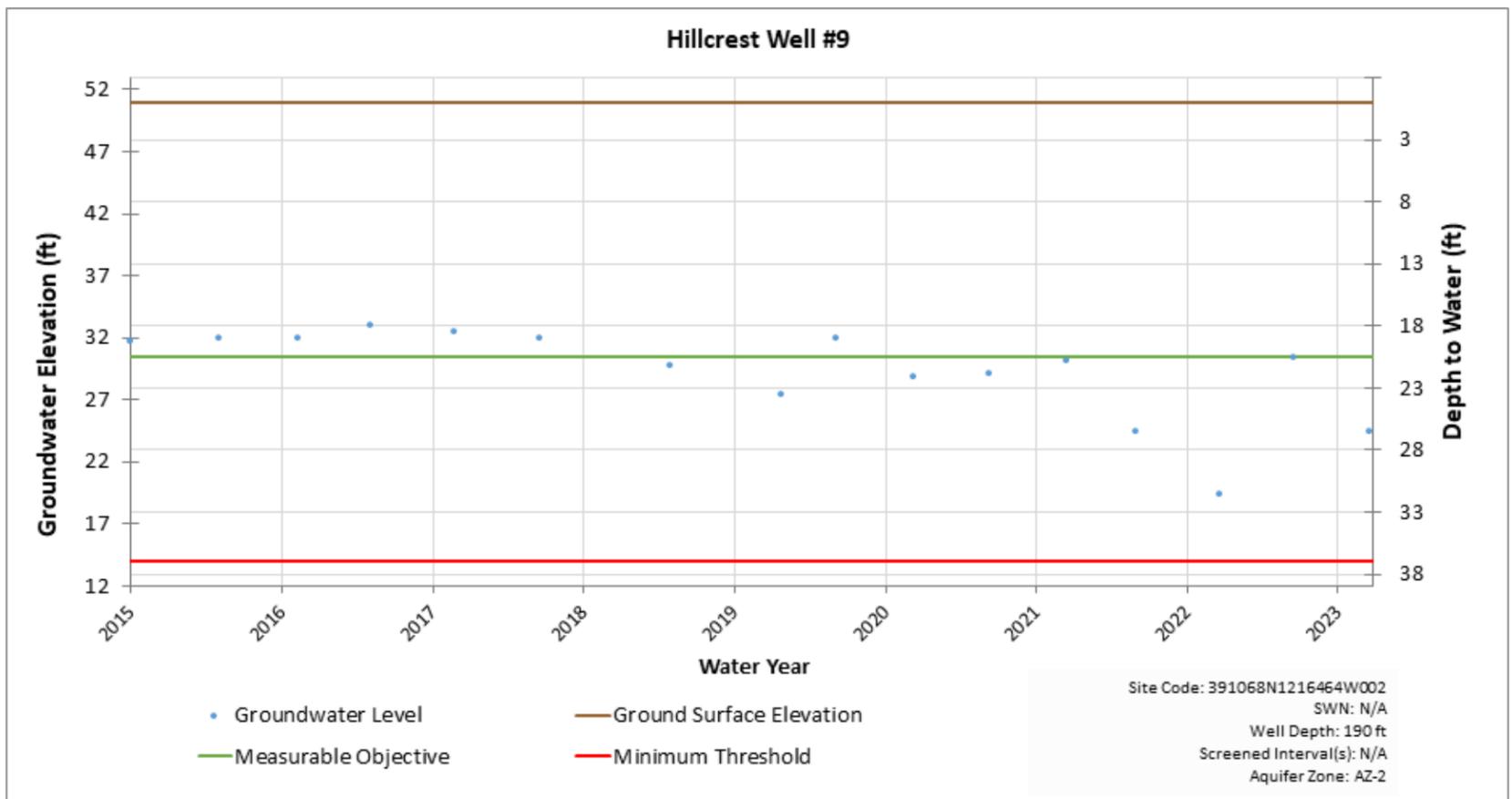
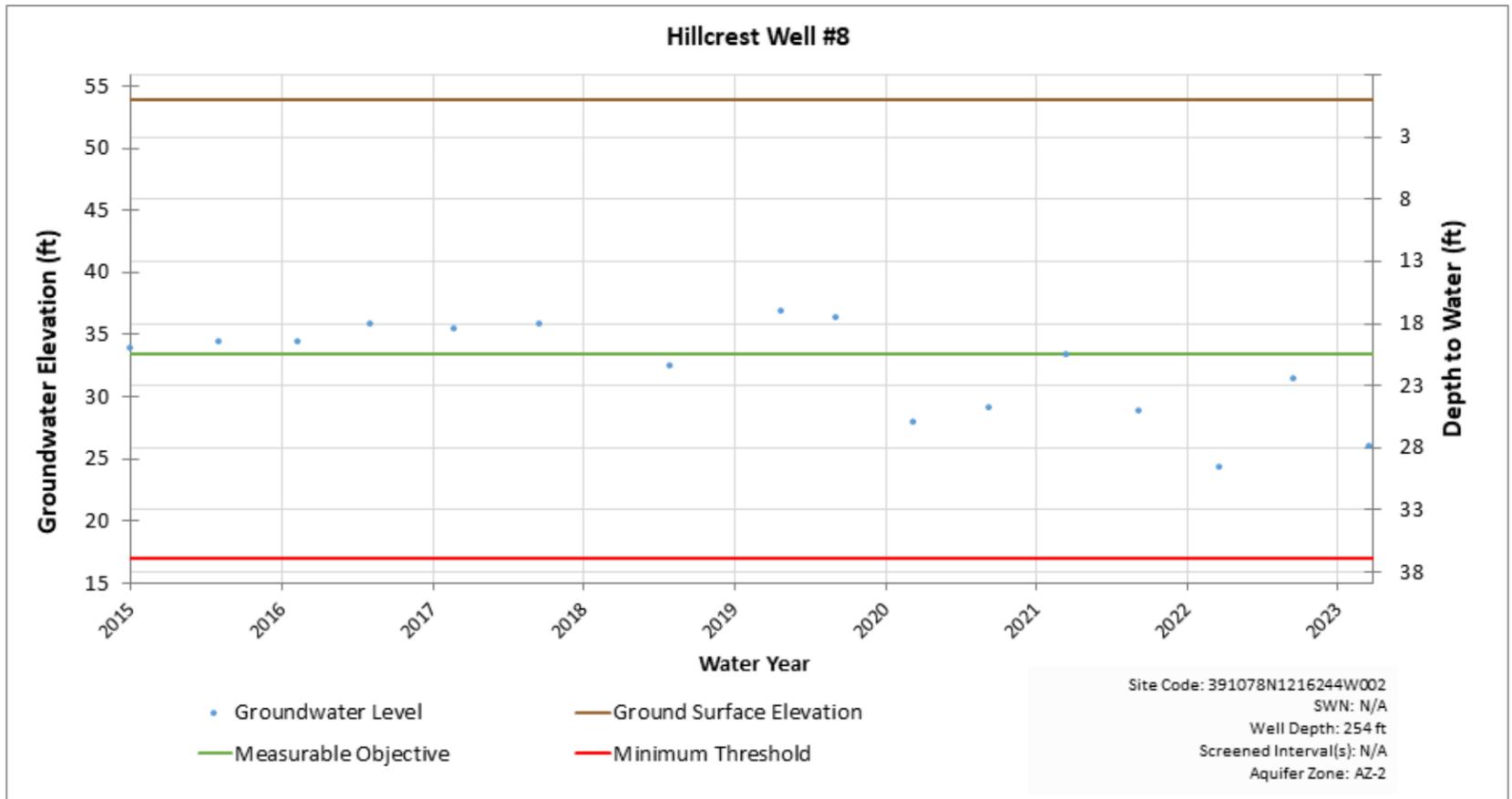


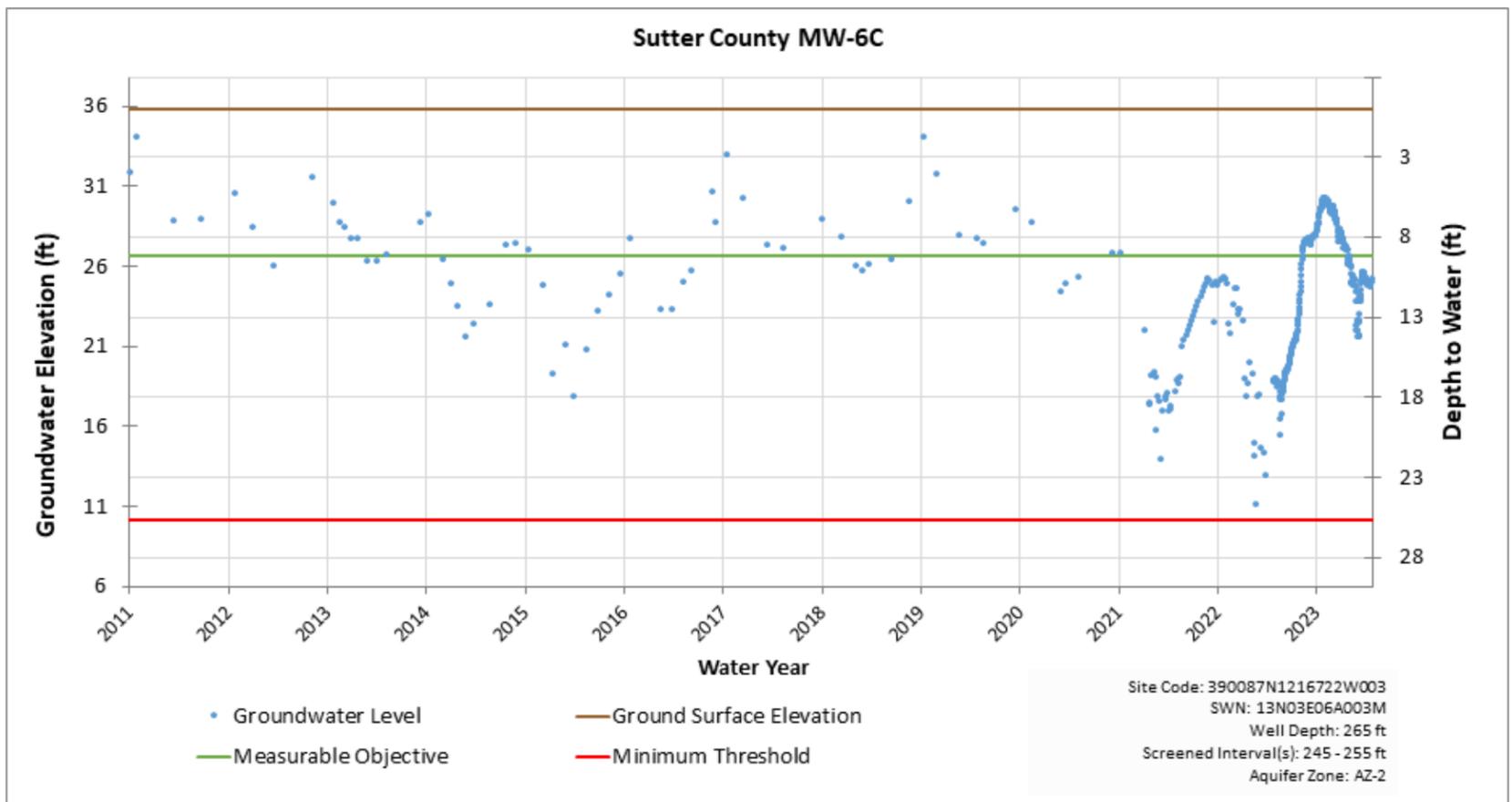
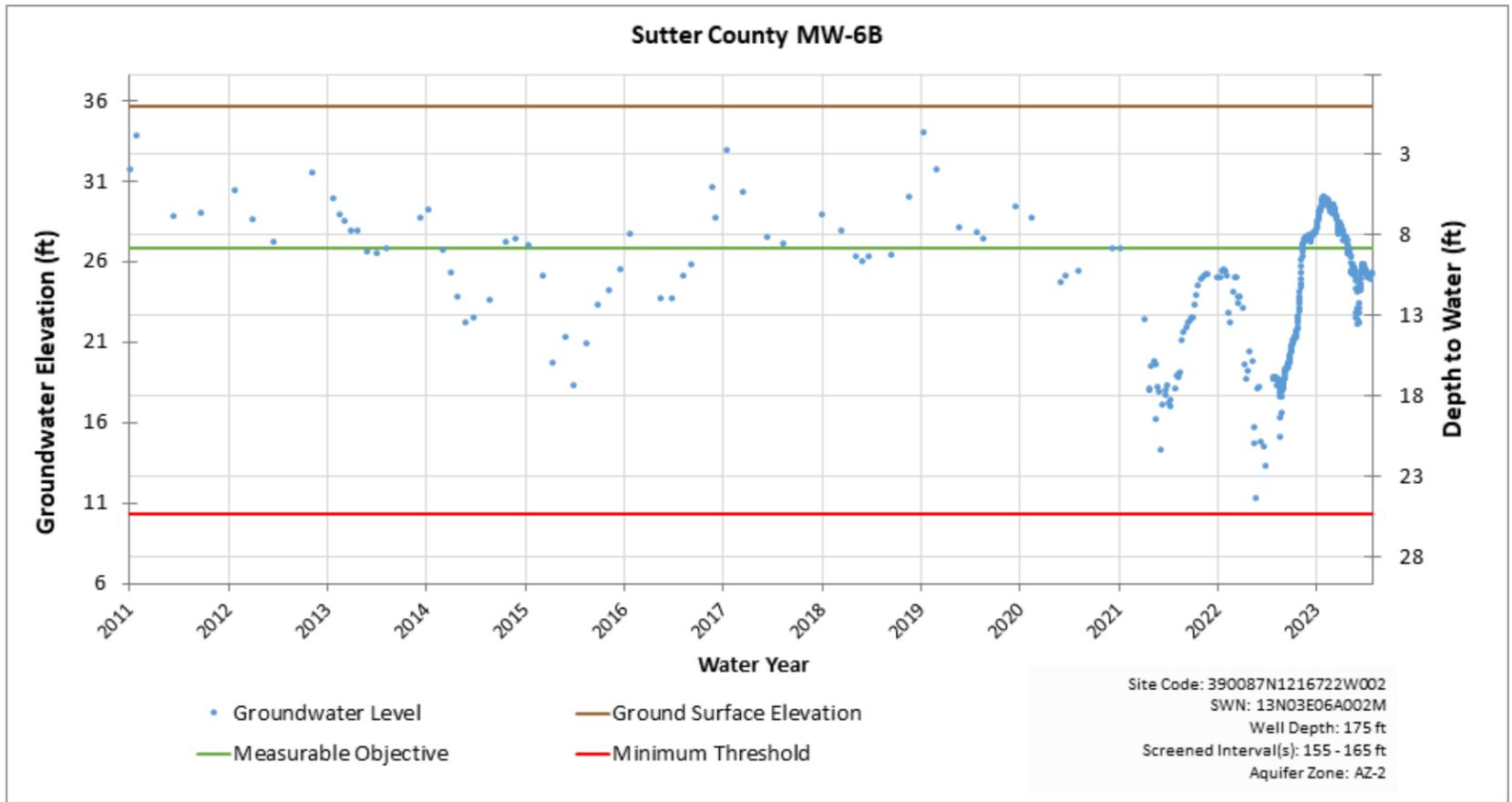


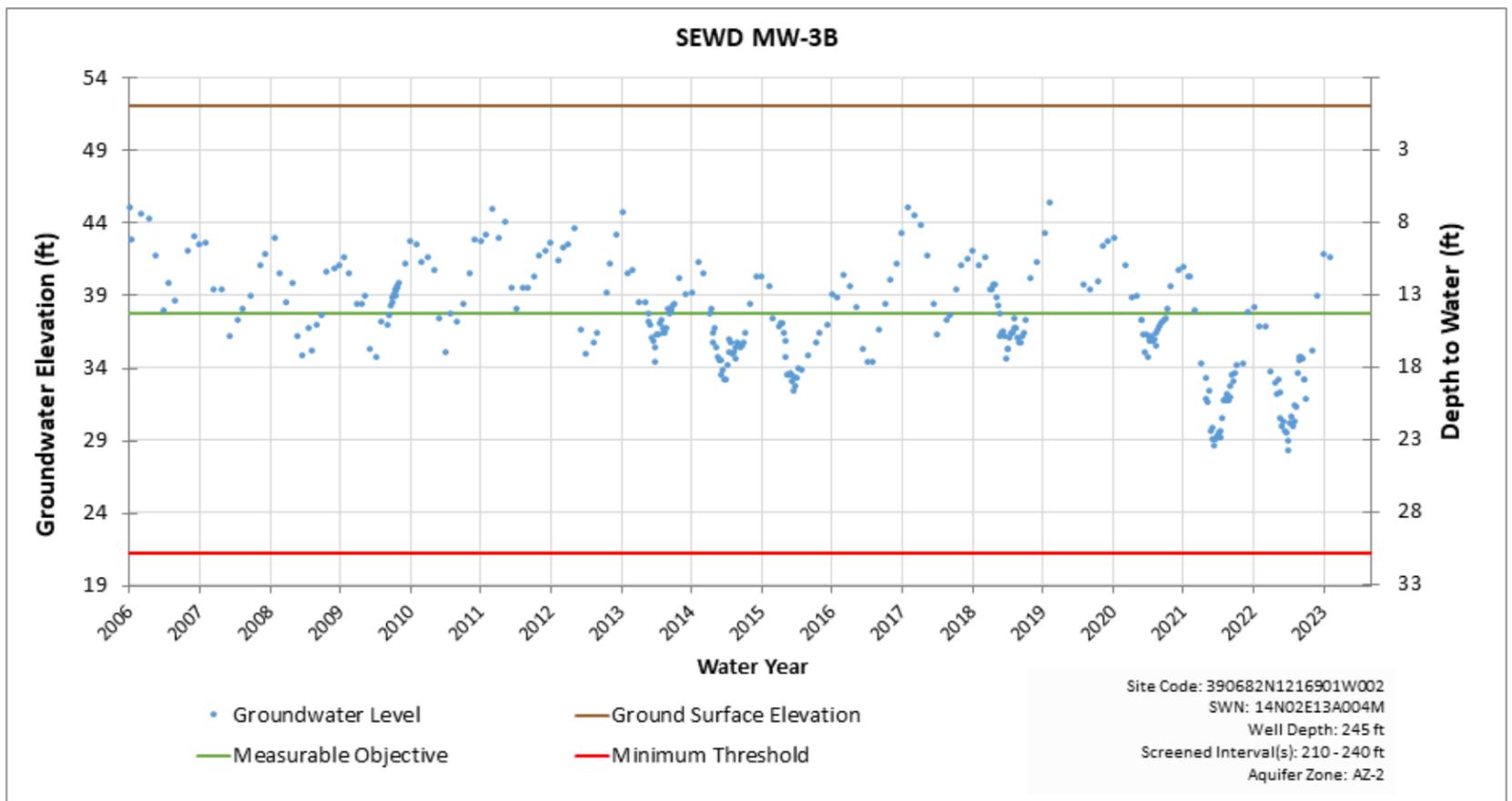
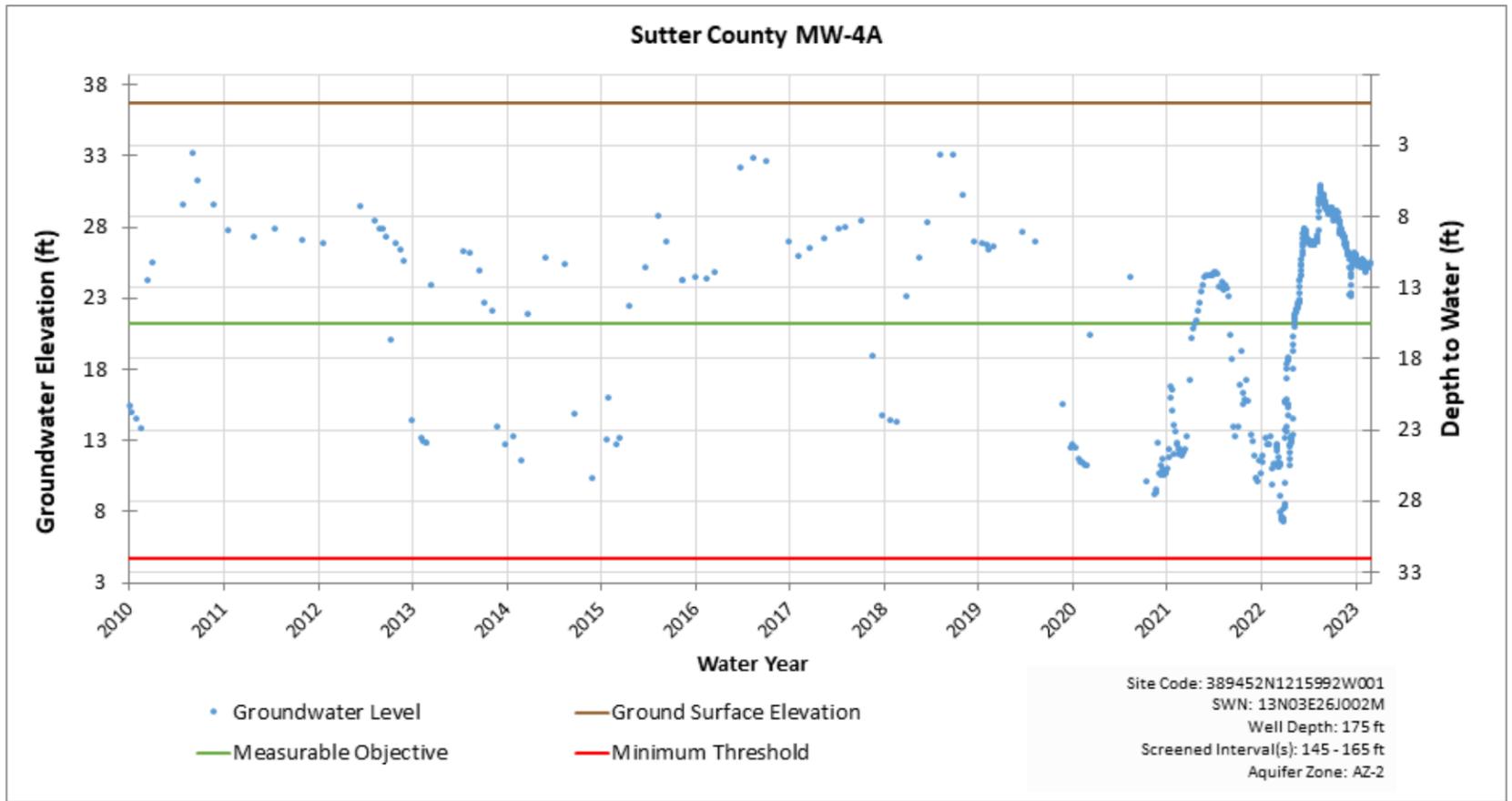


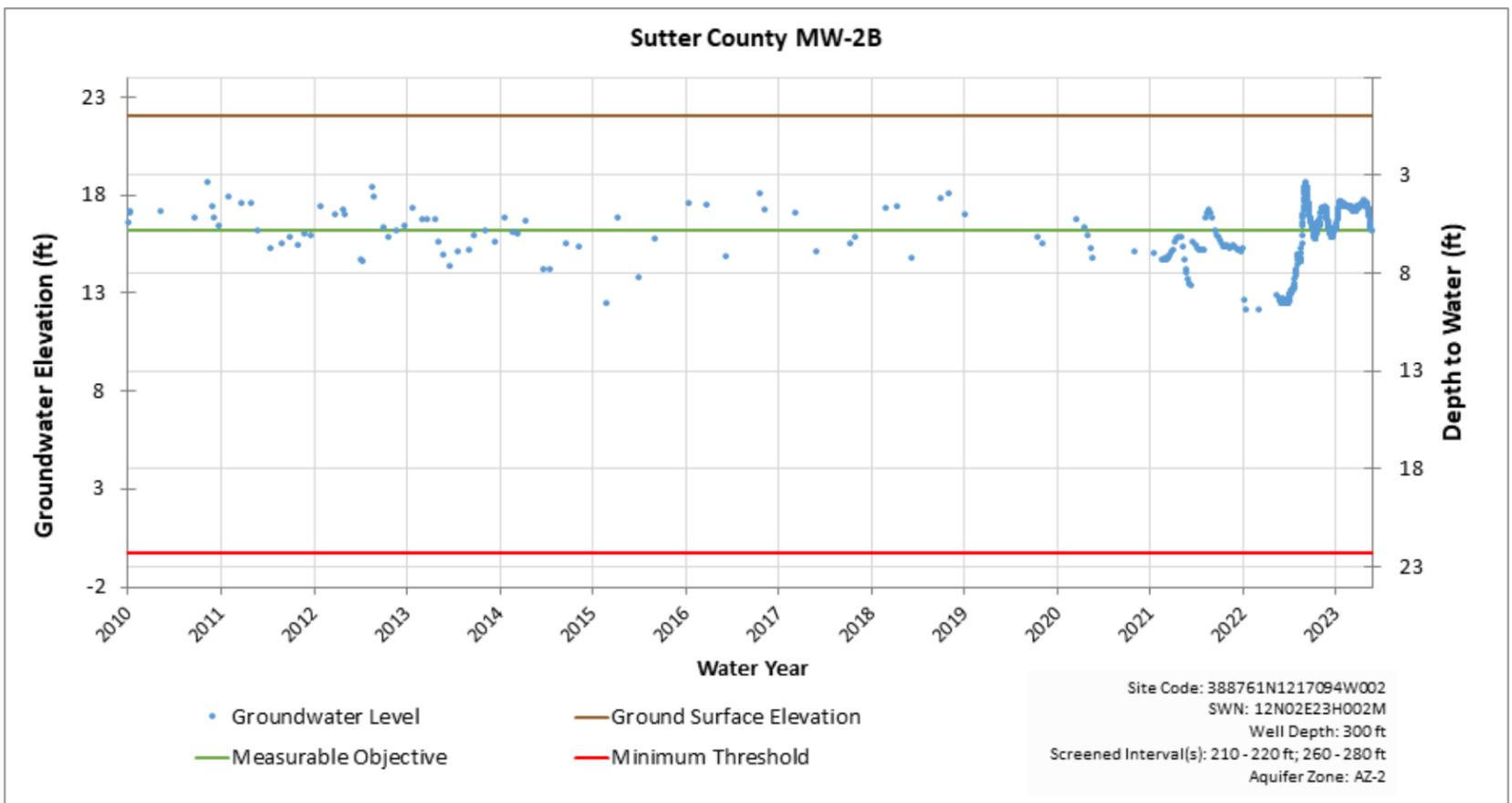
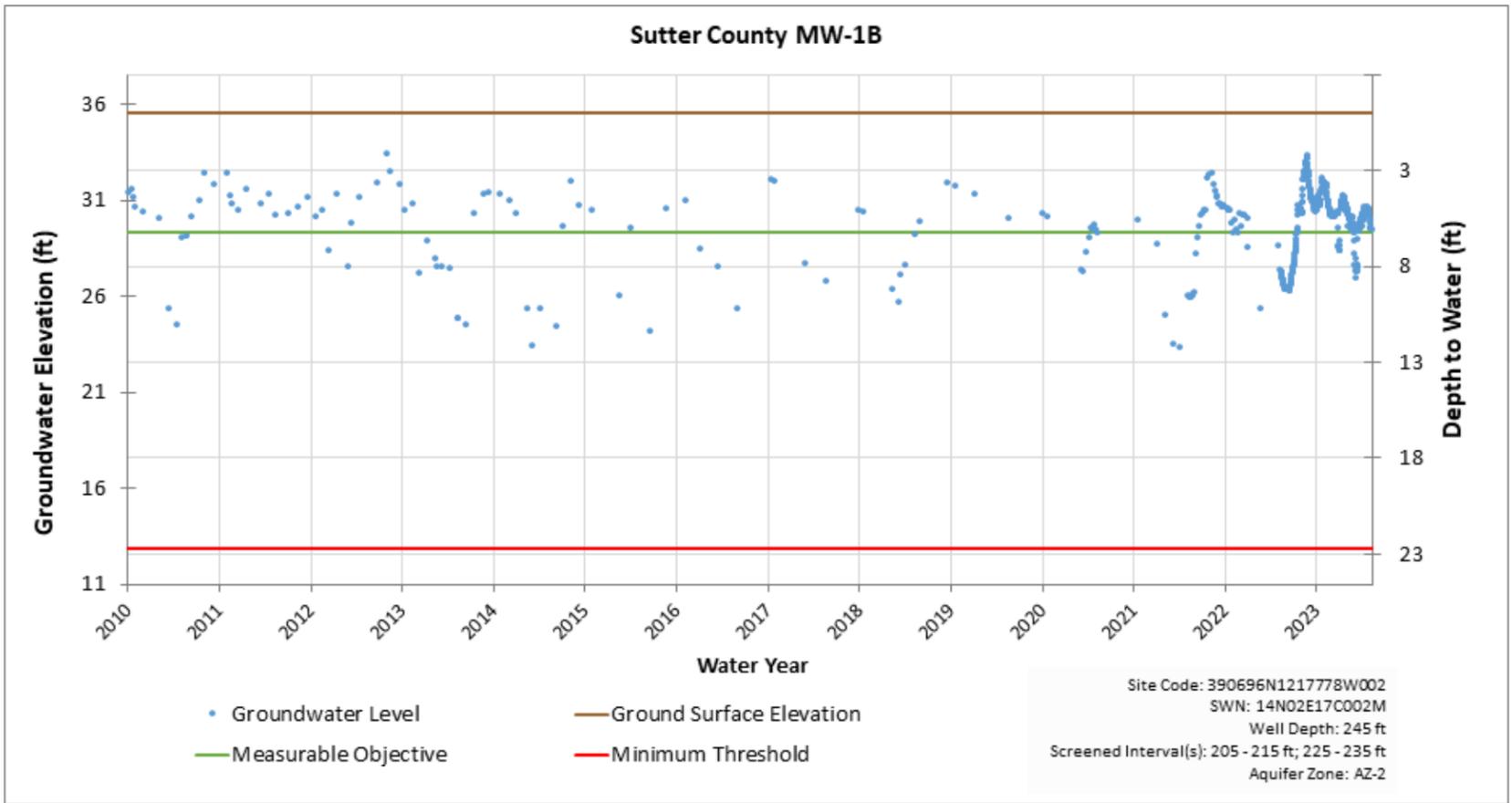


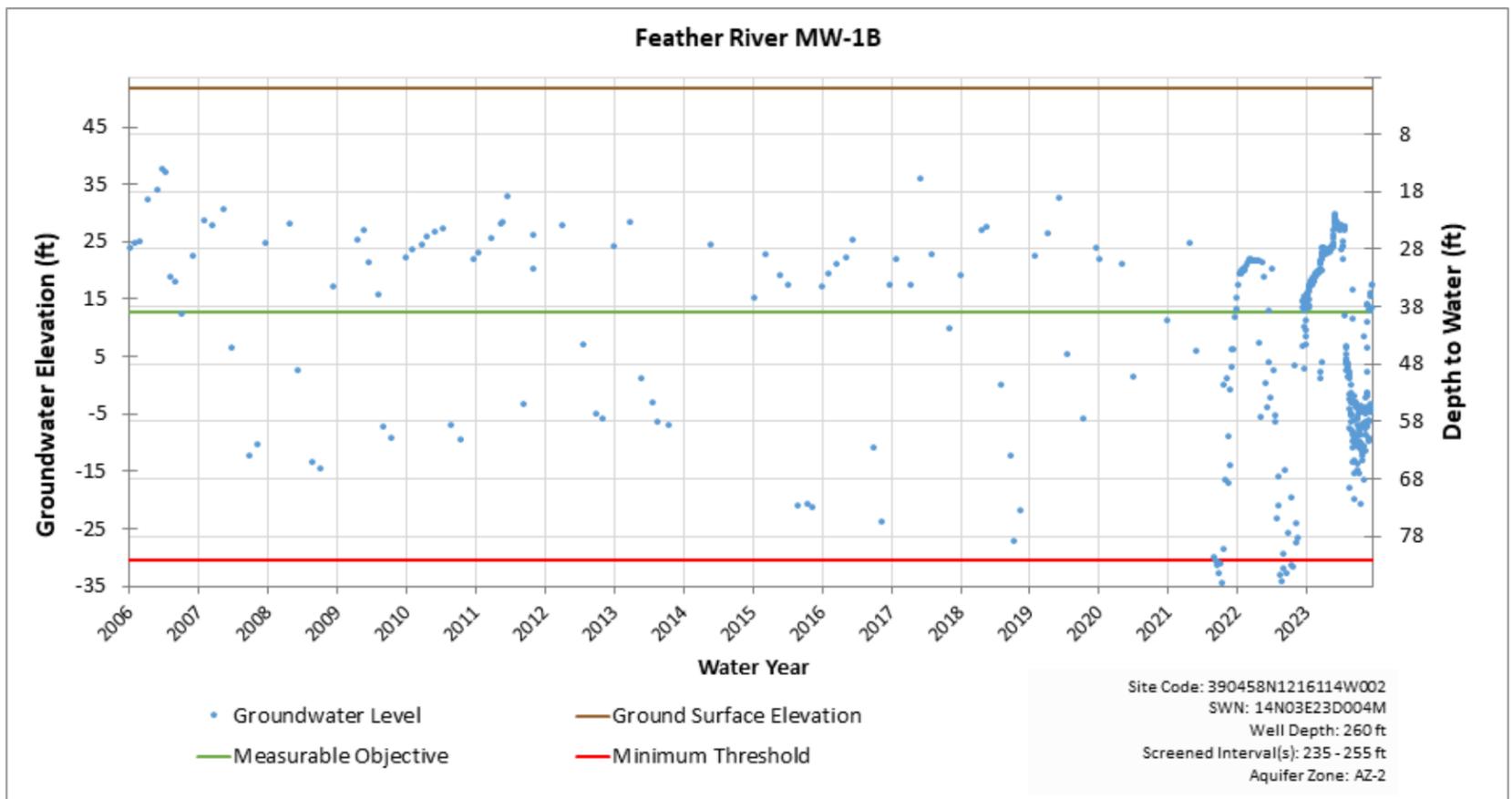
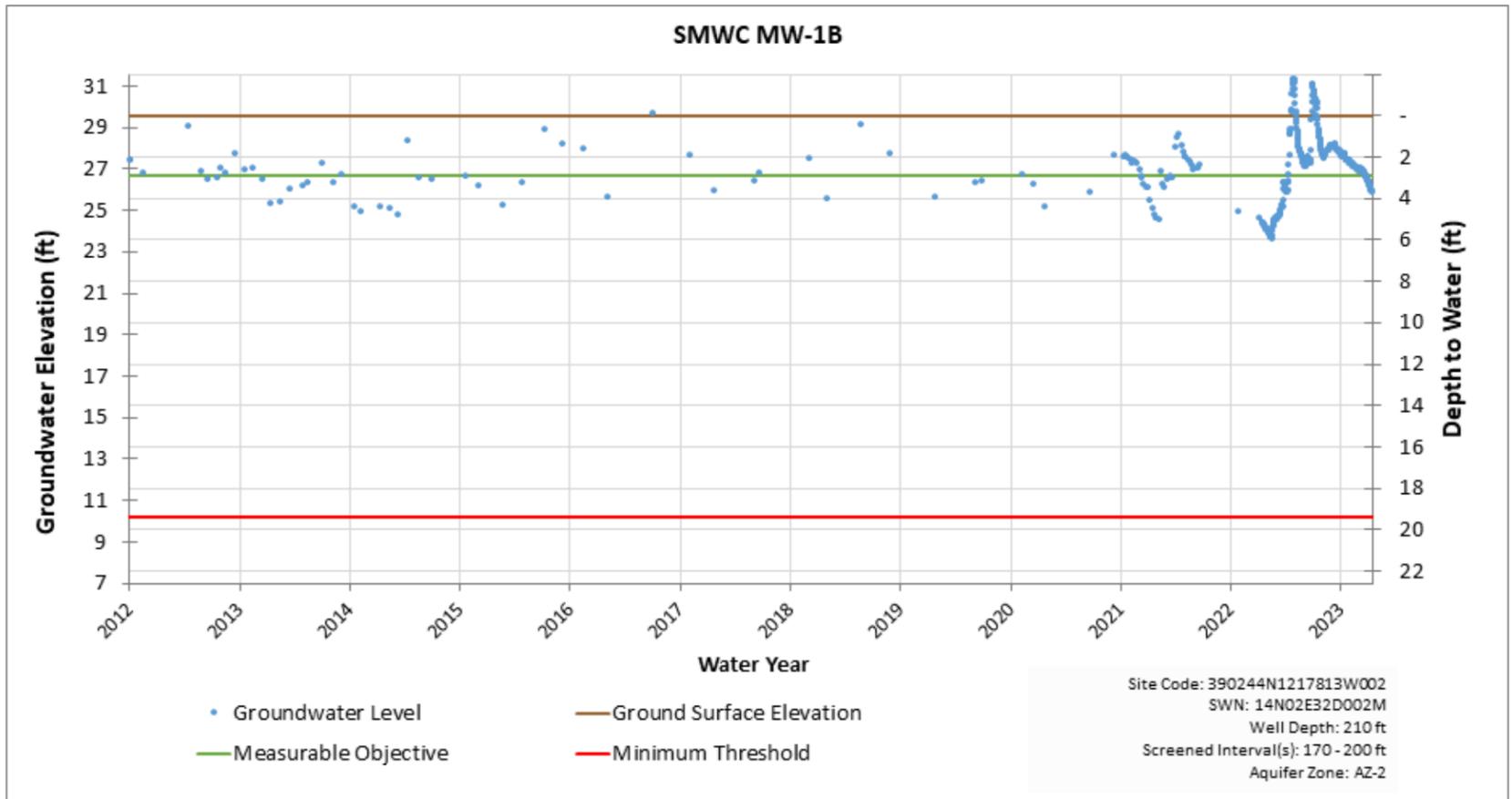


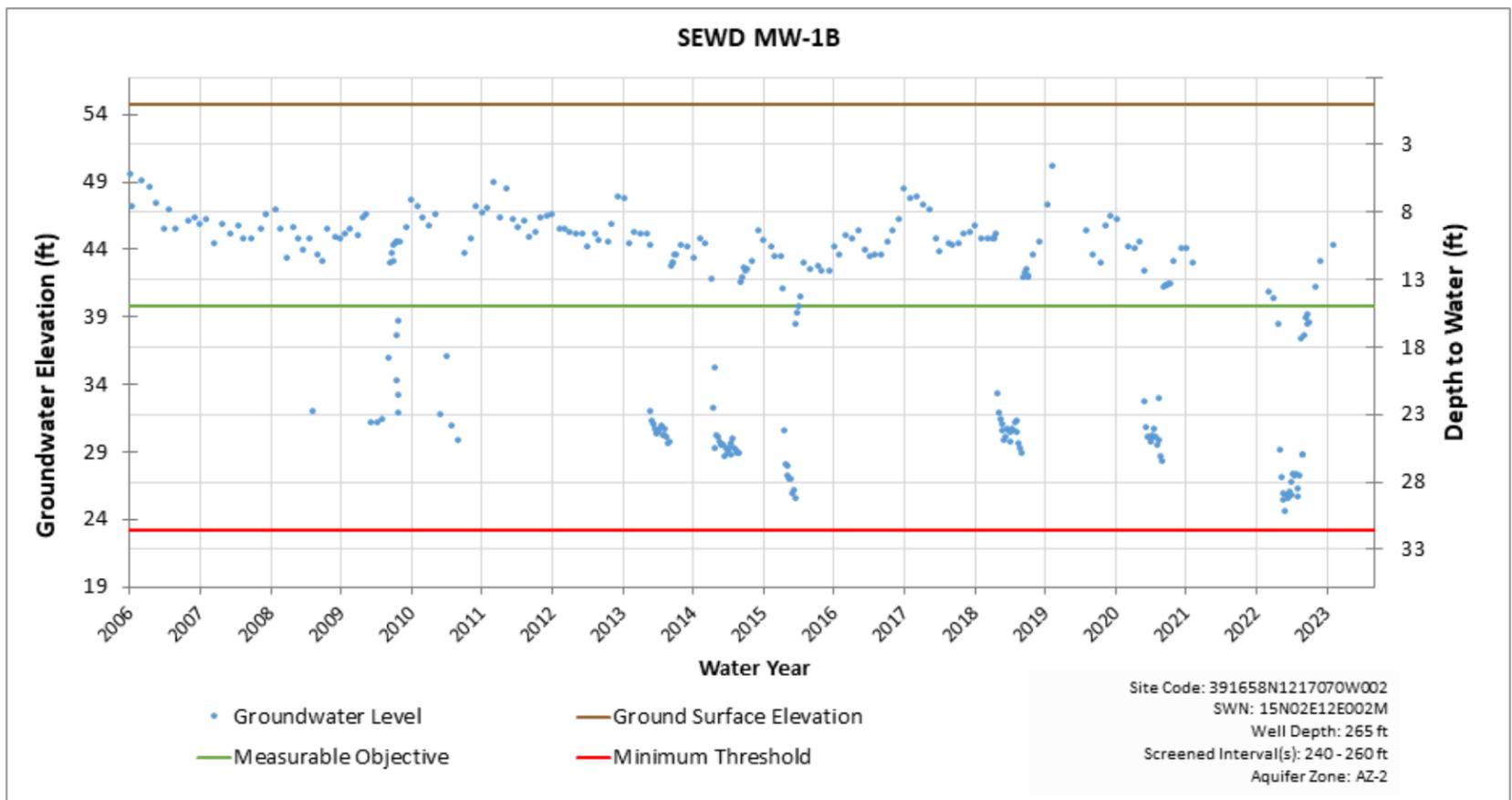
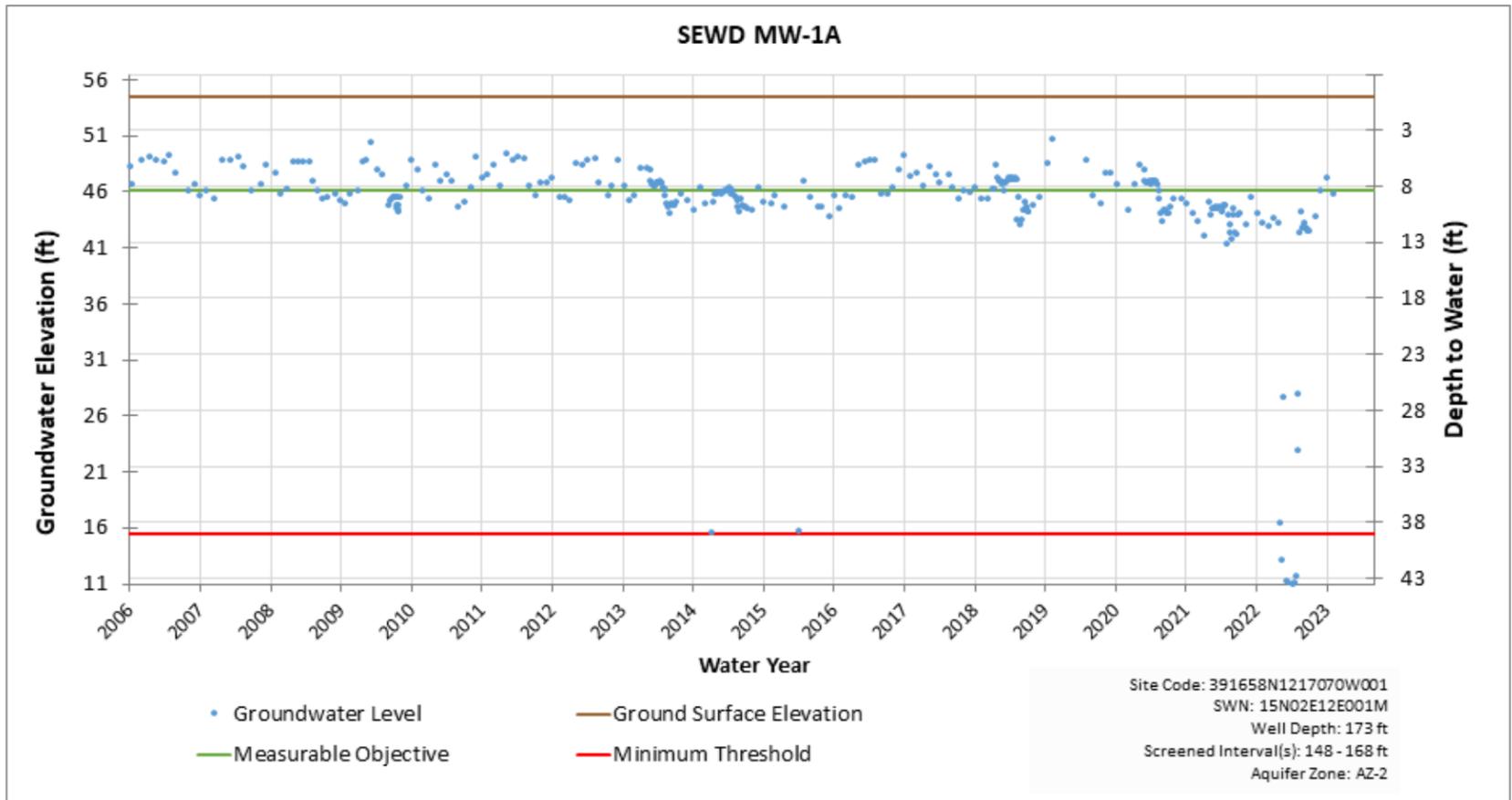


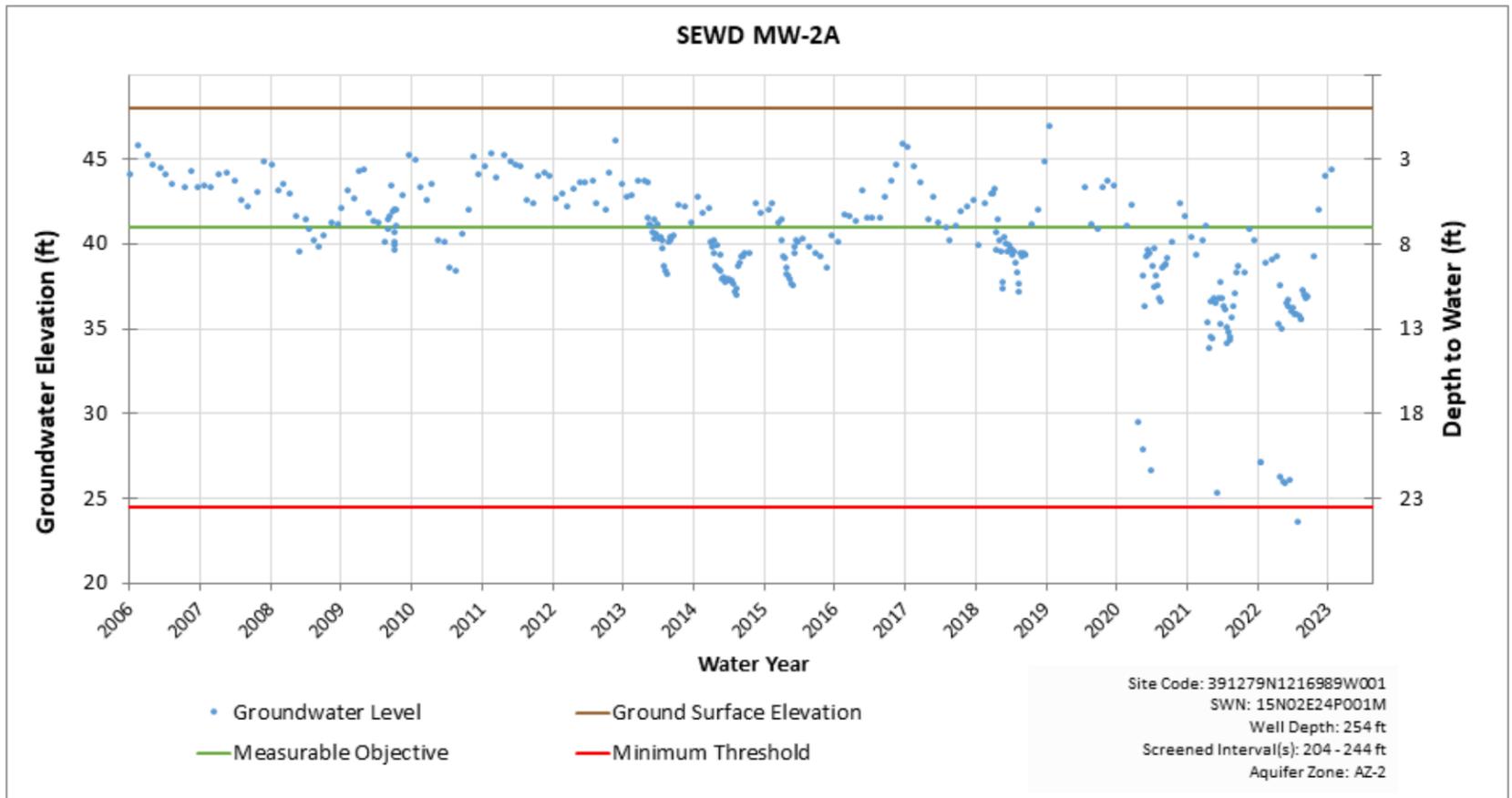
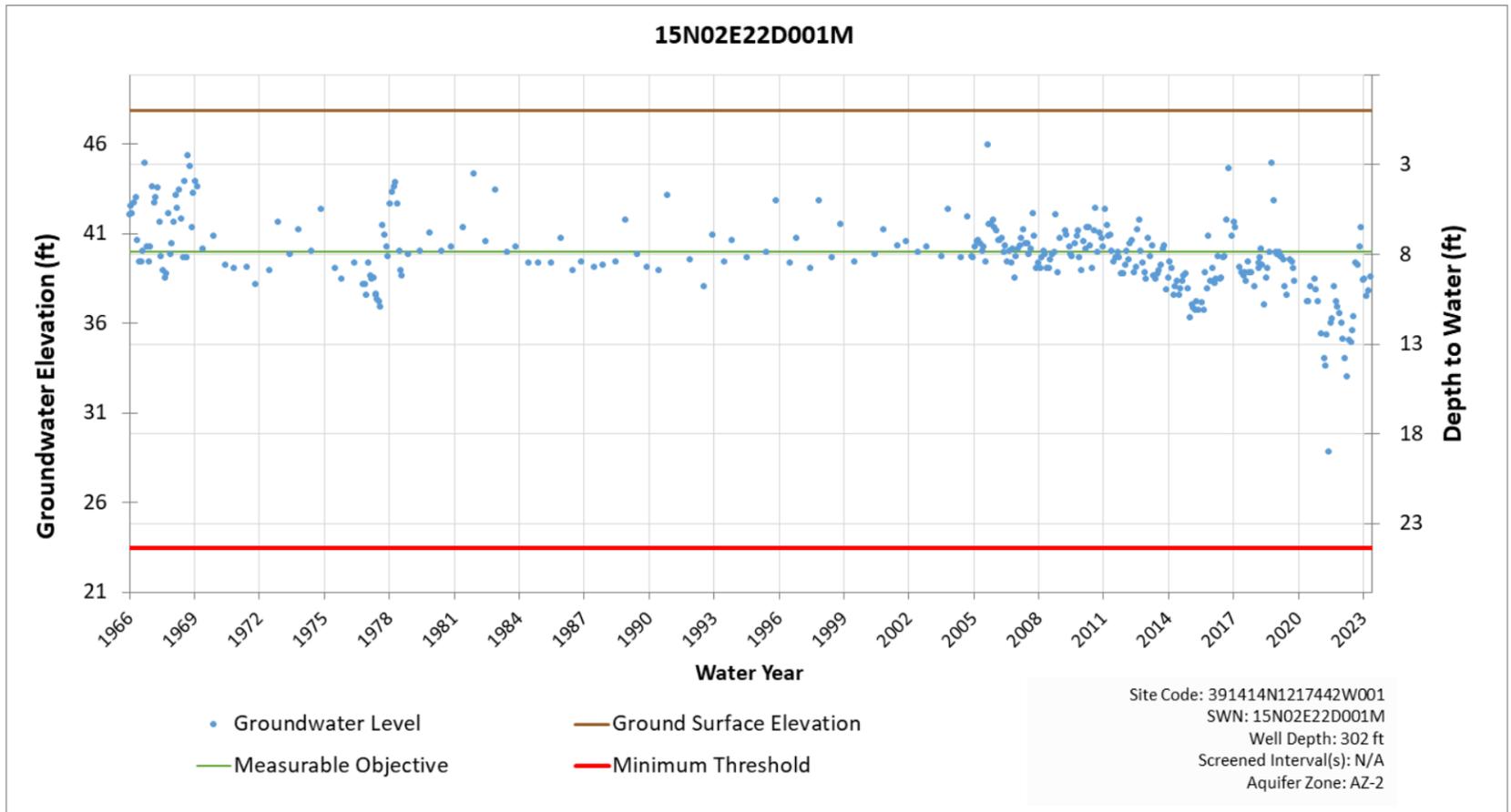


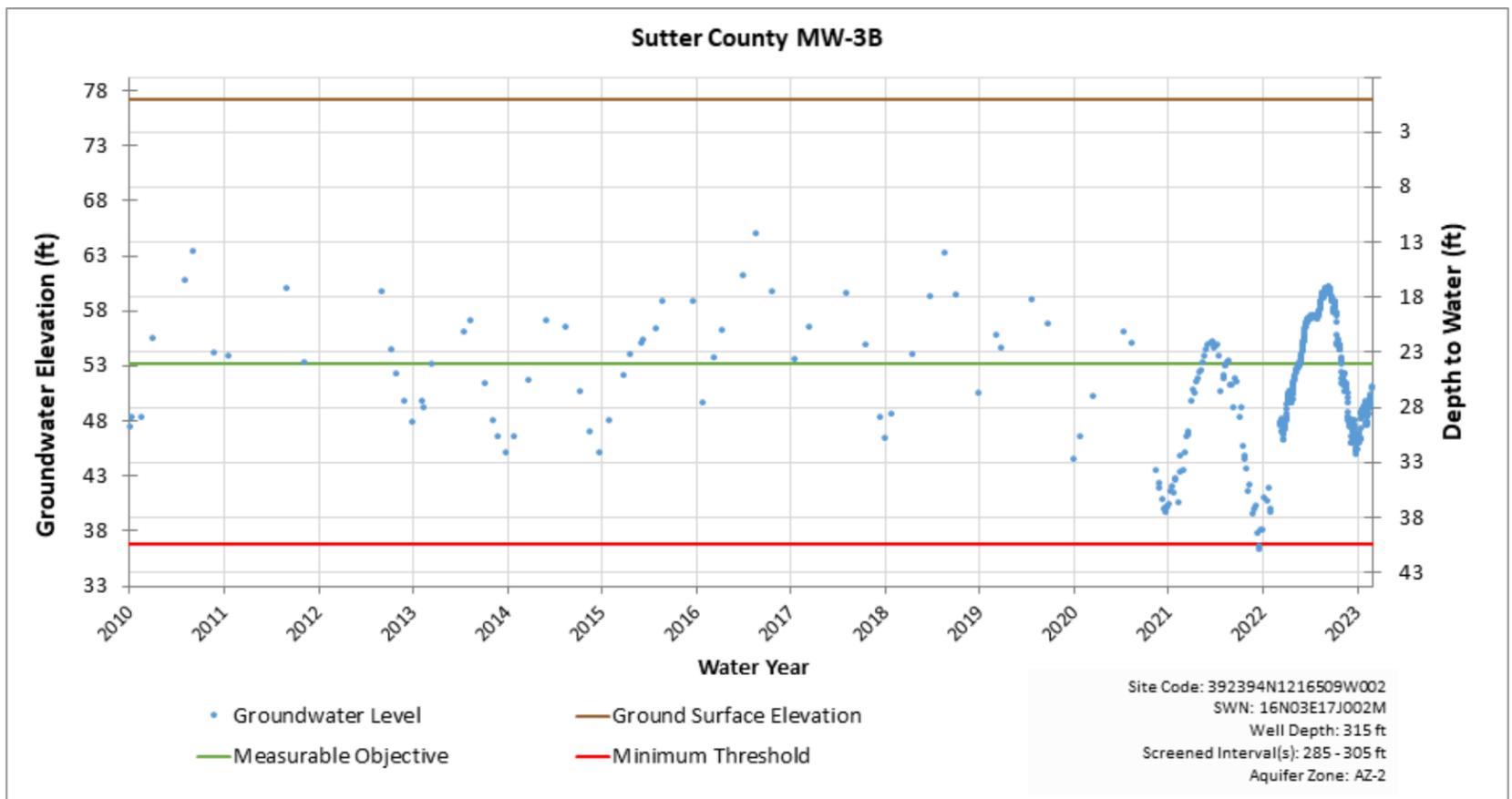
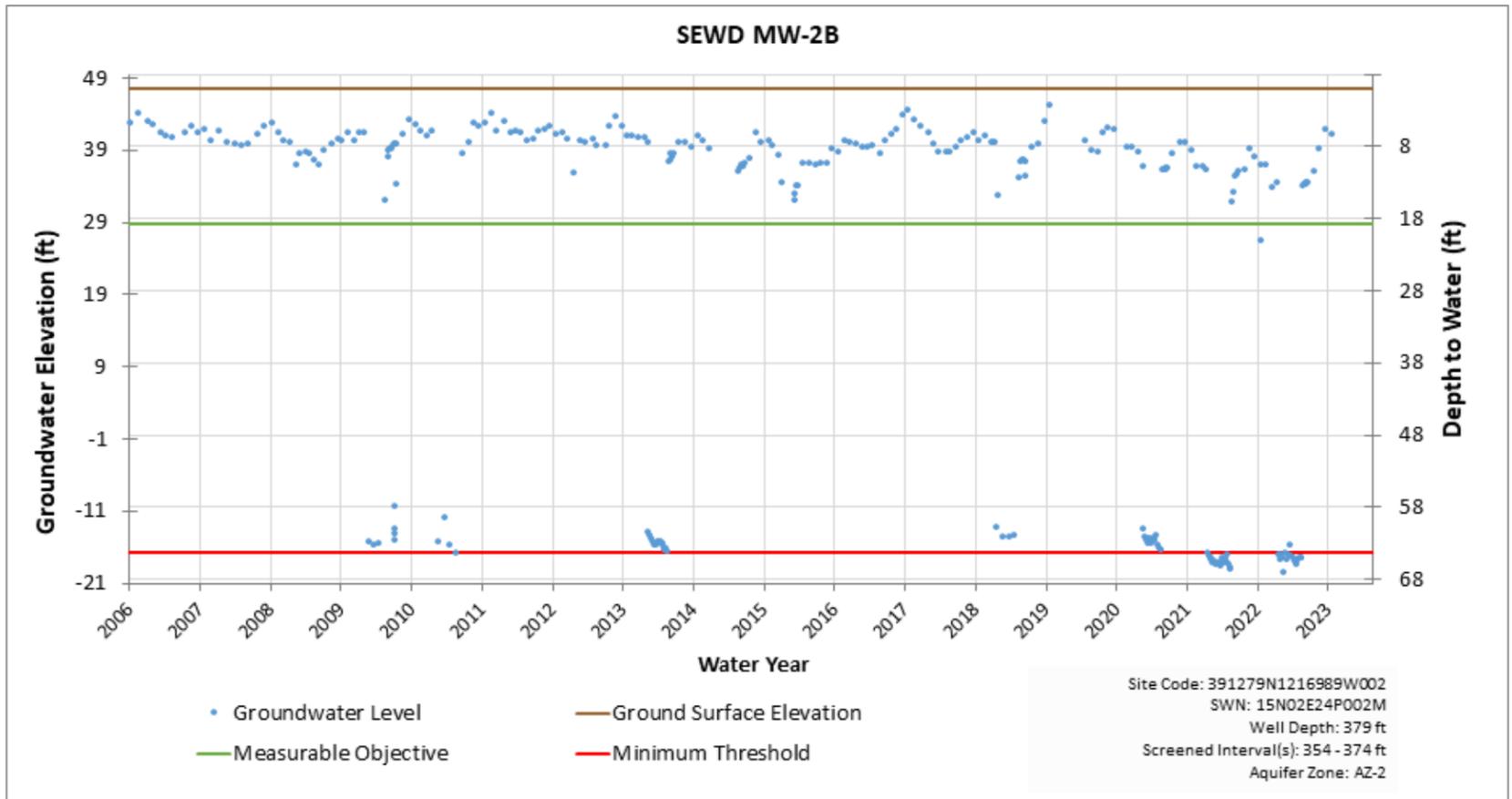


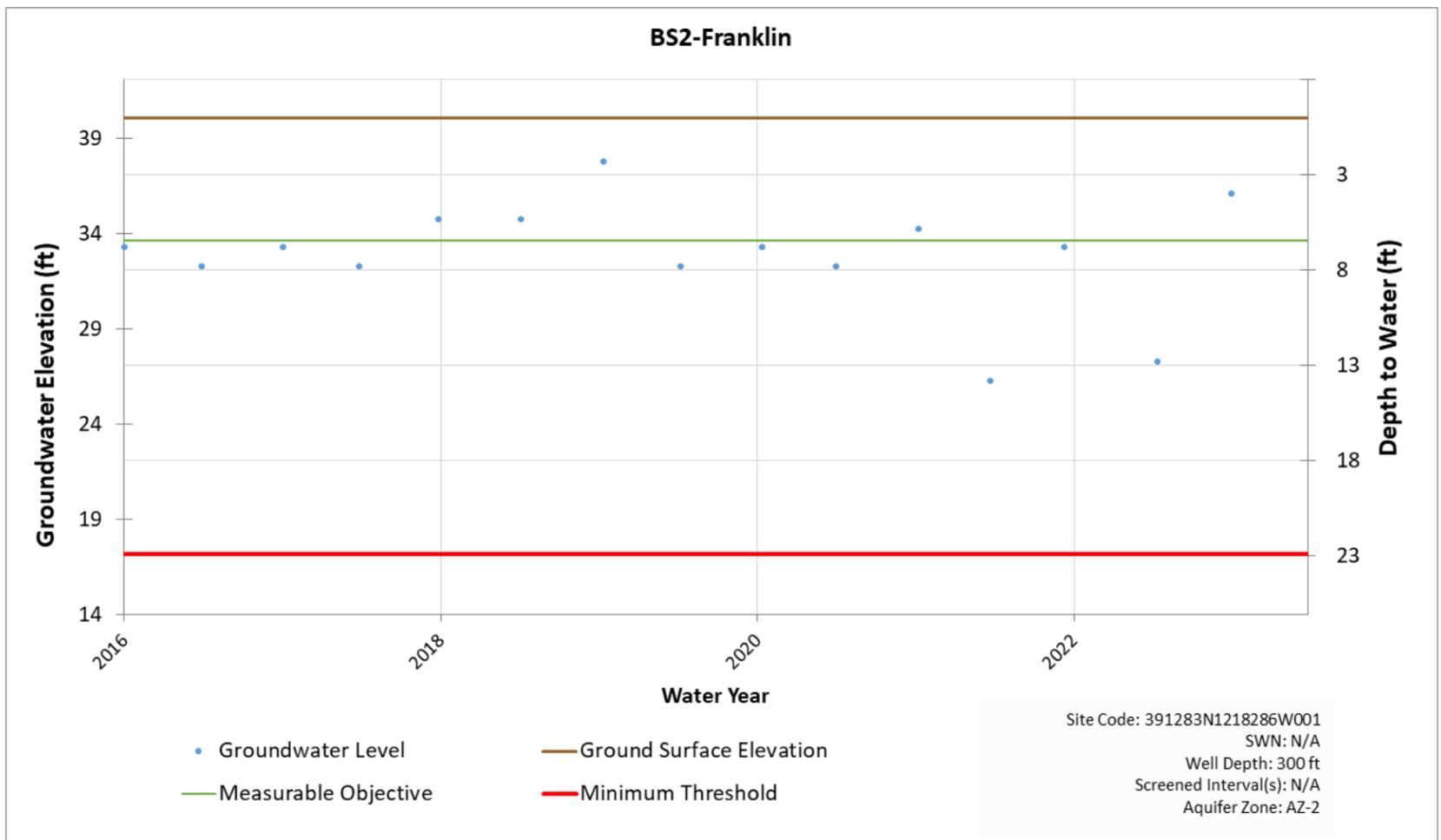
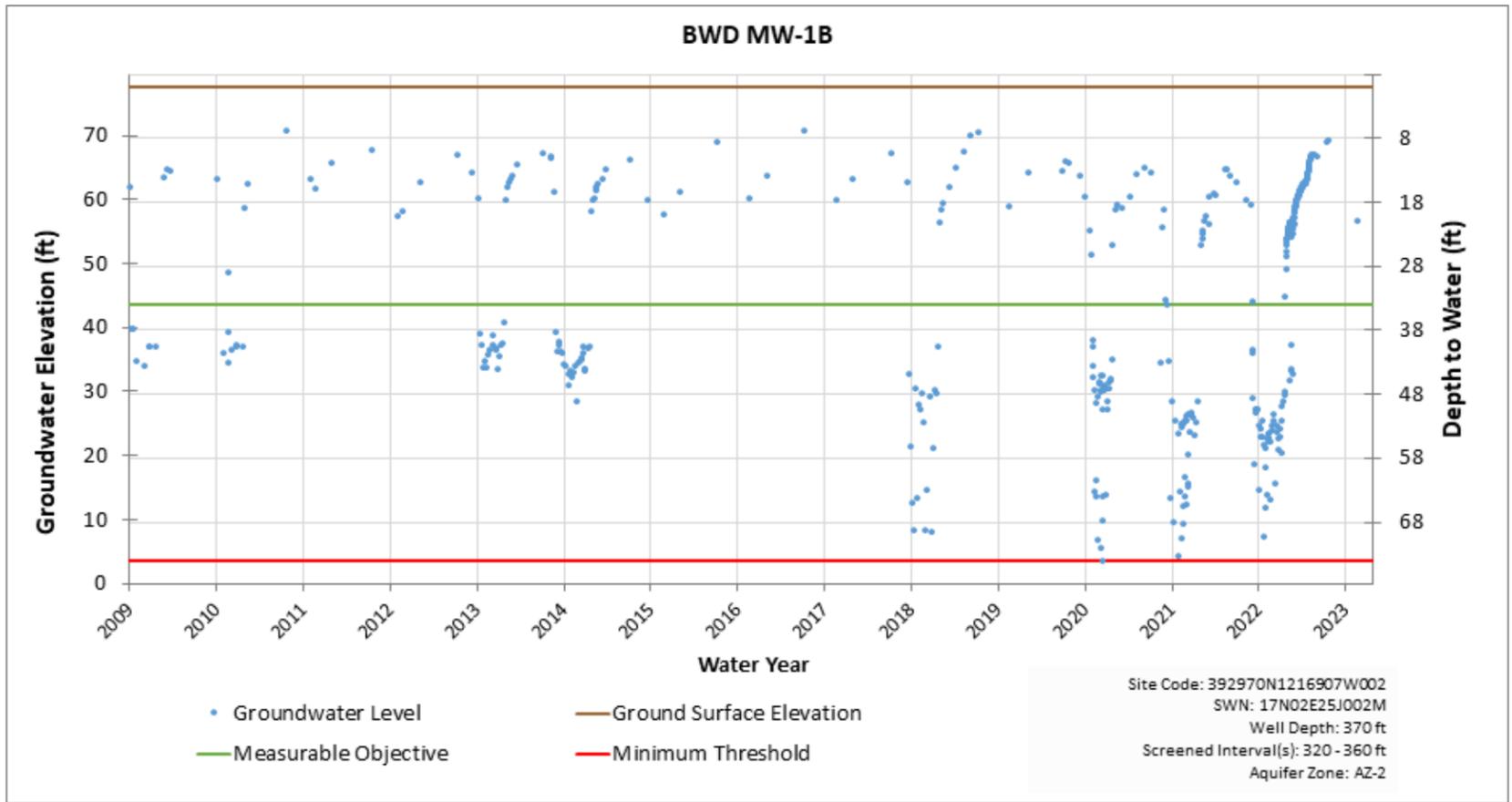


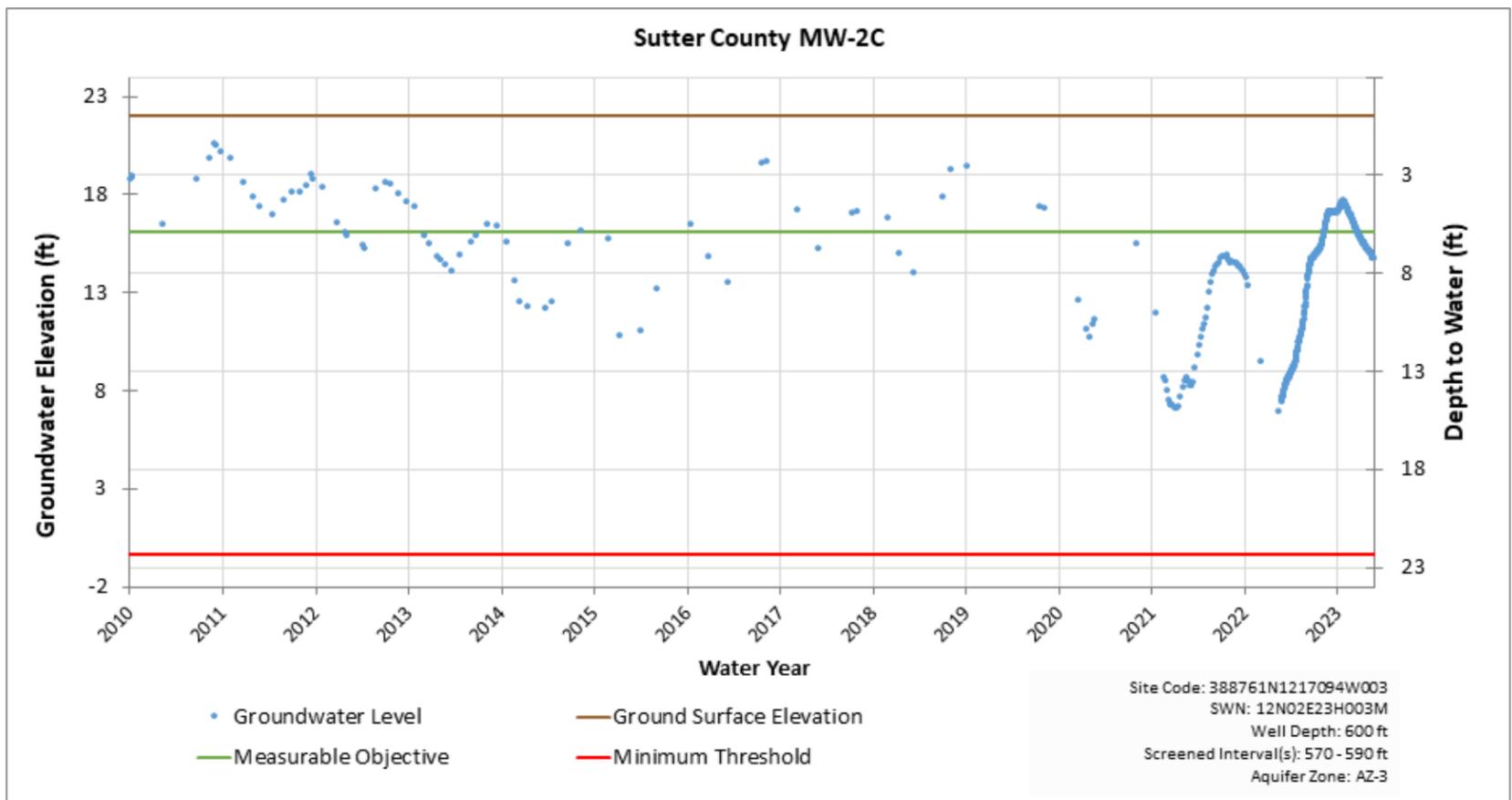
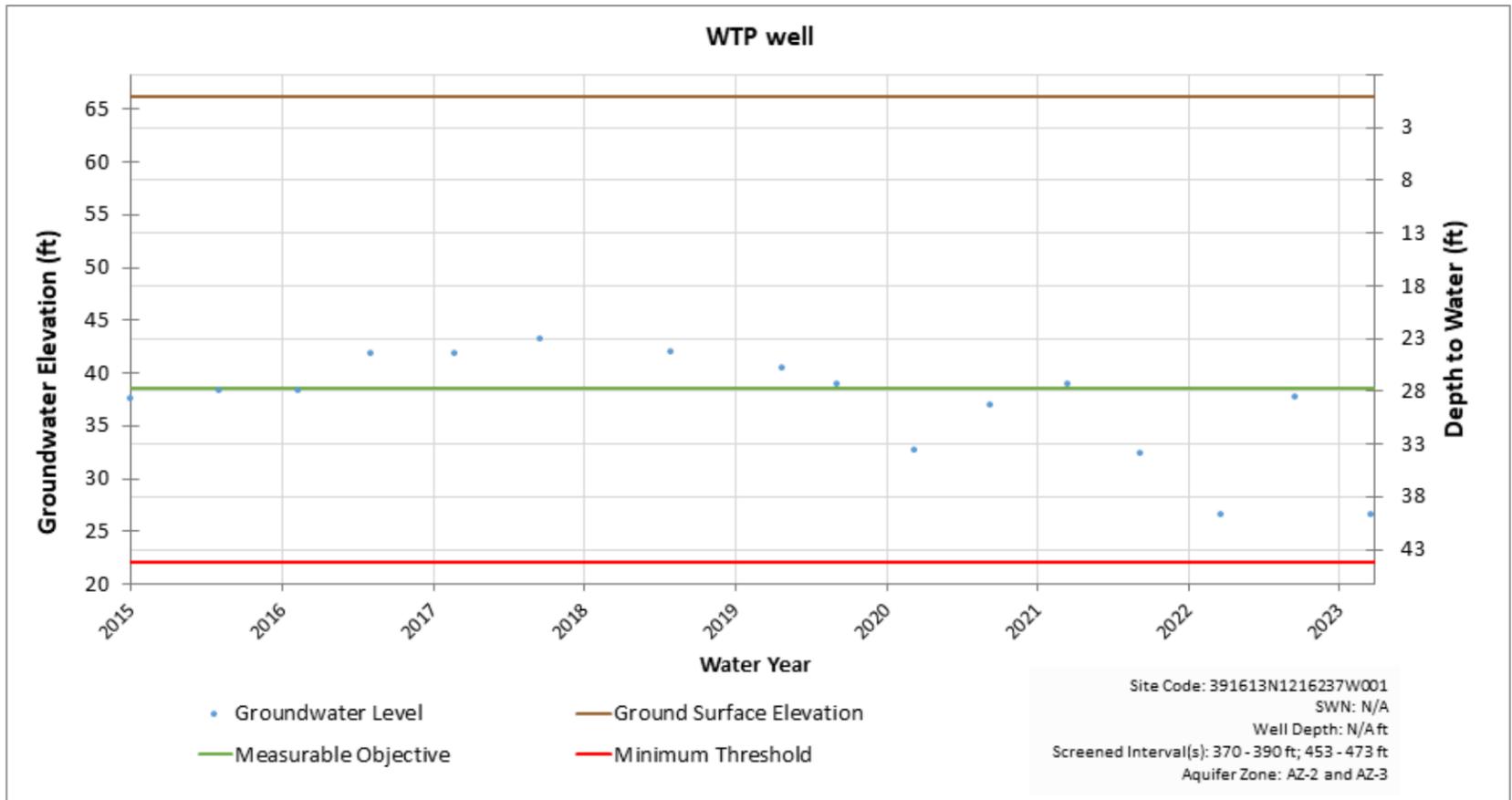


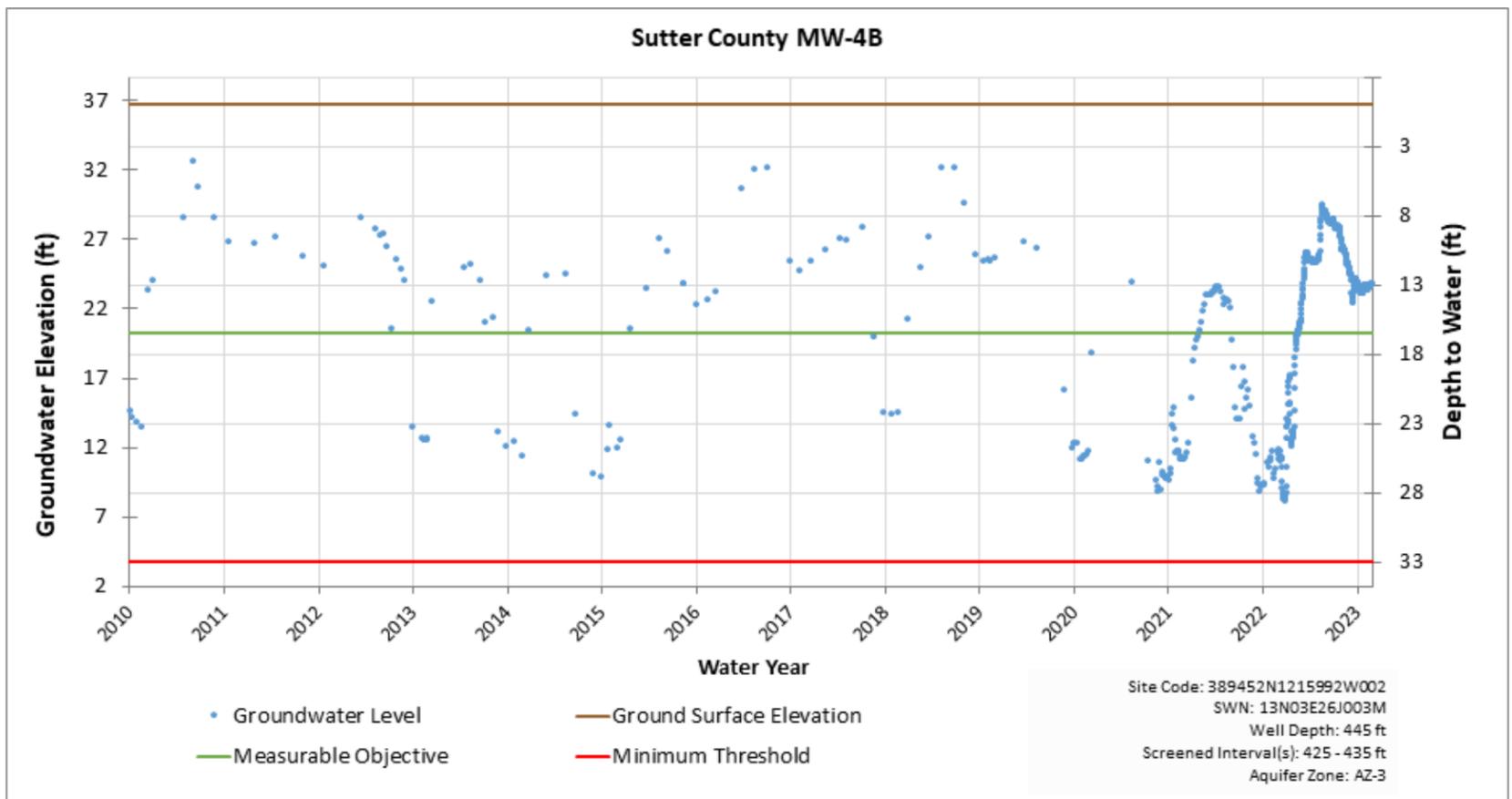
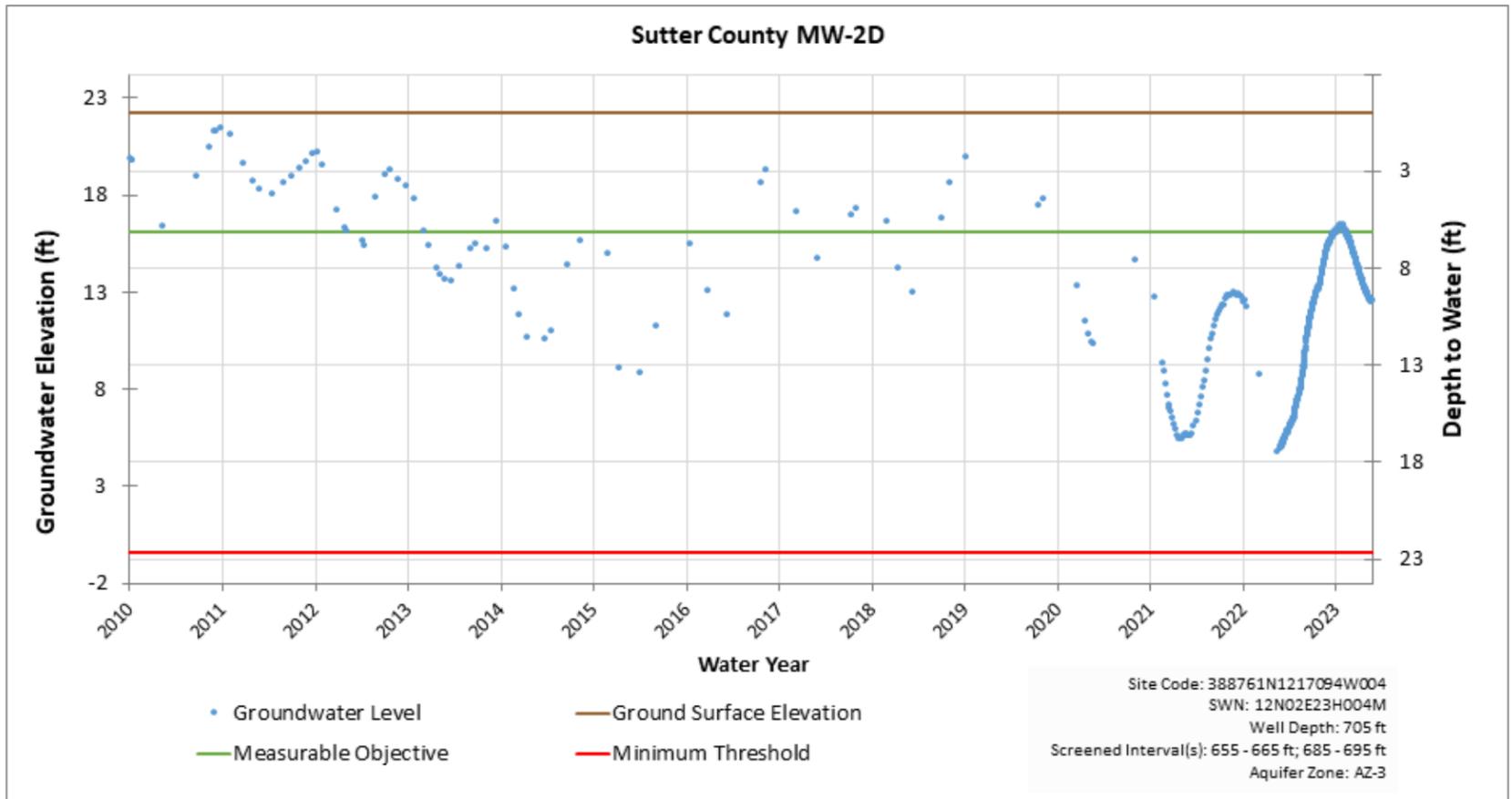


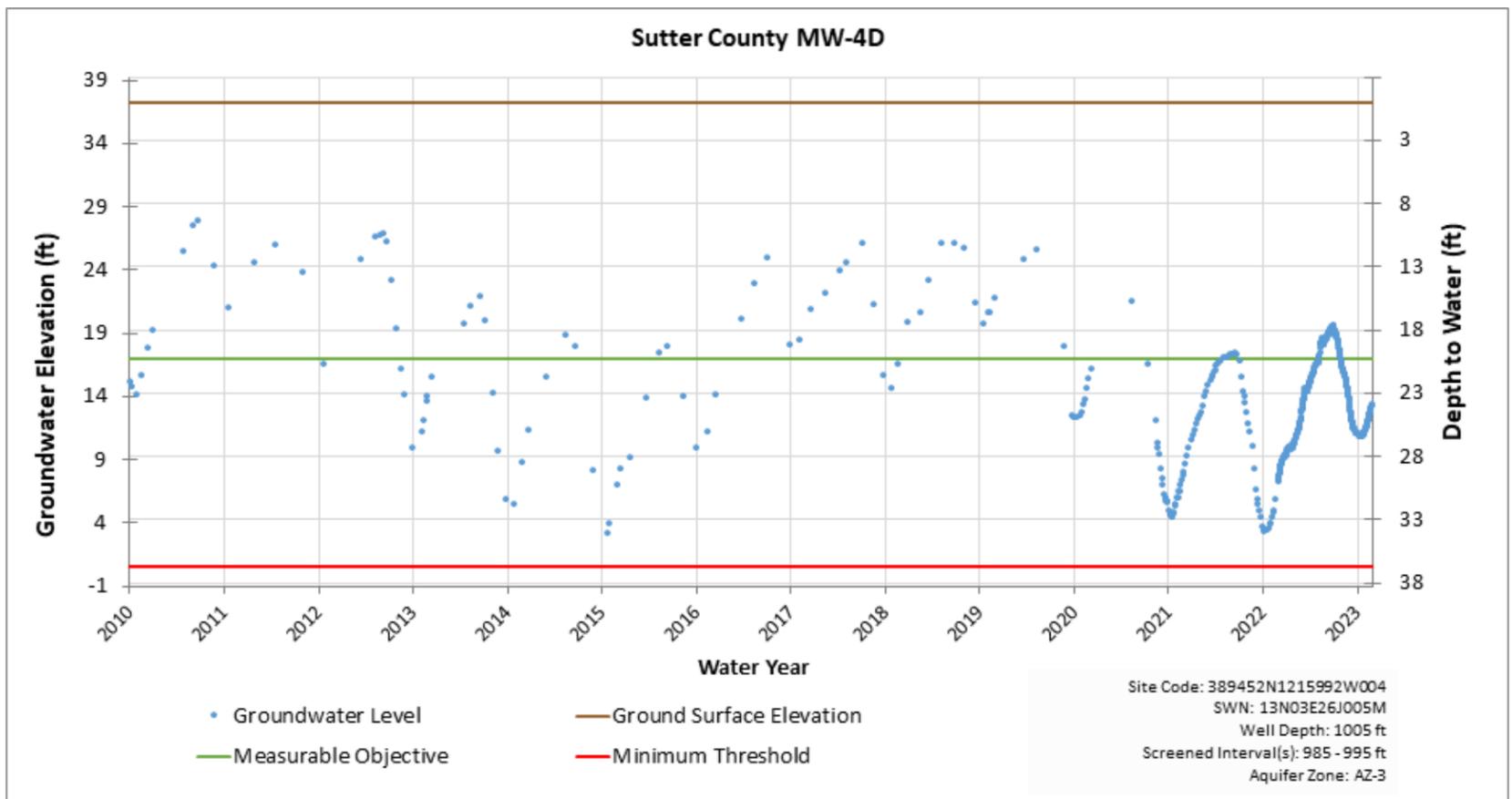
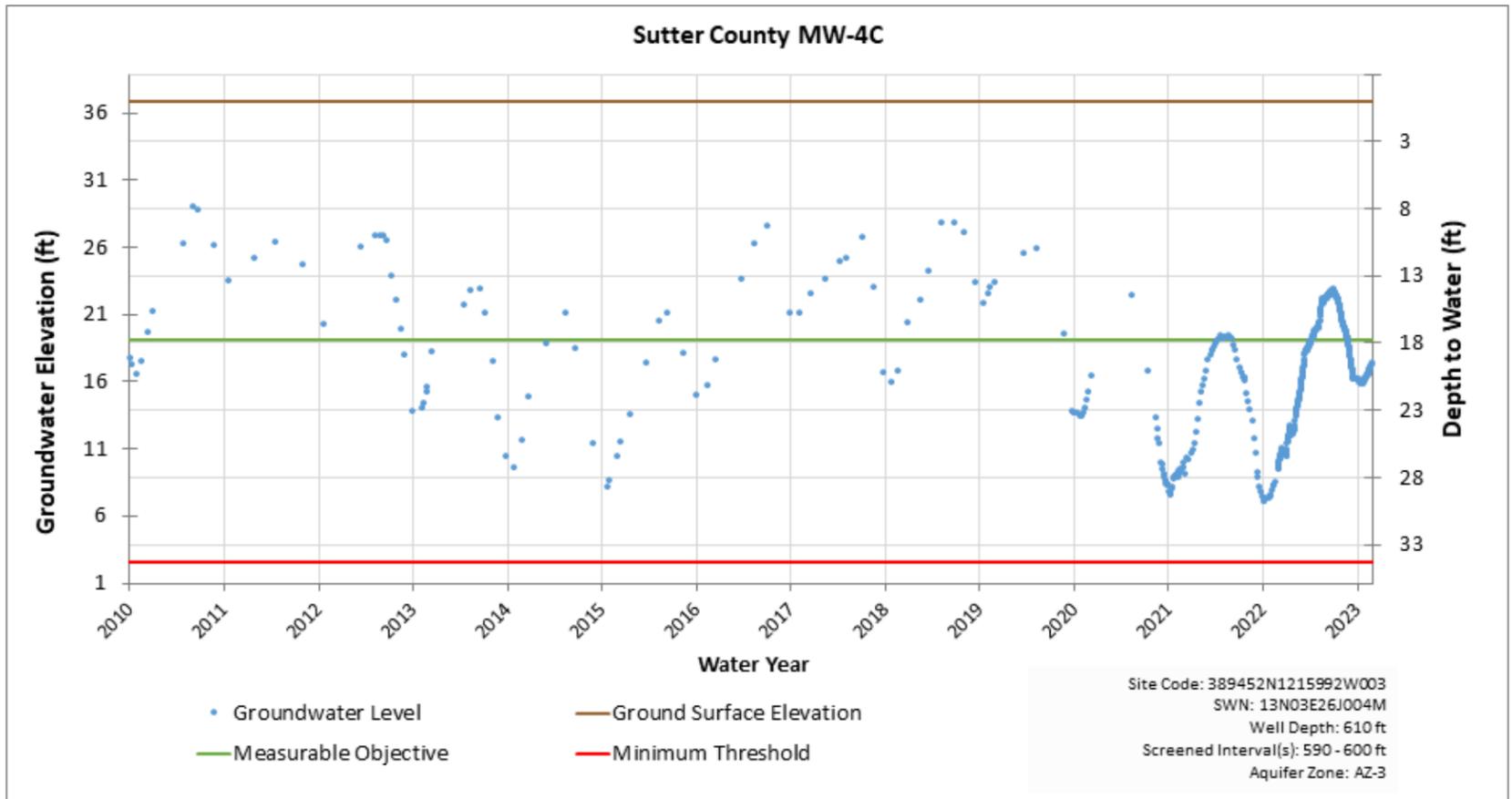


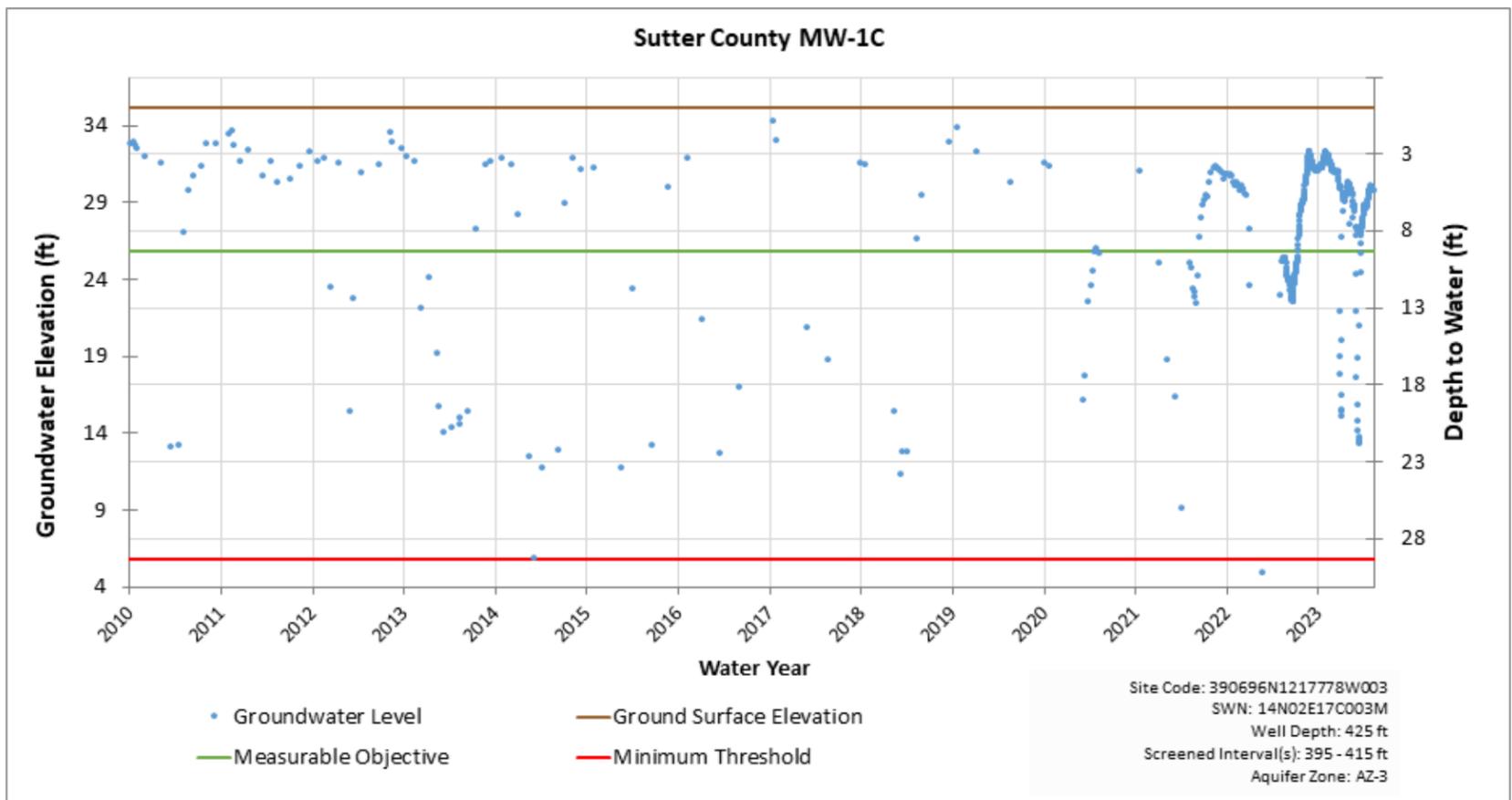
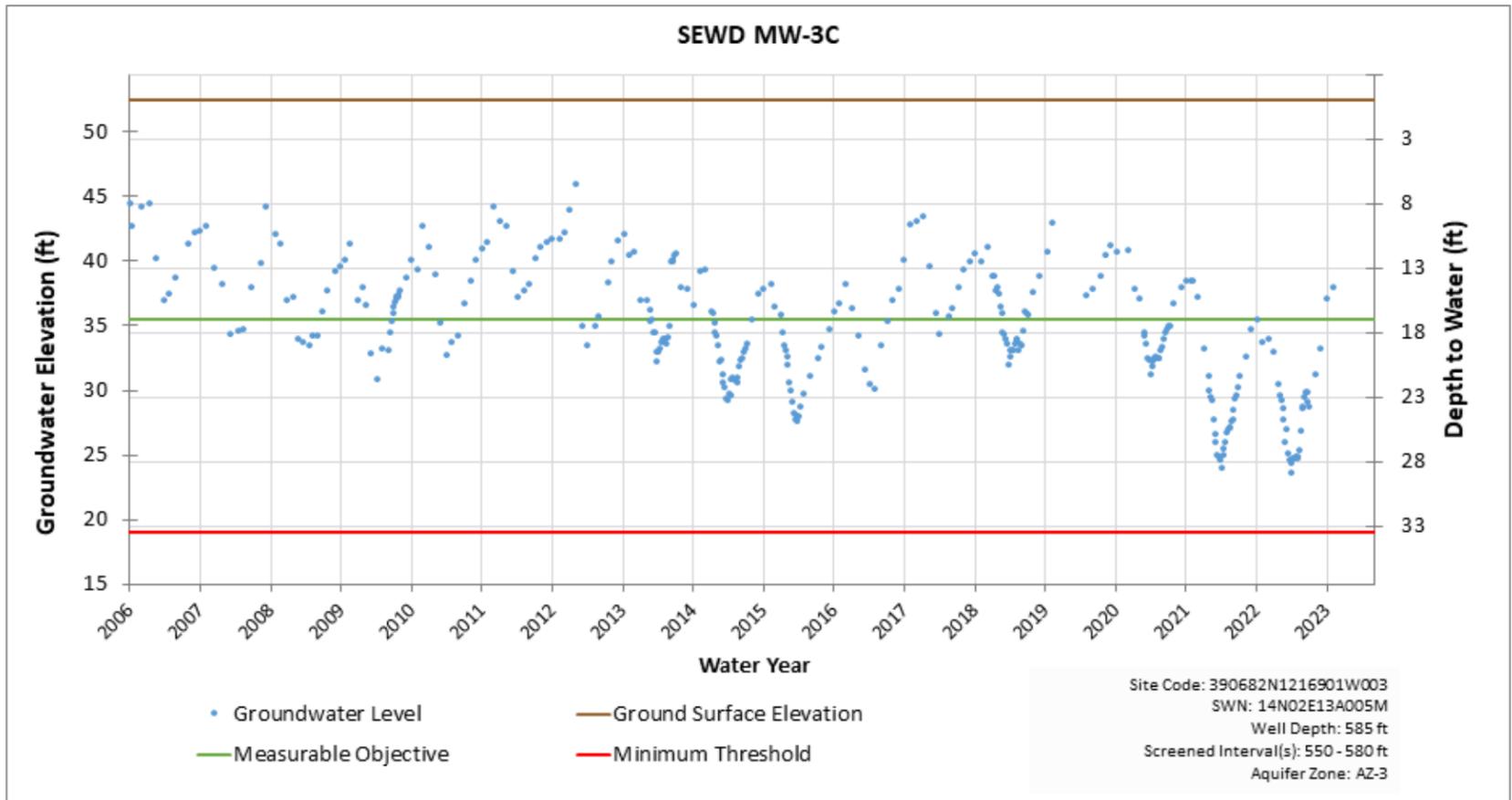


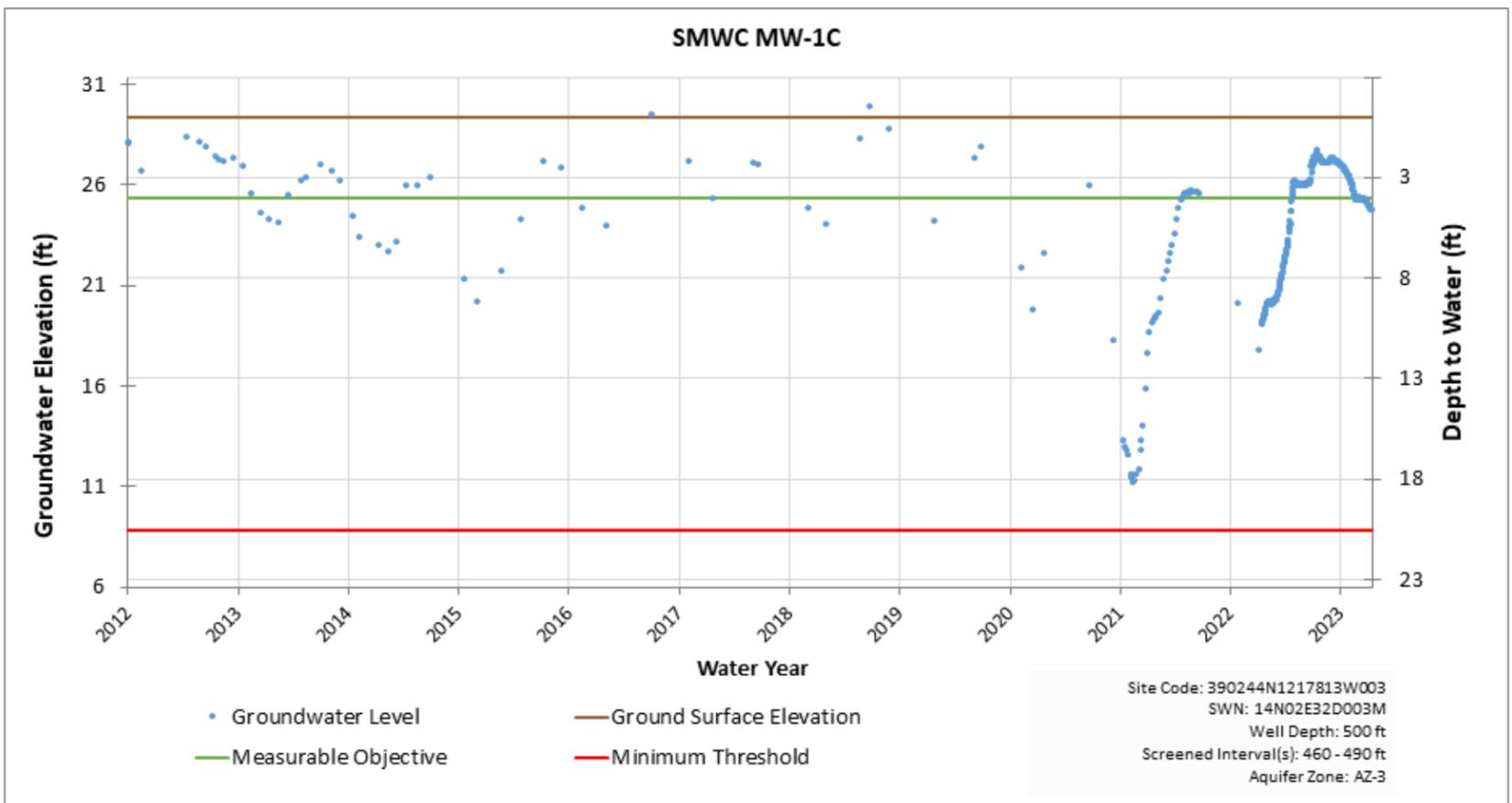
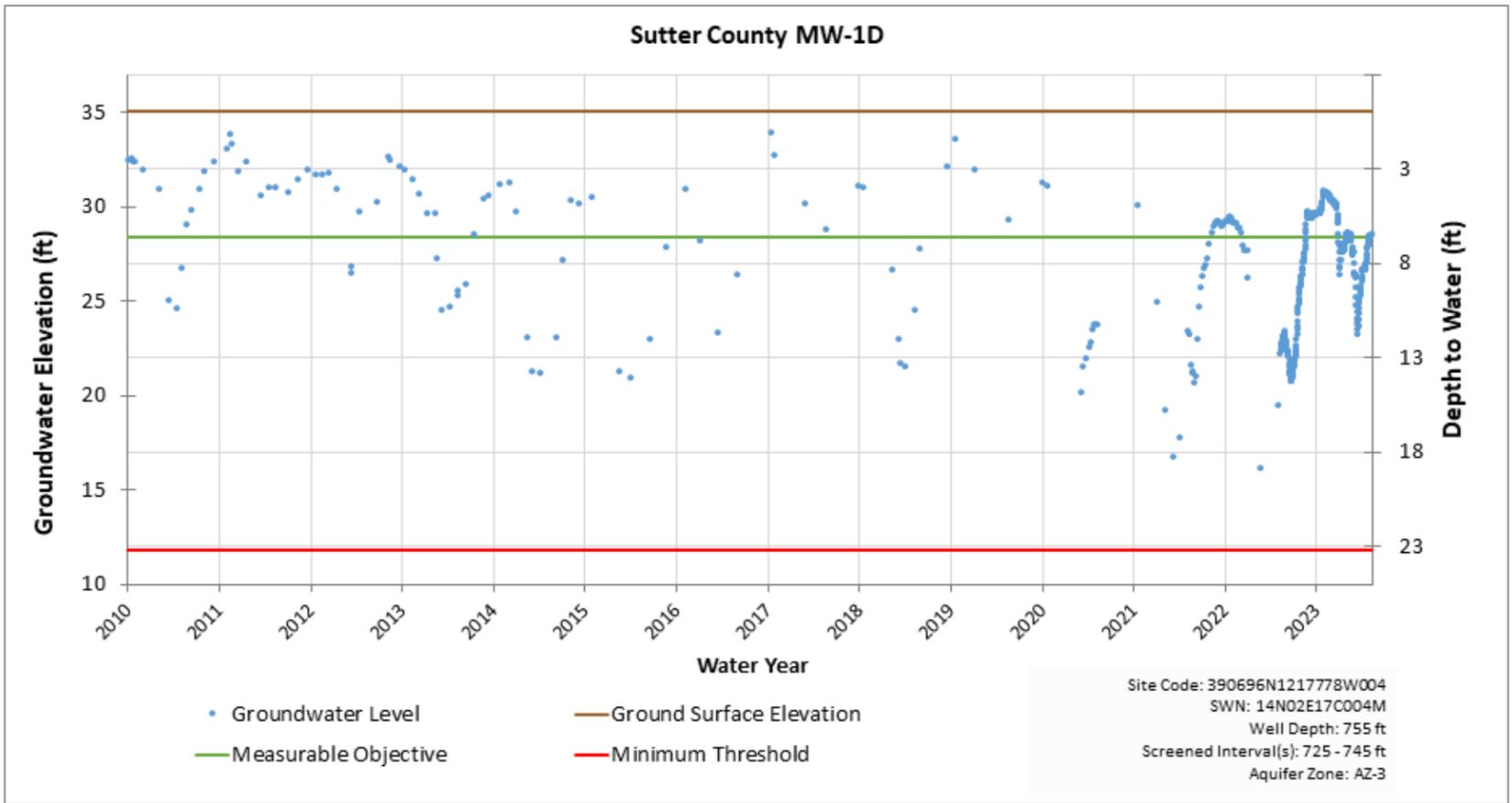


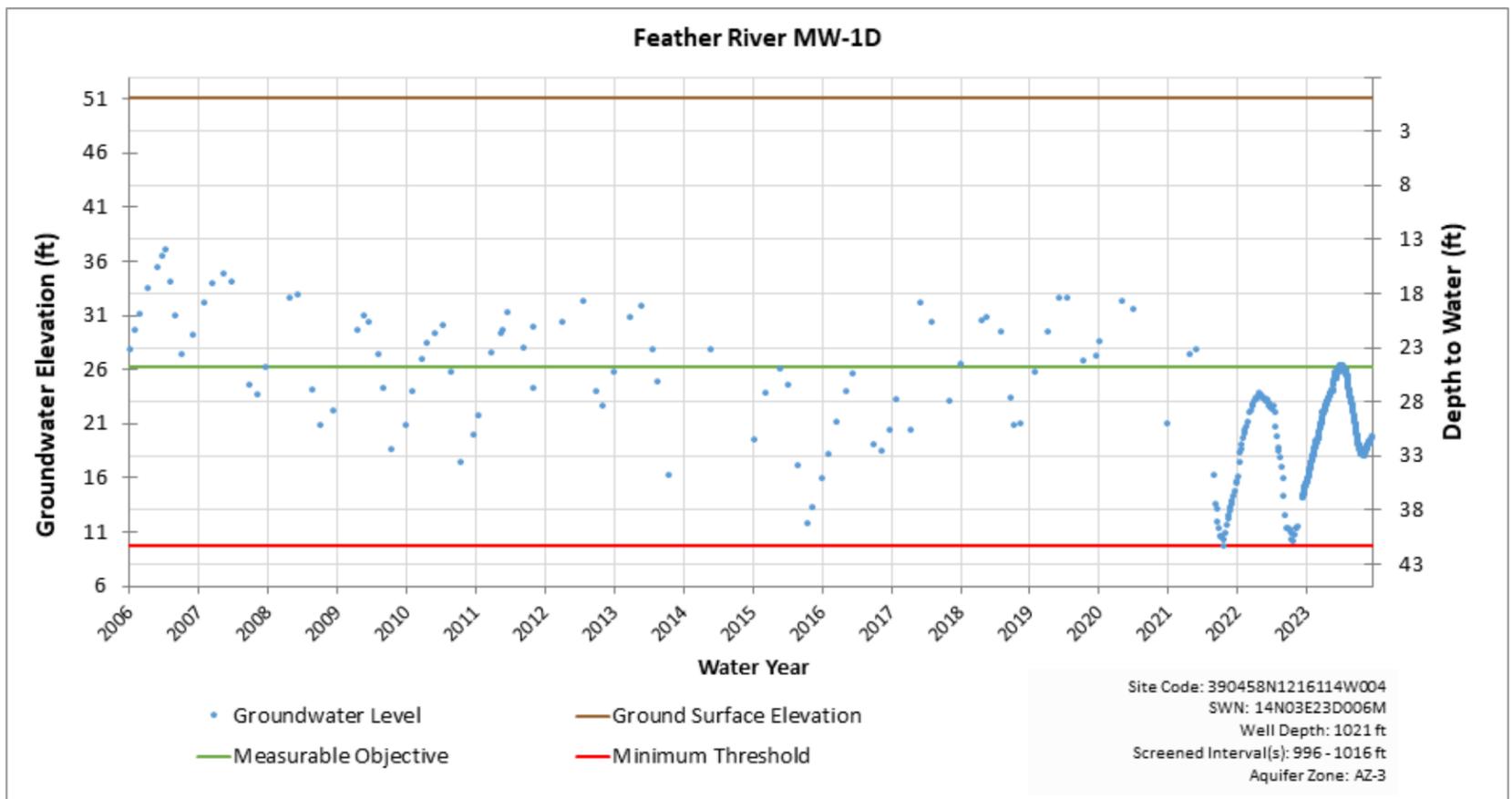
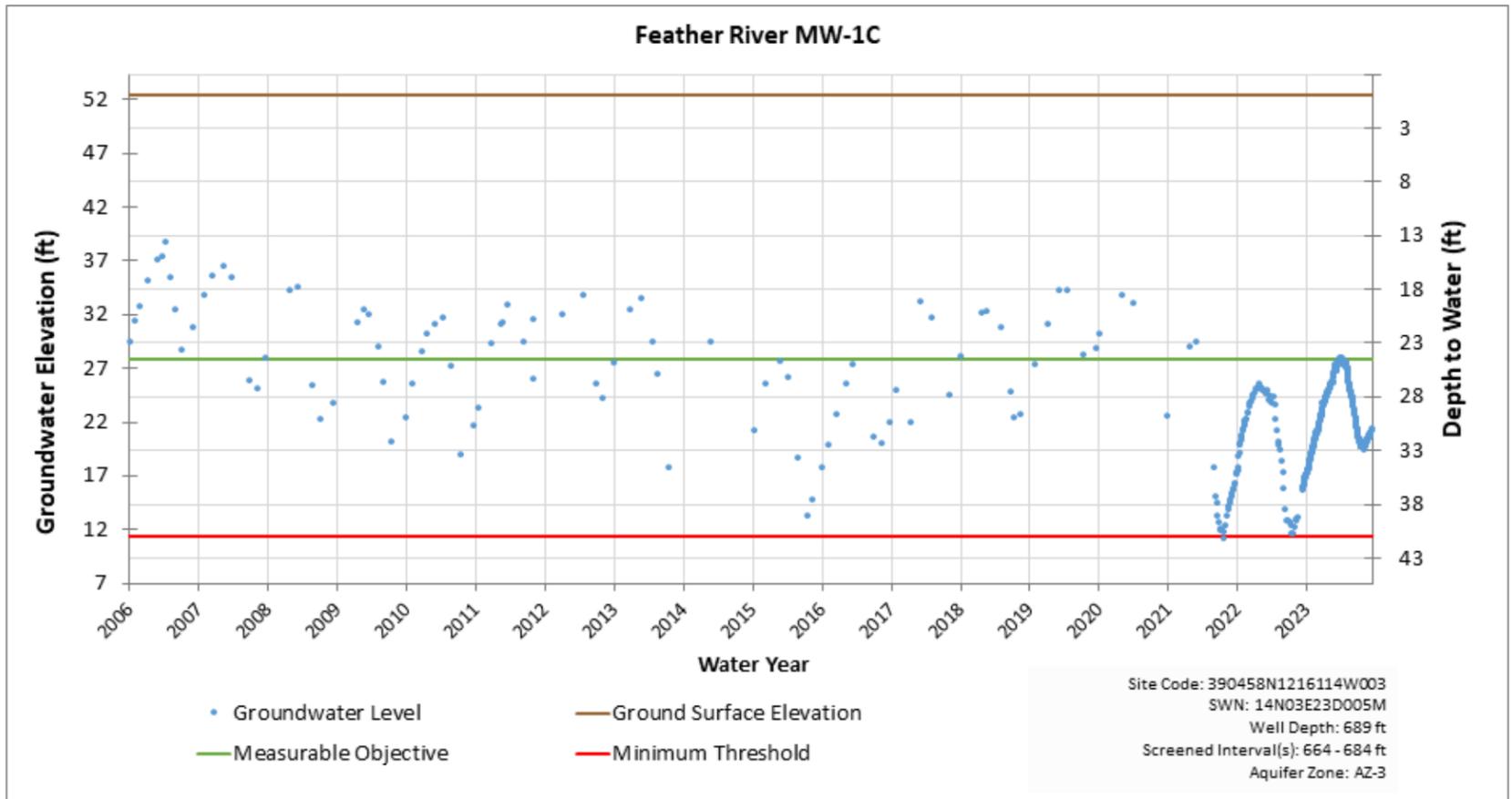


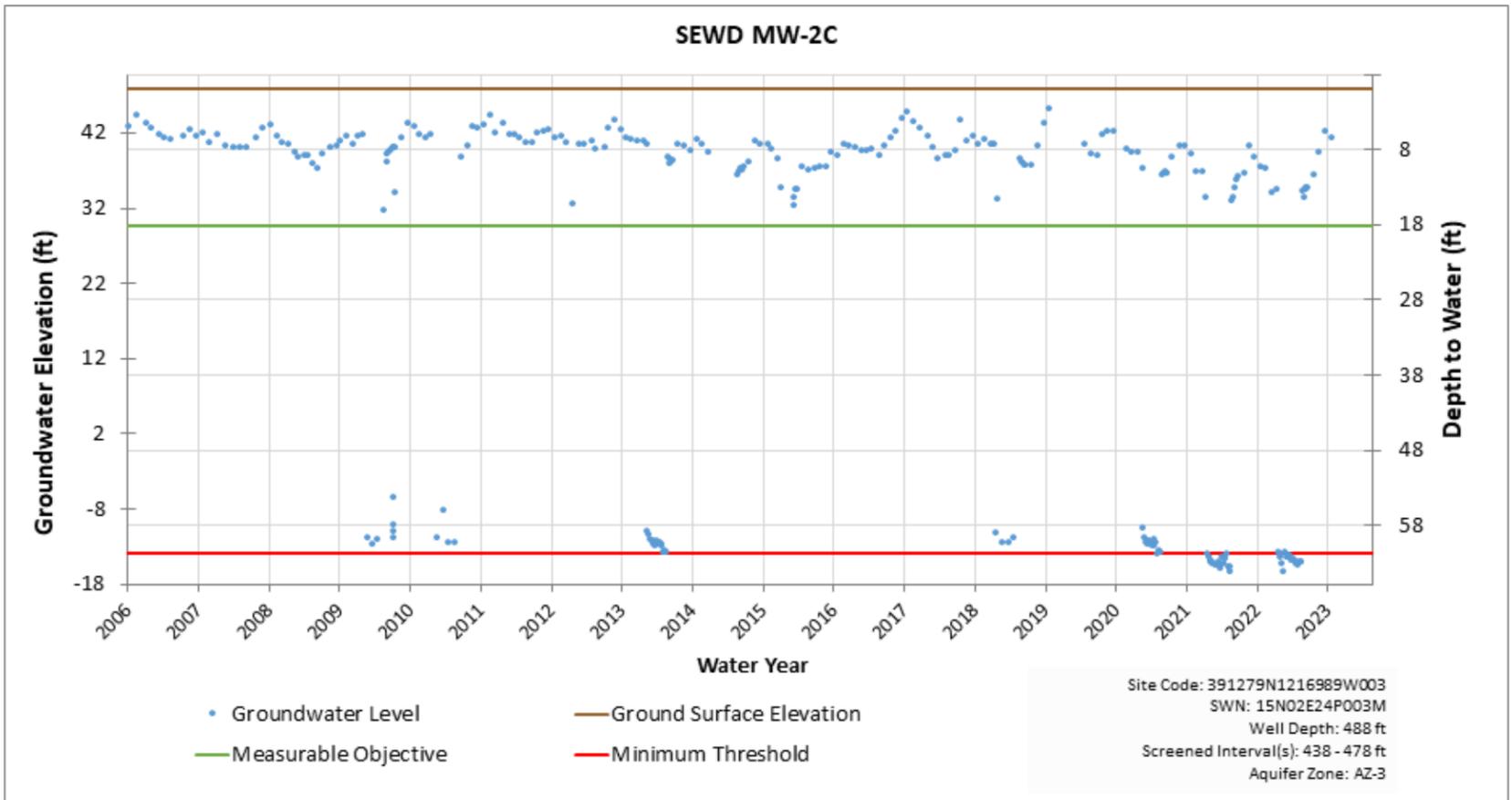
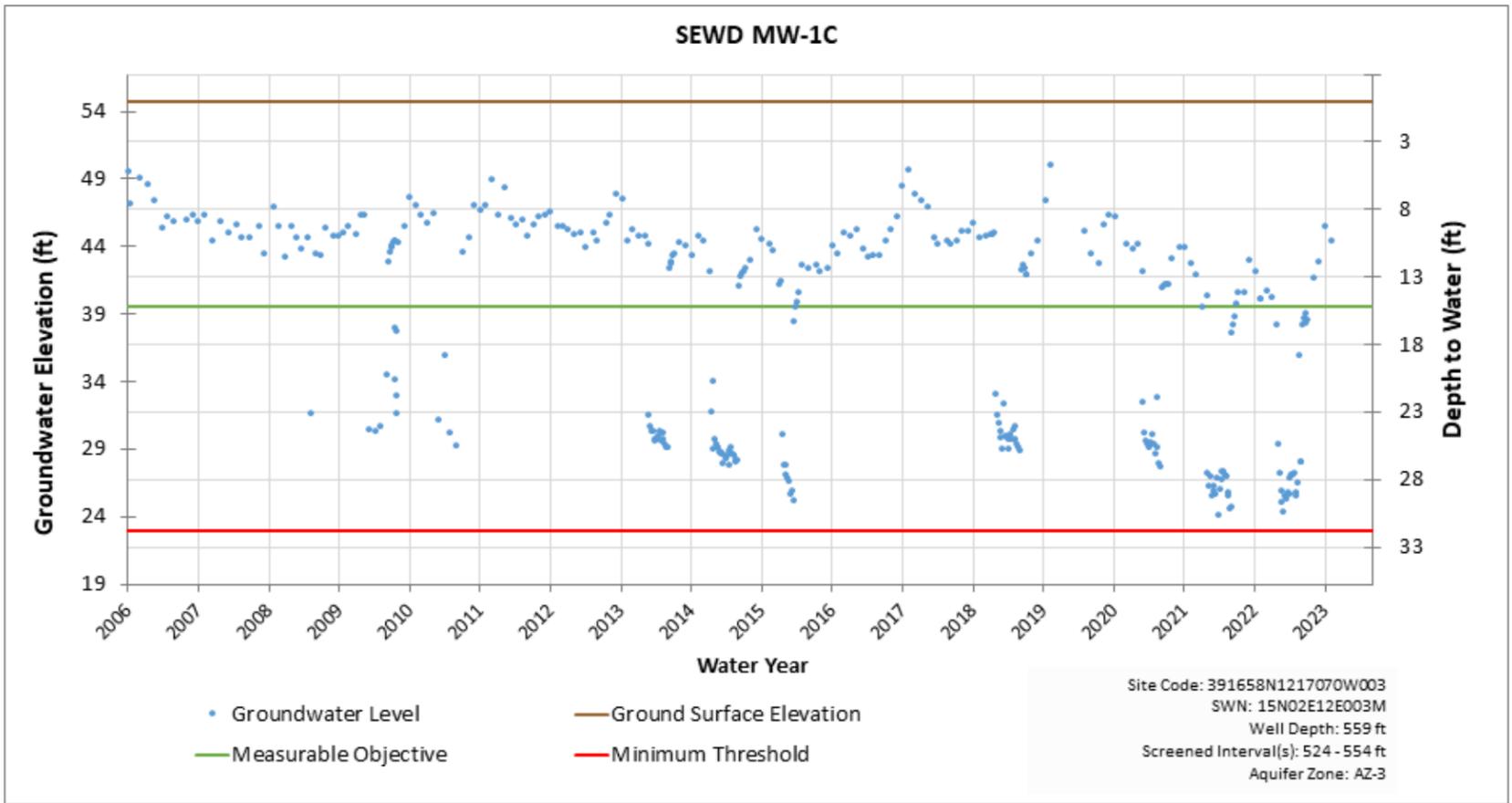


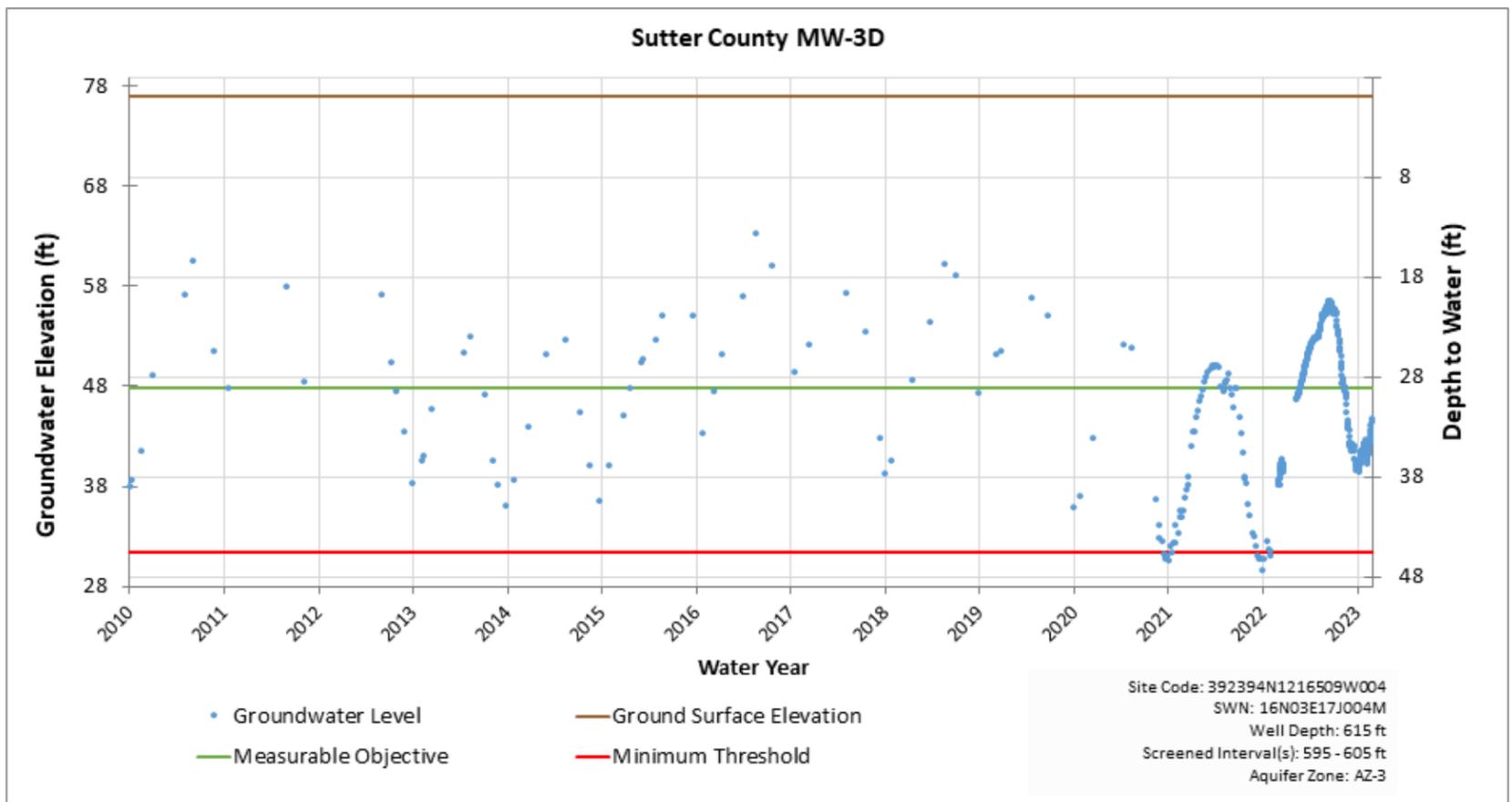
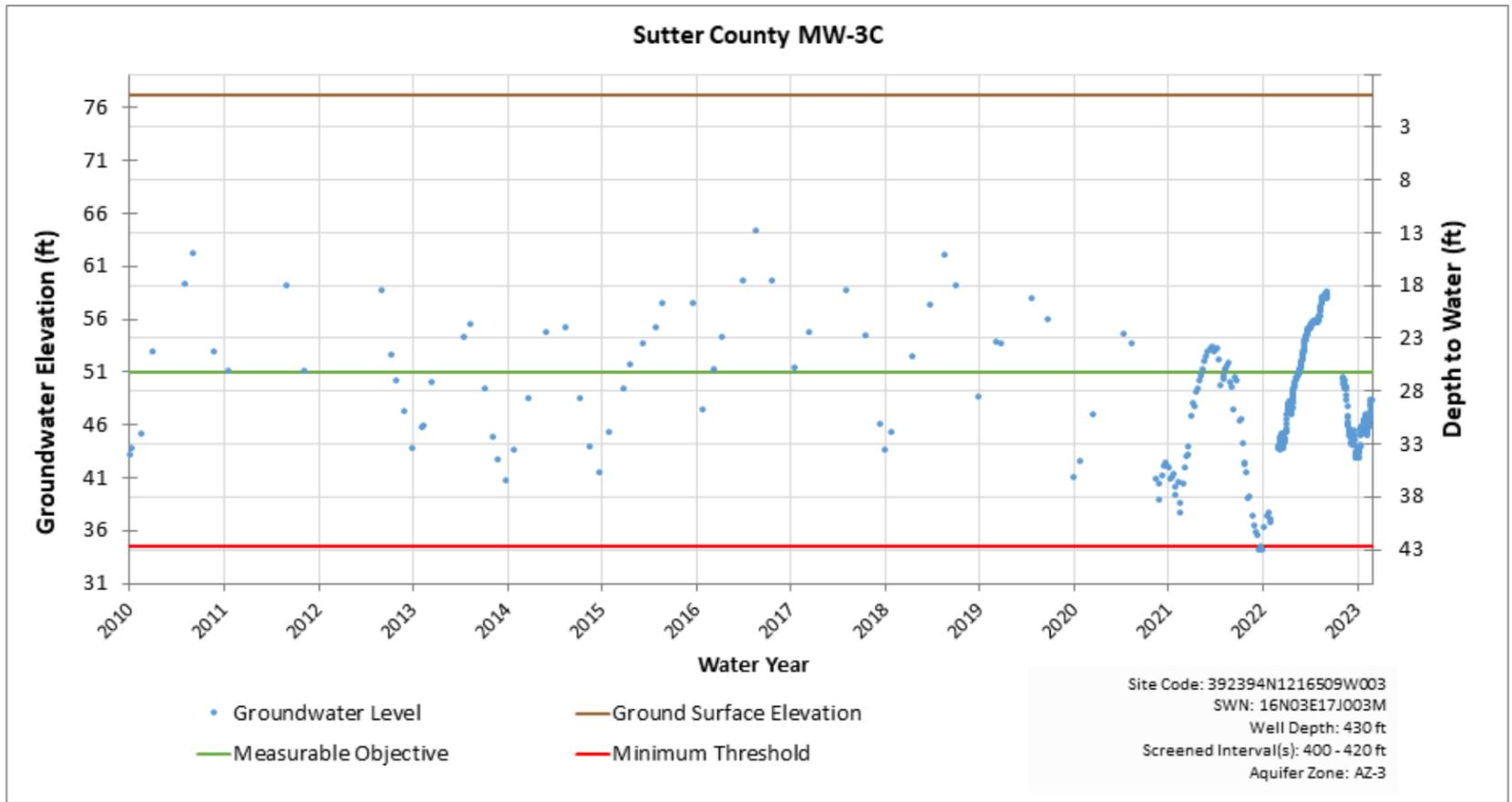


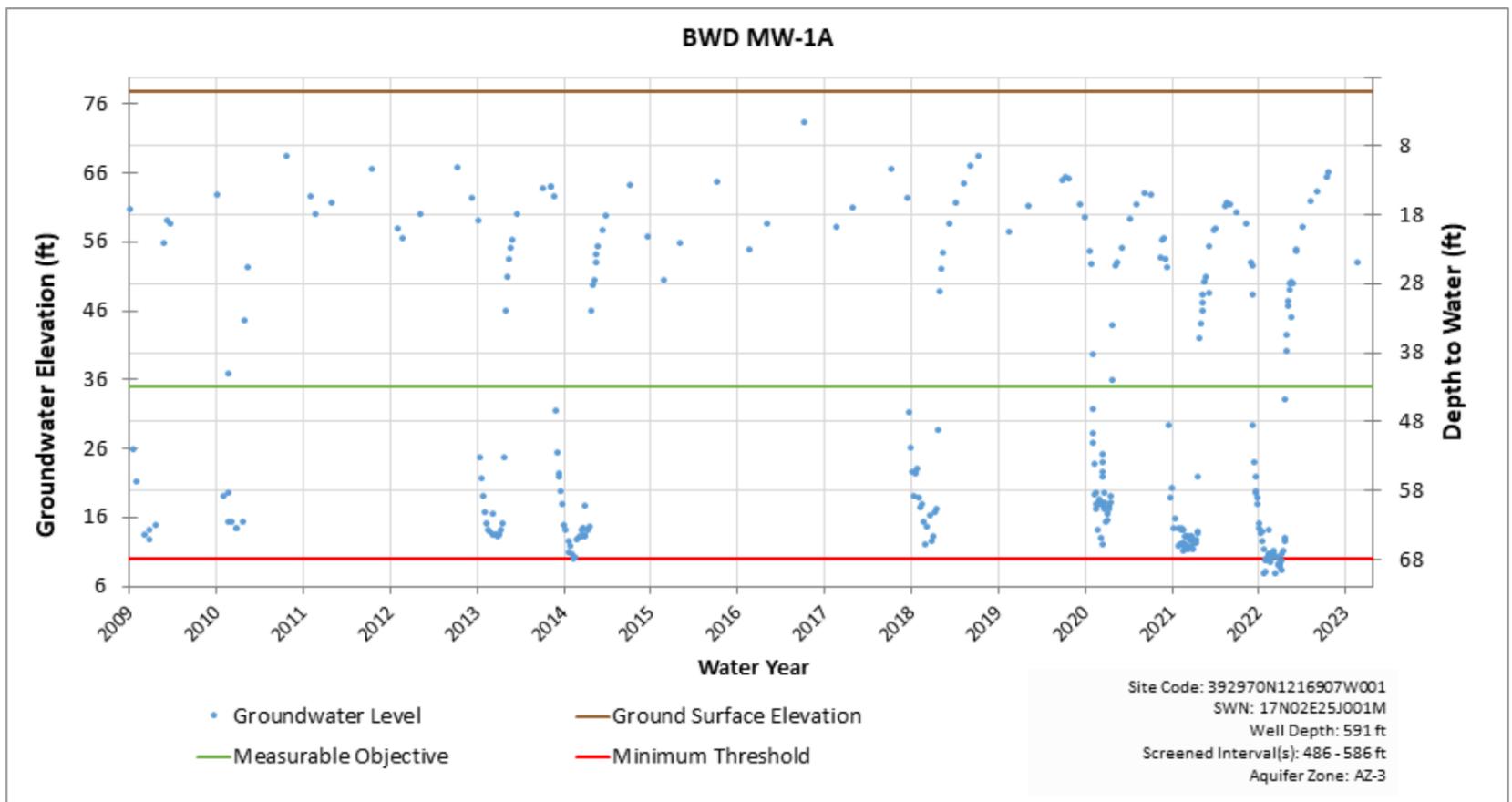
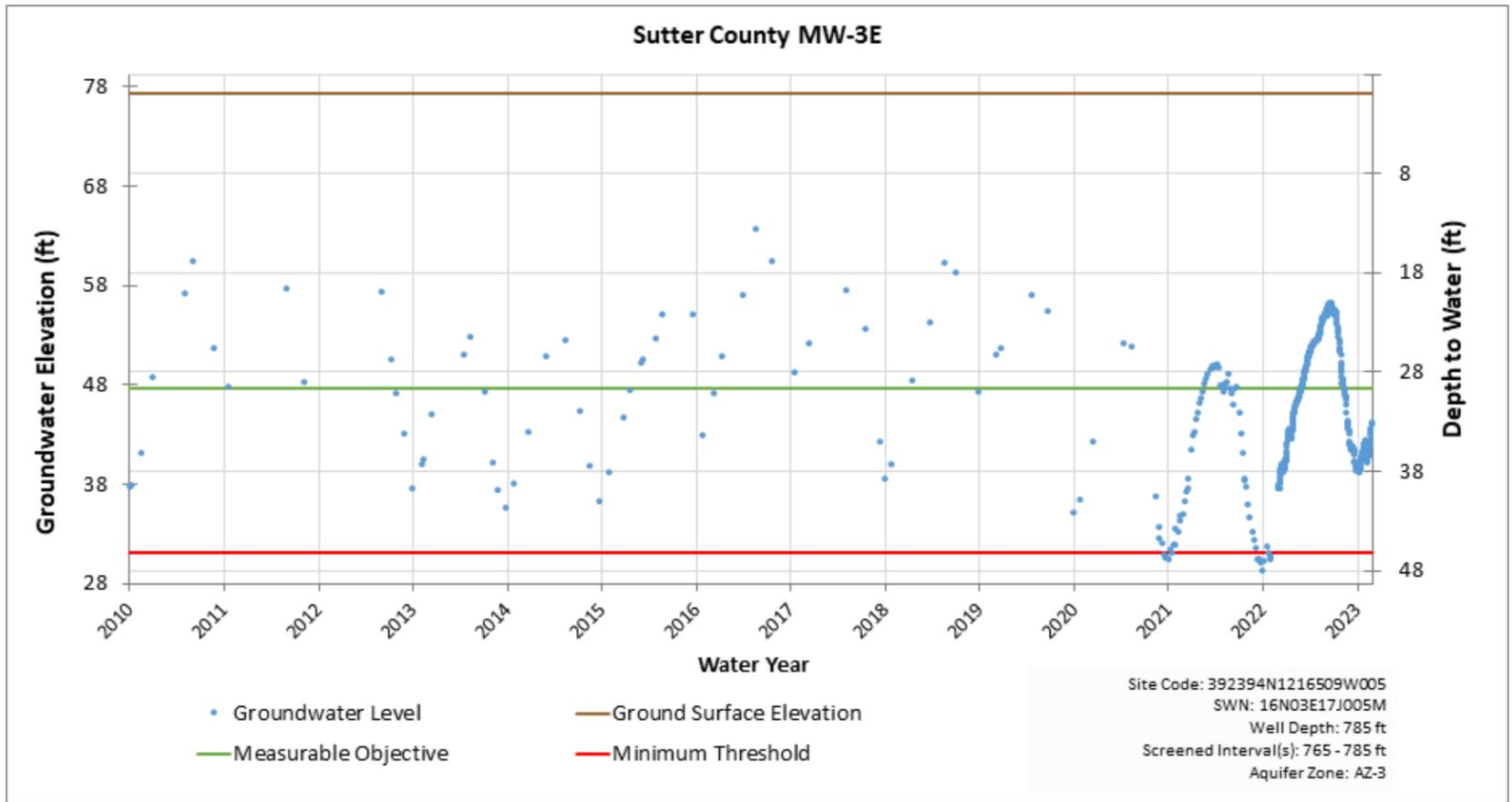


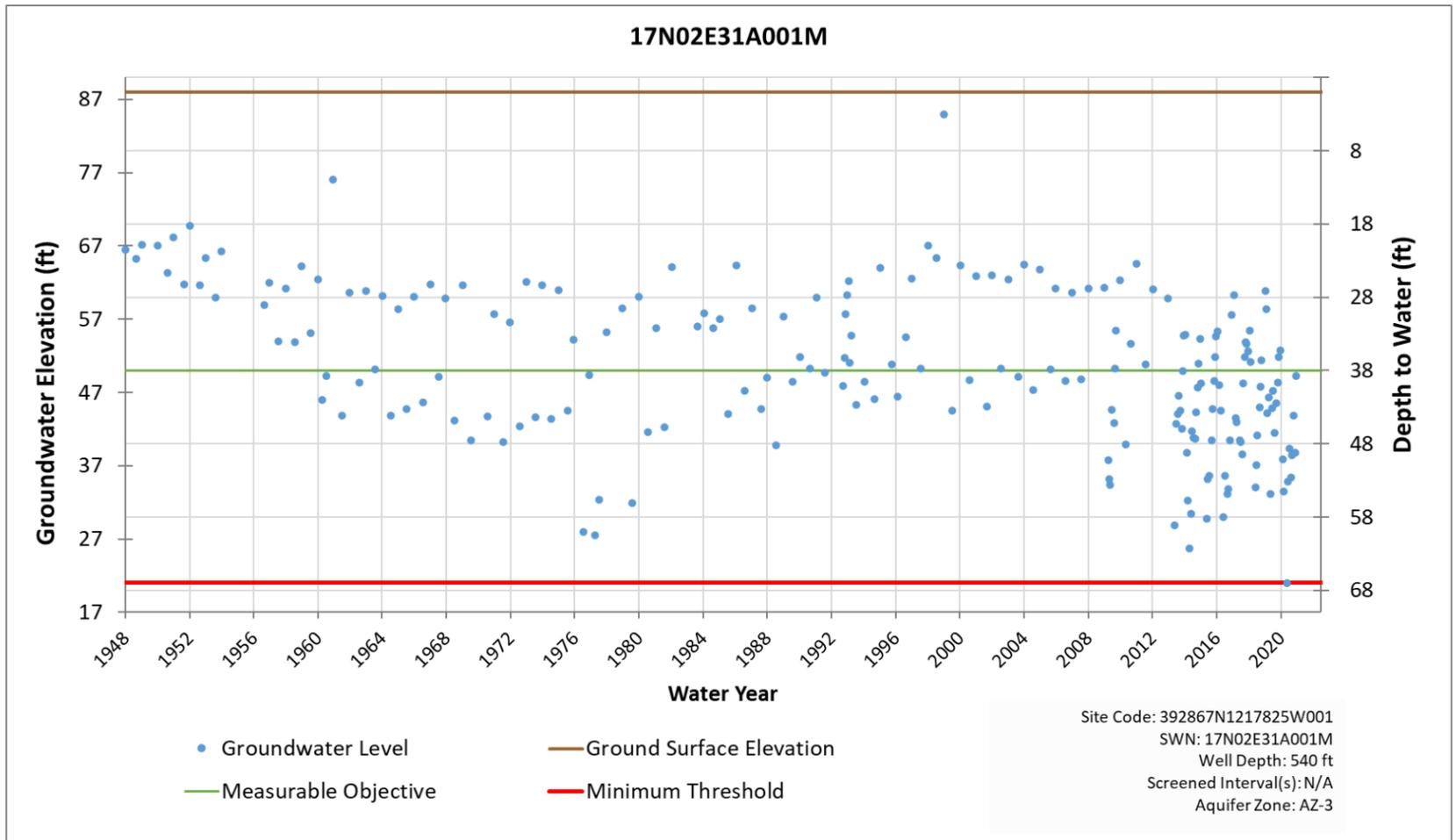




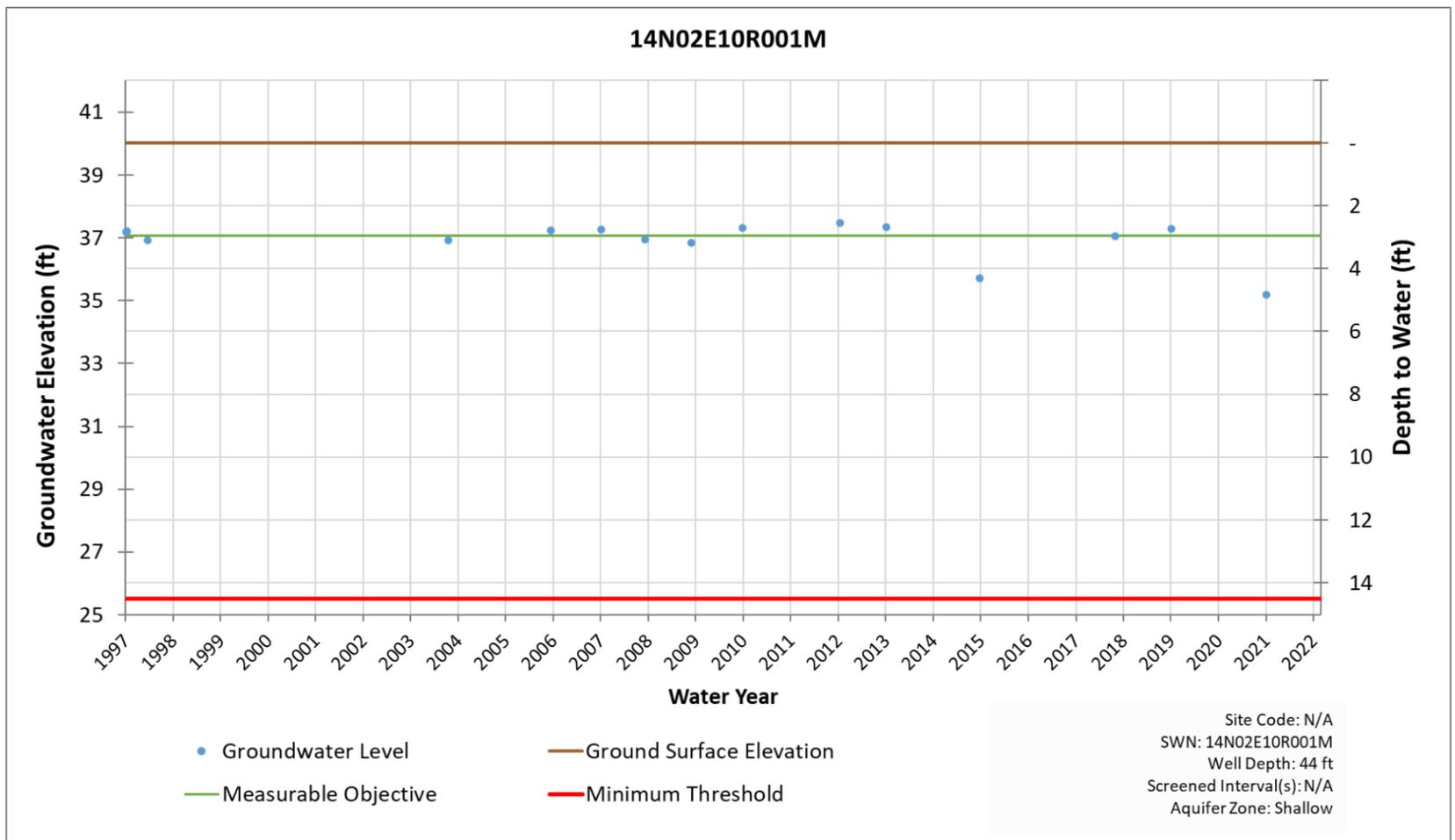
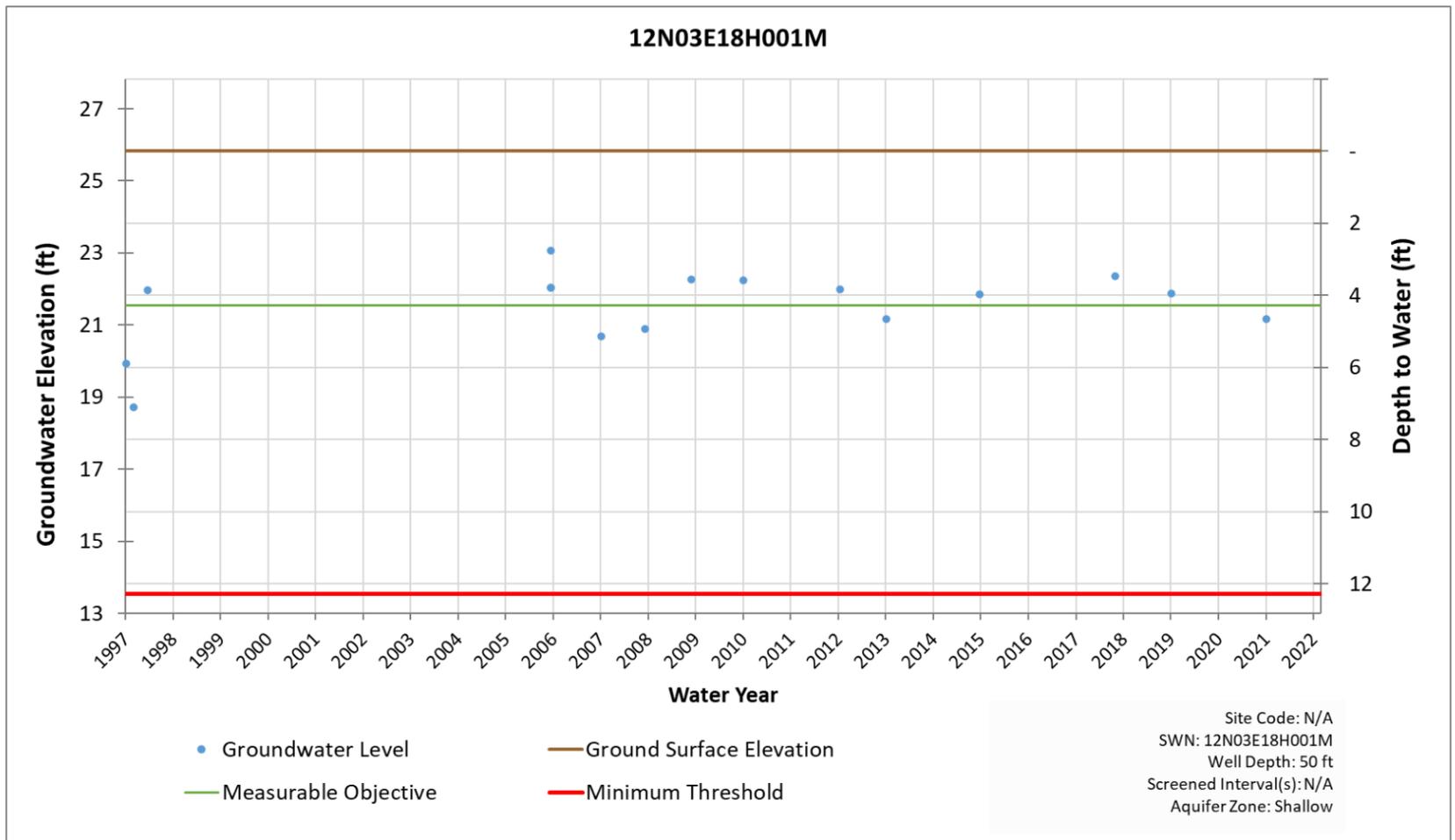


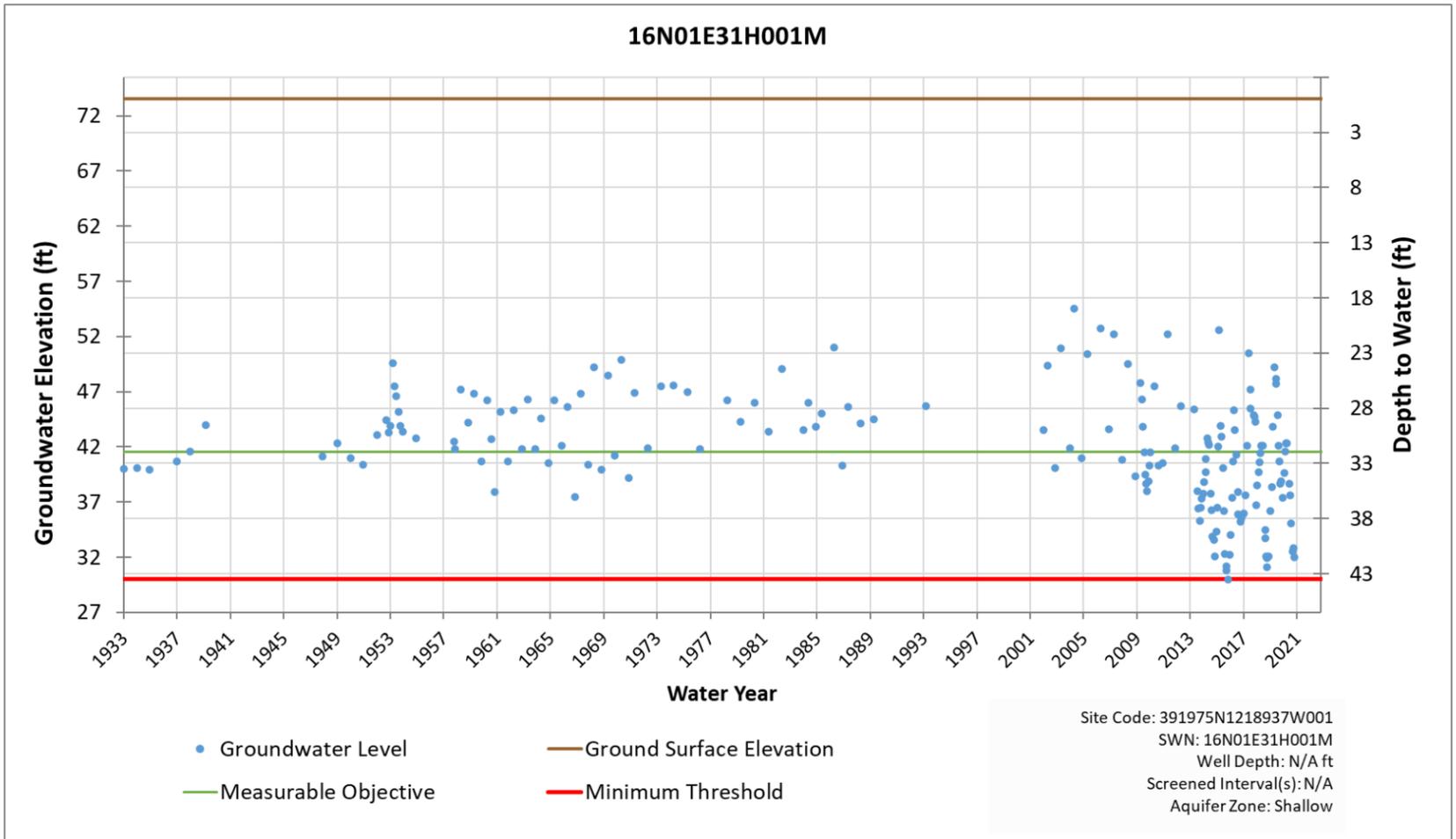
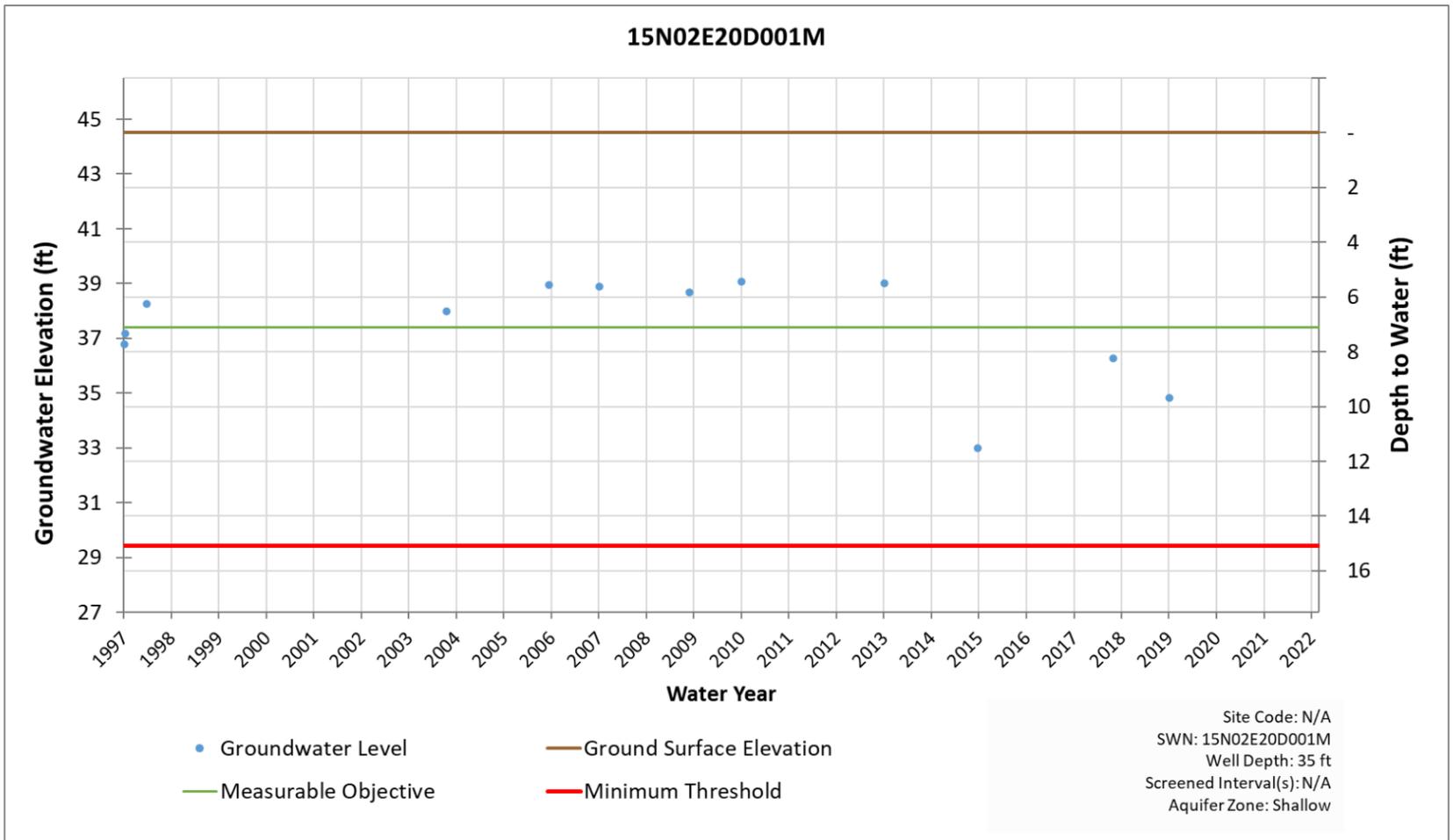


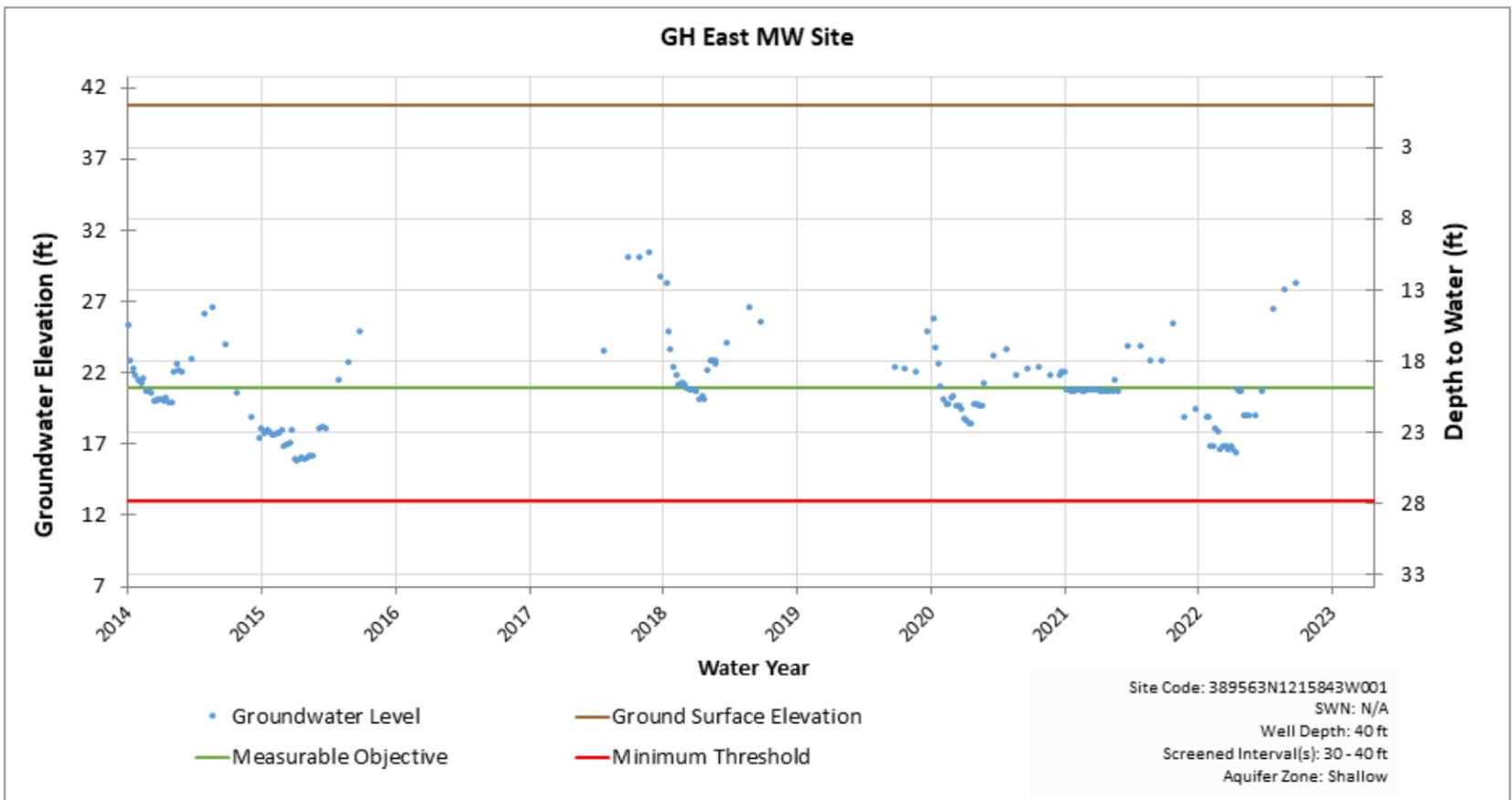
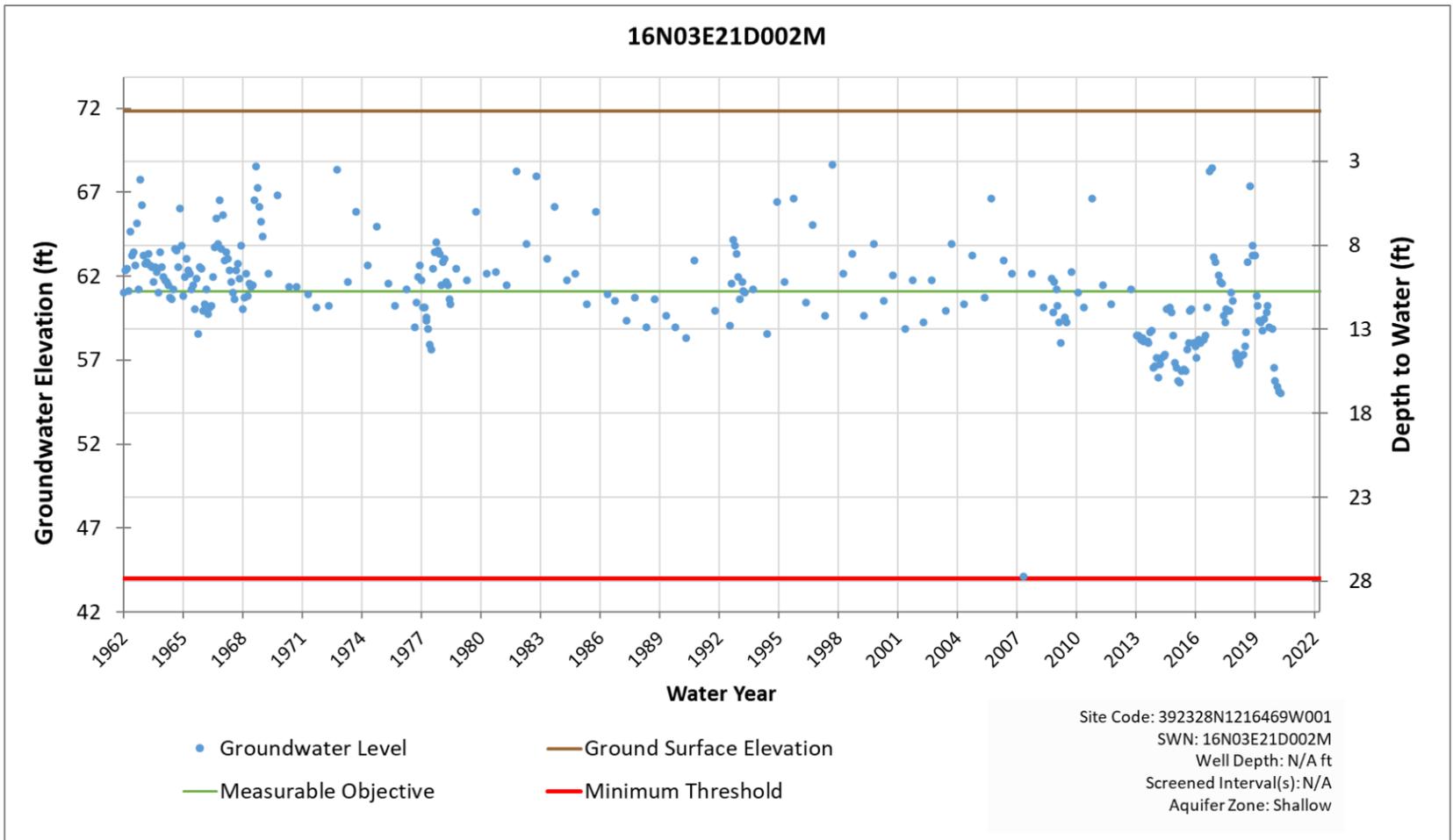


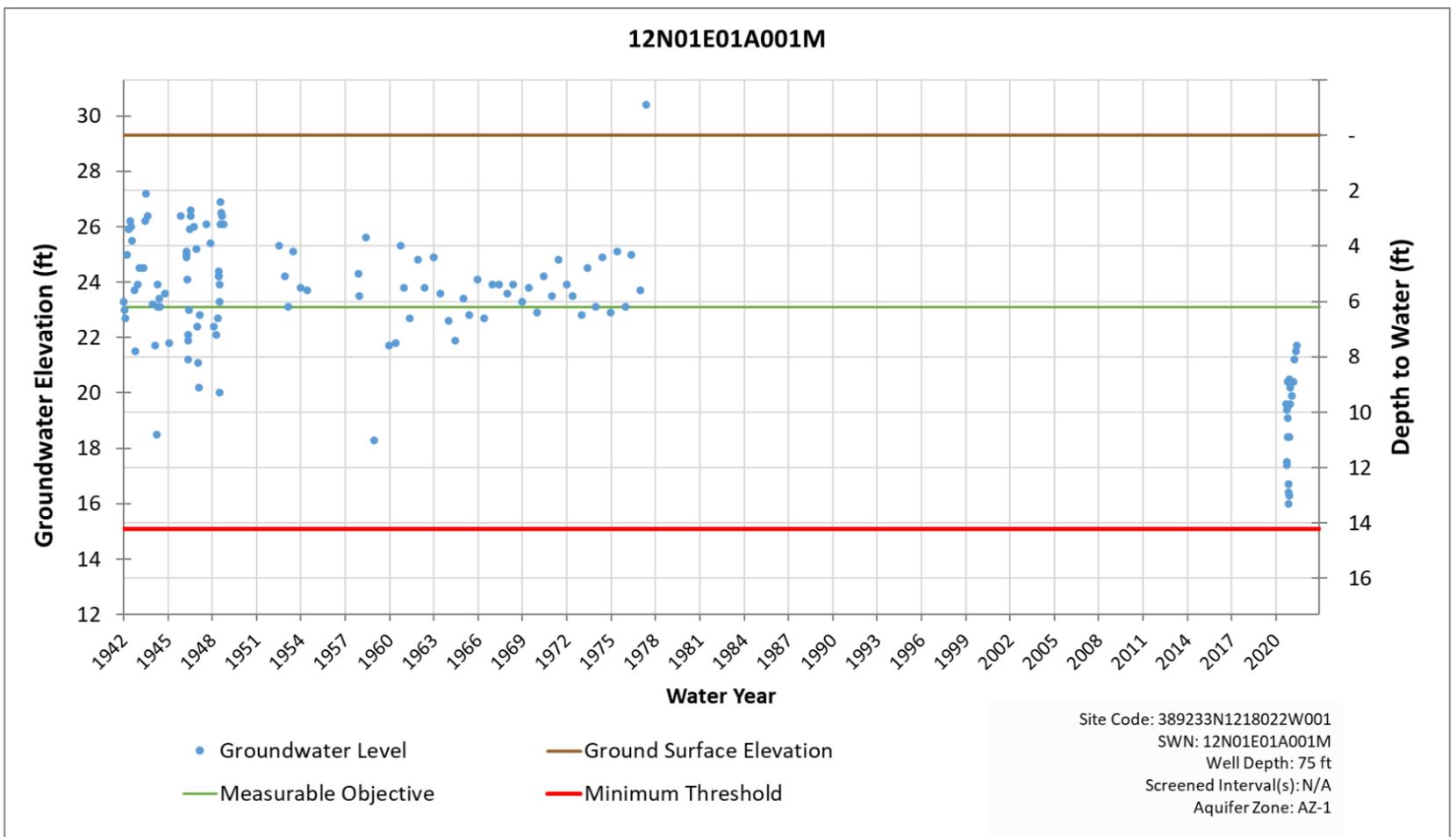
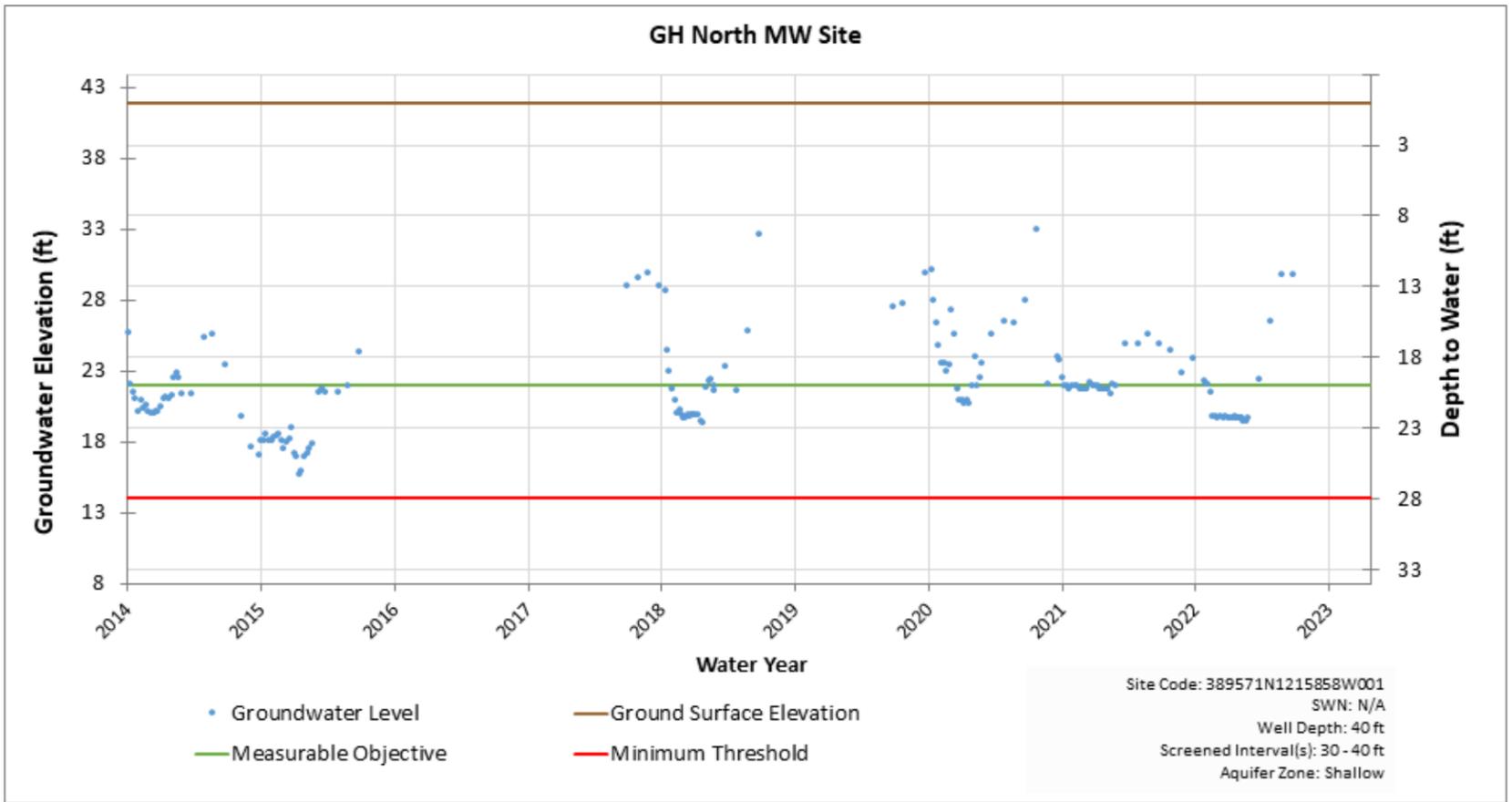


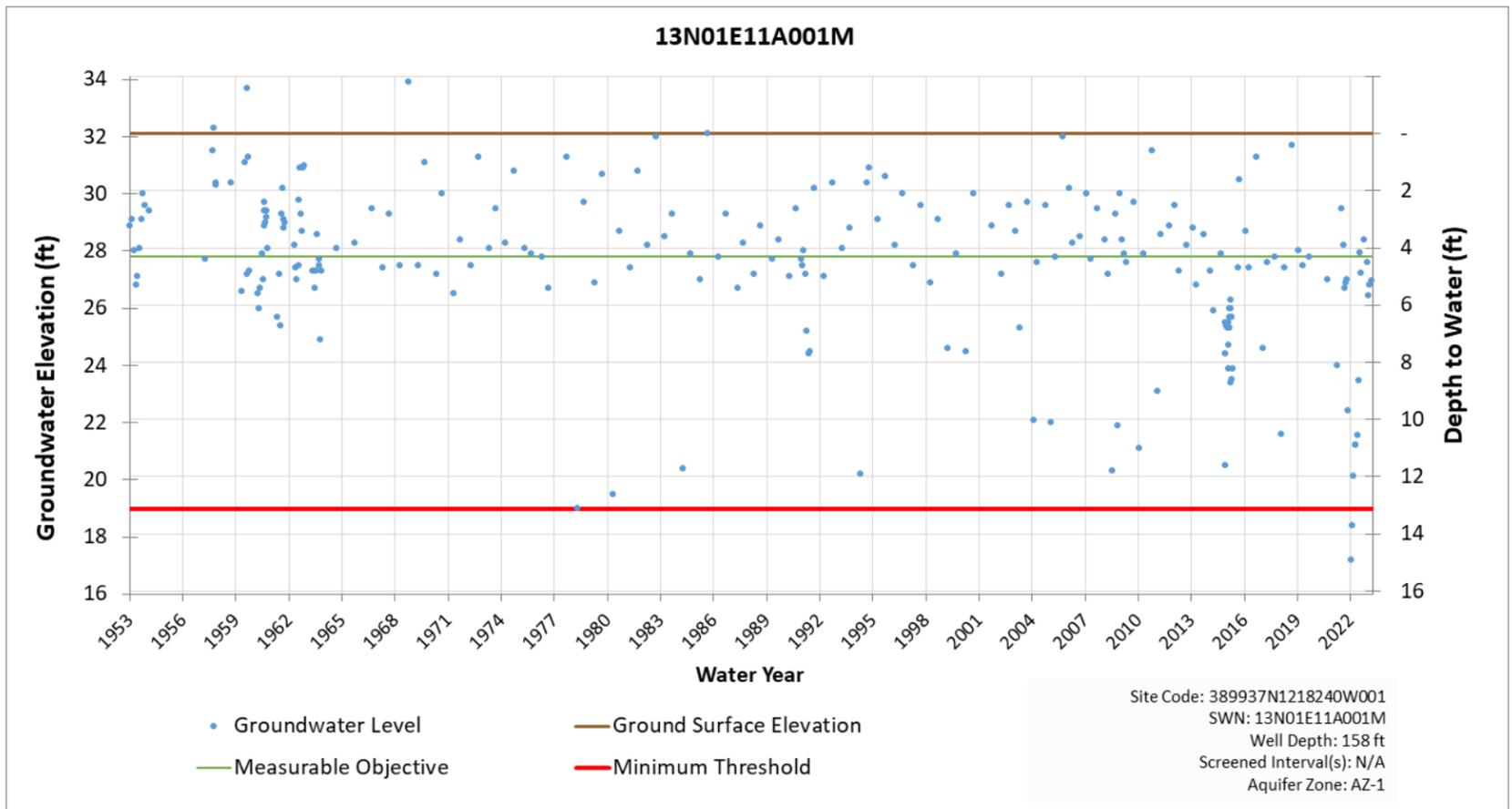
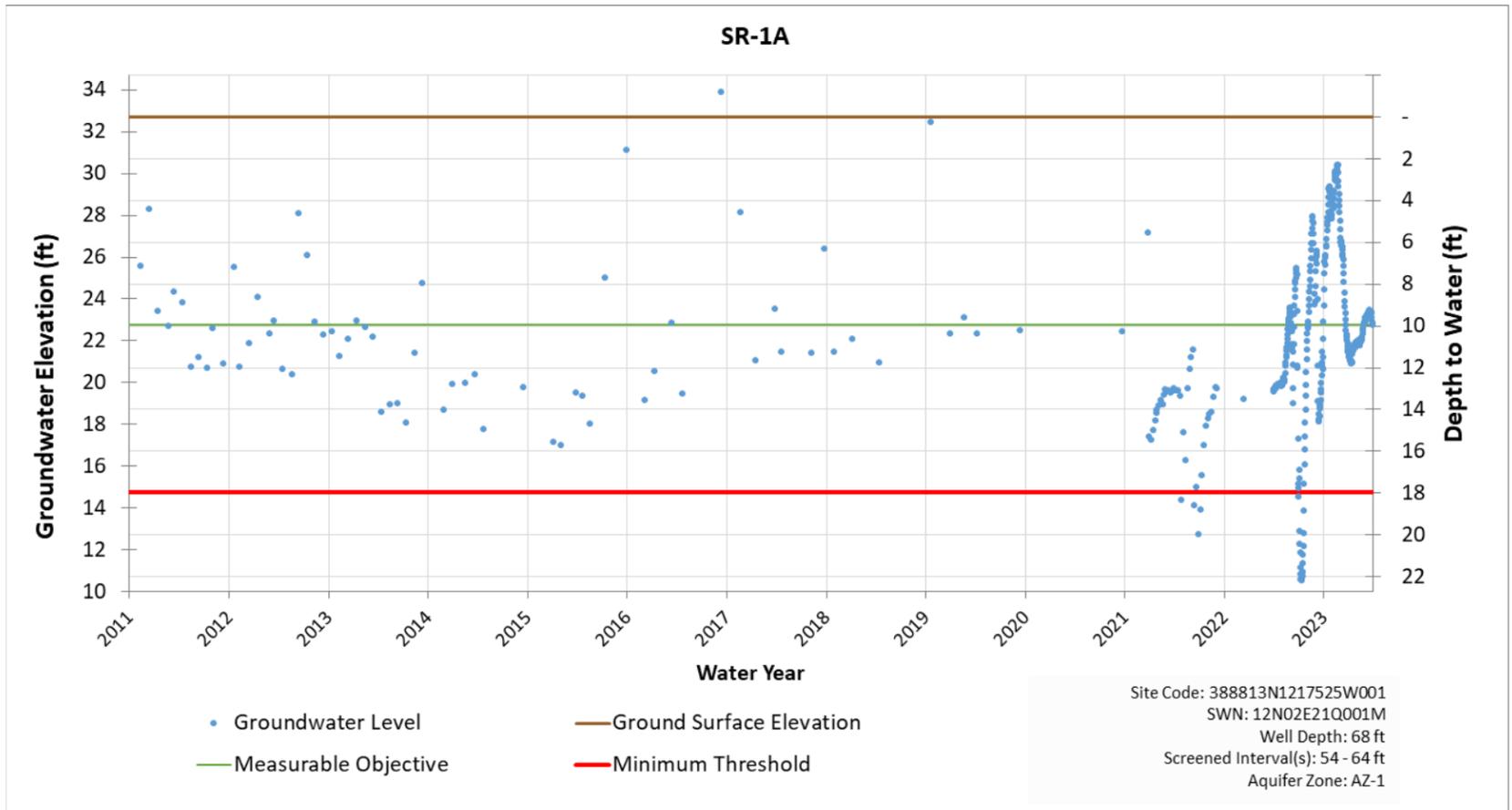
**Depletions of Interconnected Surface Water Monitoring Network**

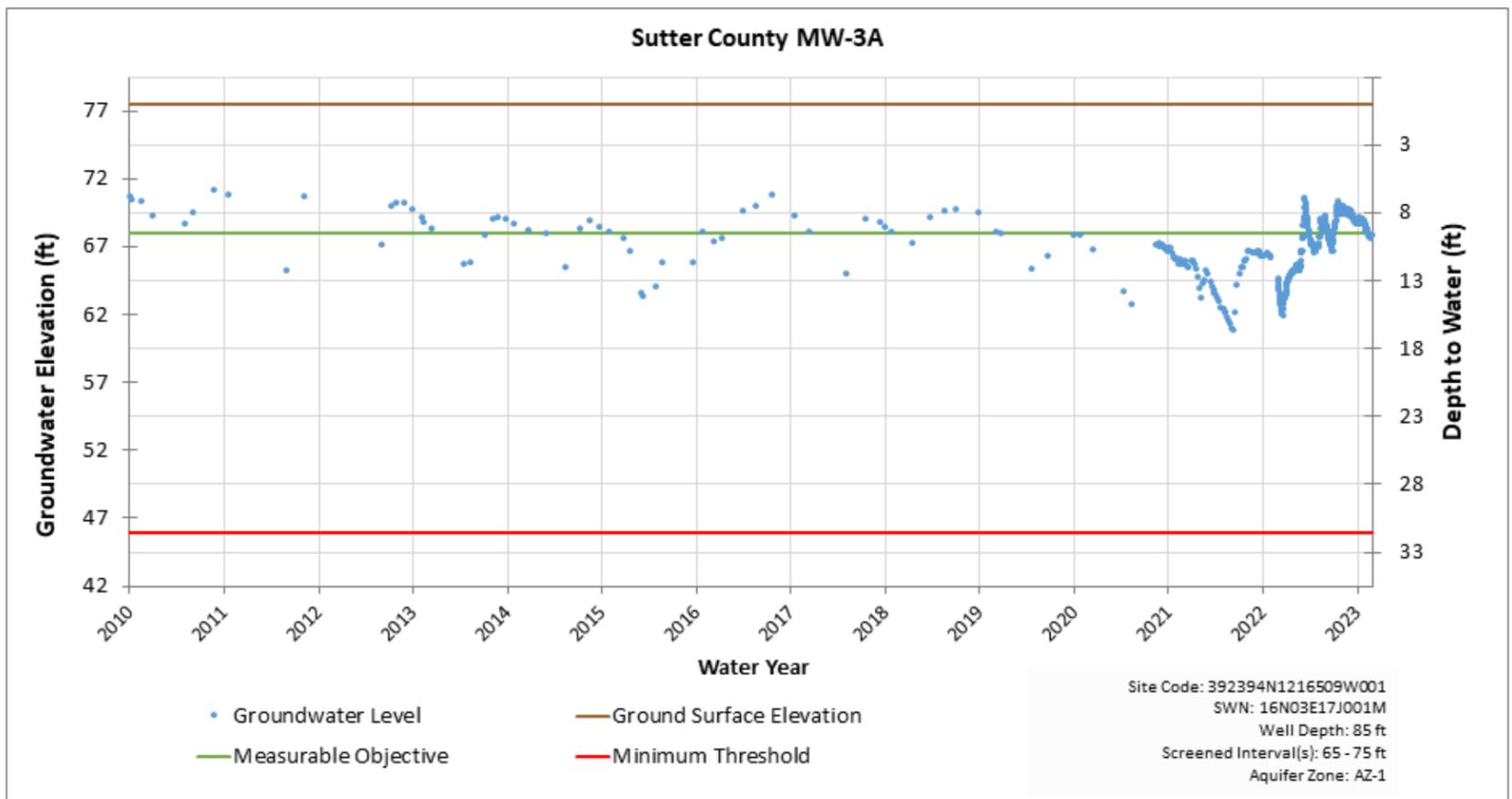
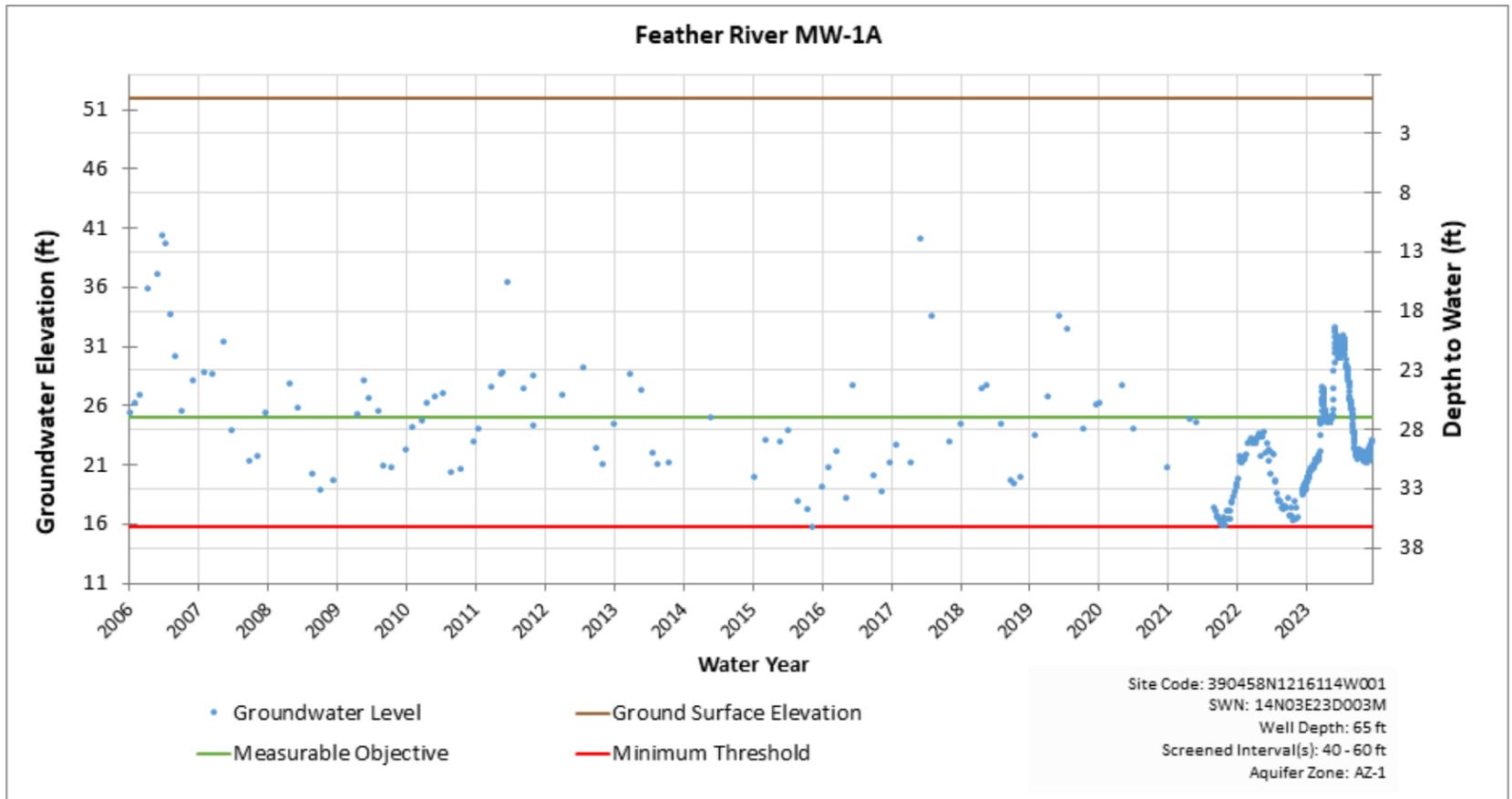


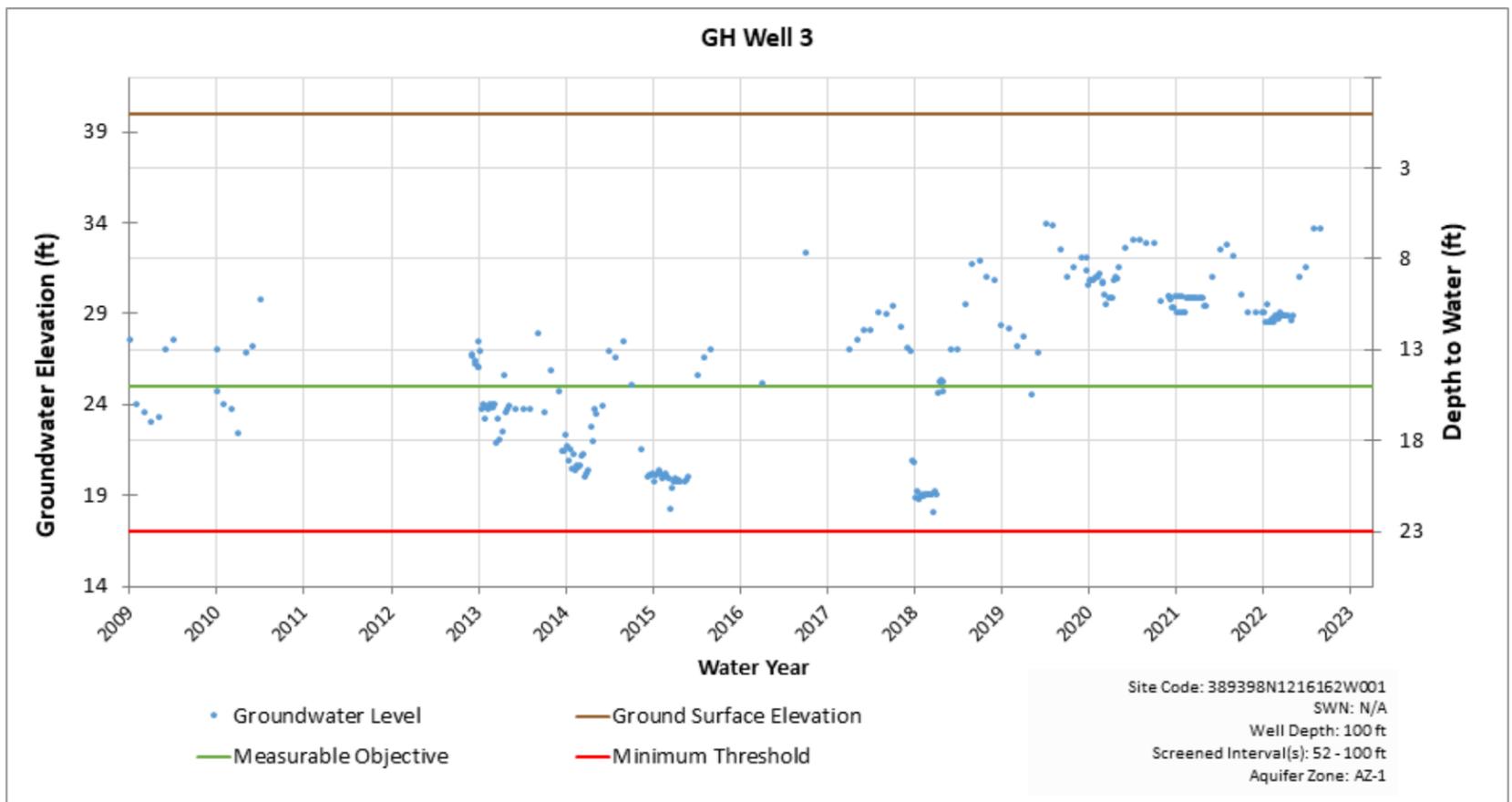
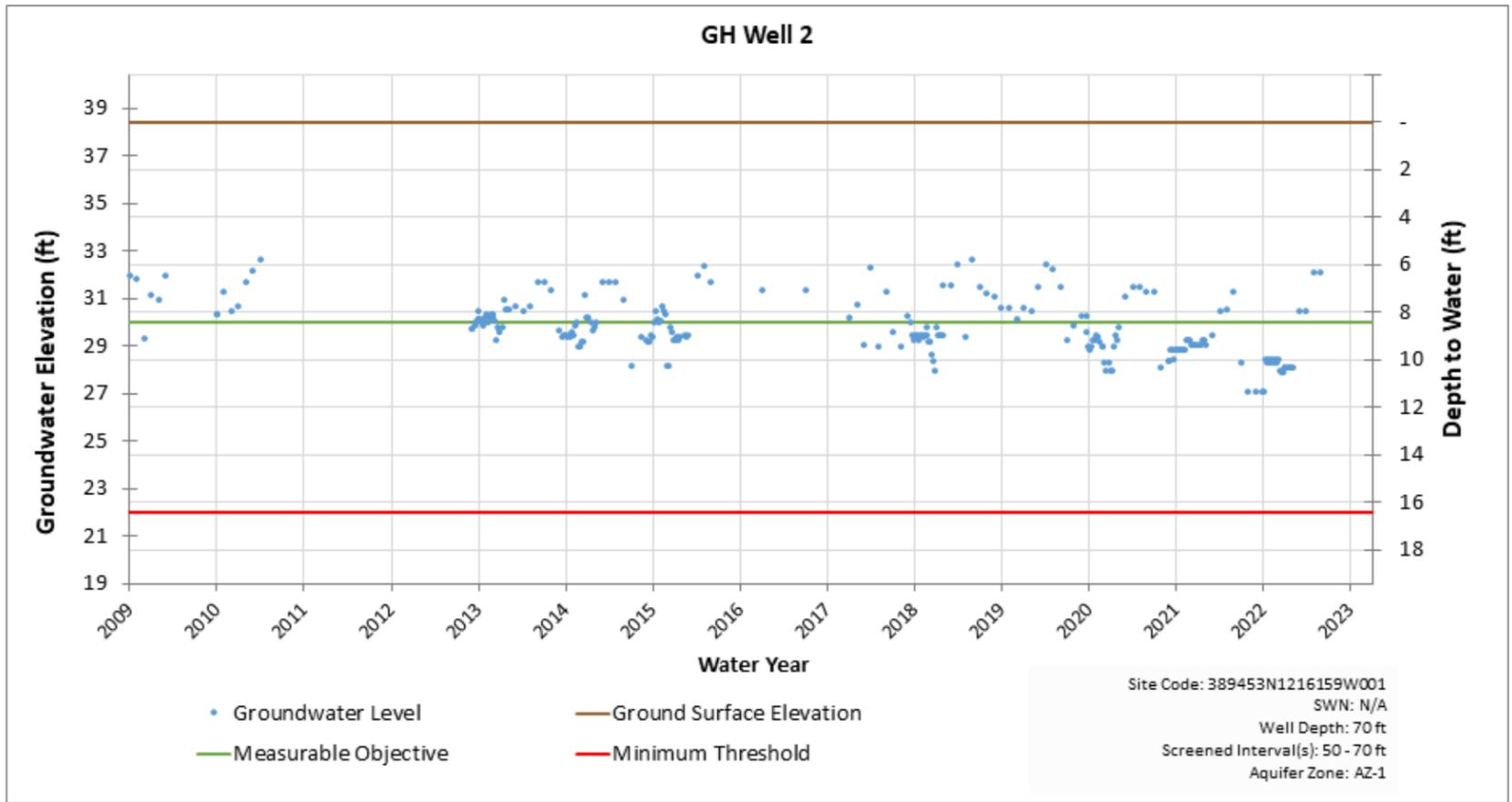


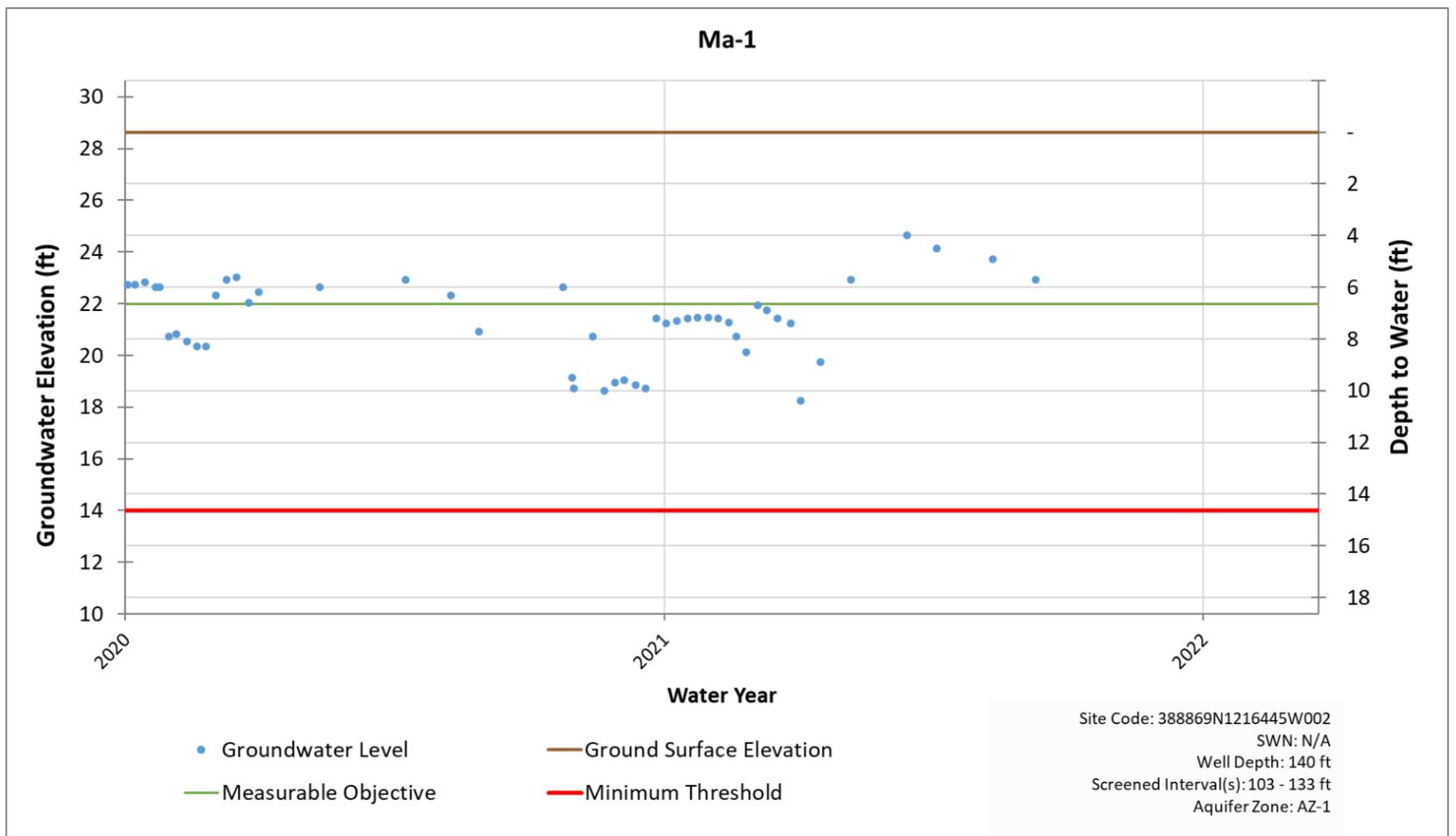
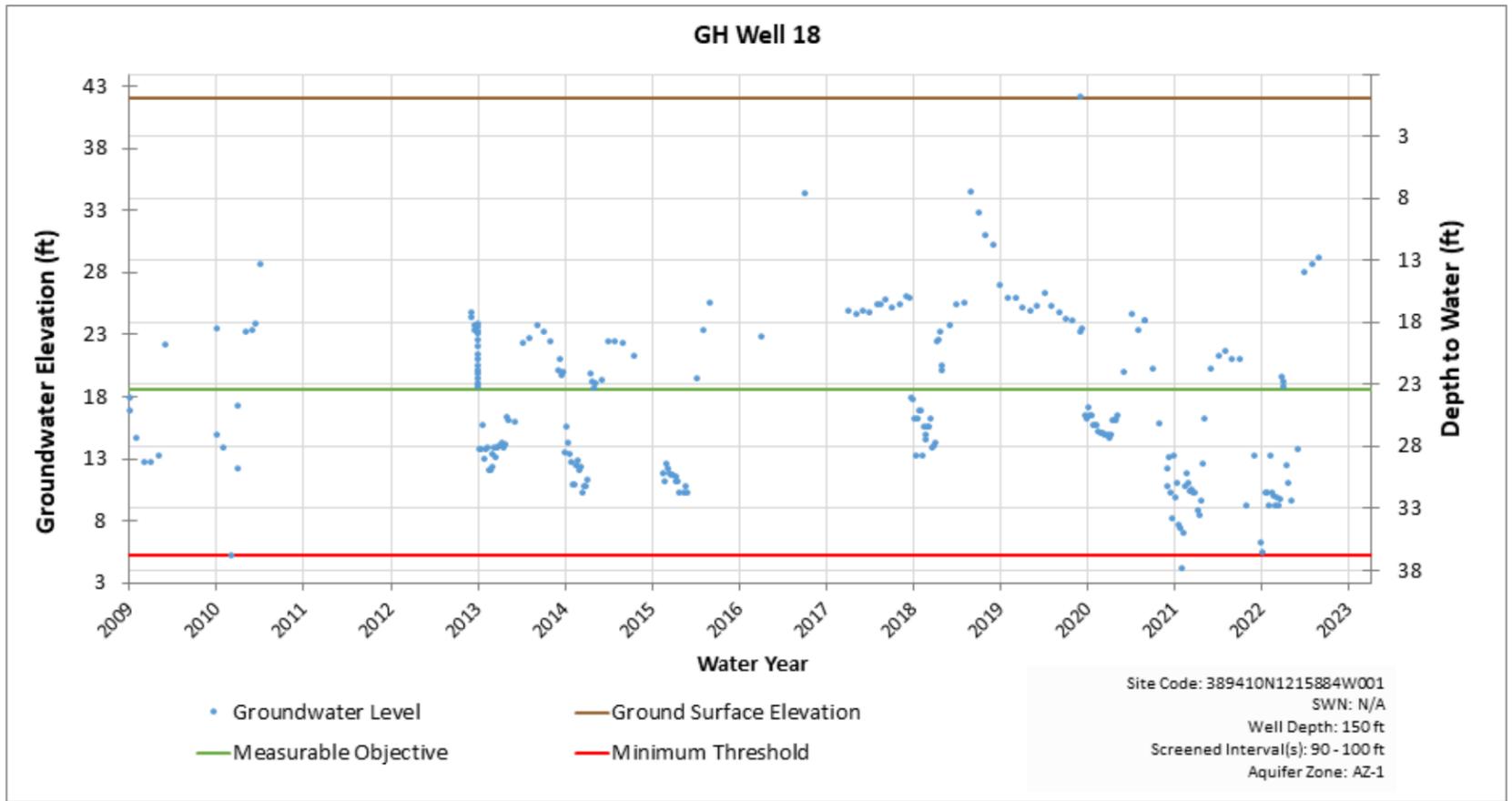


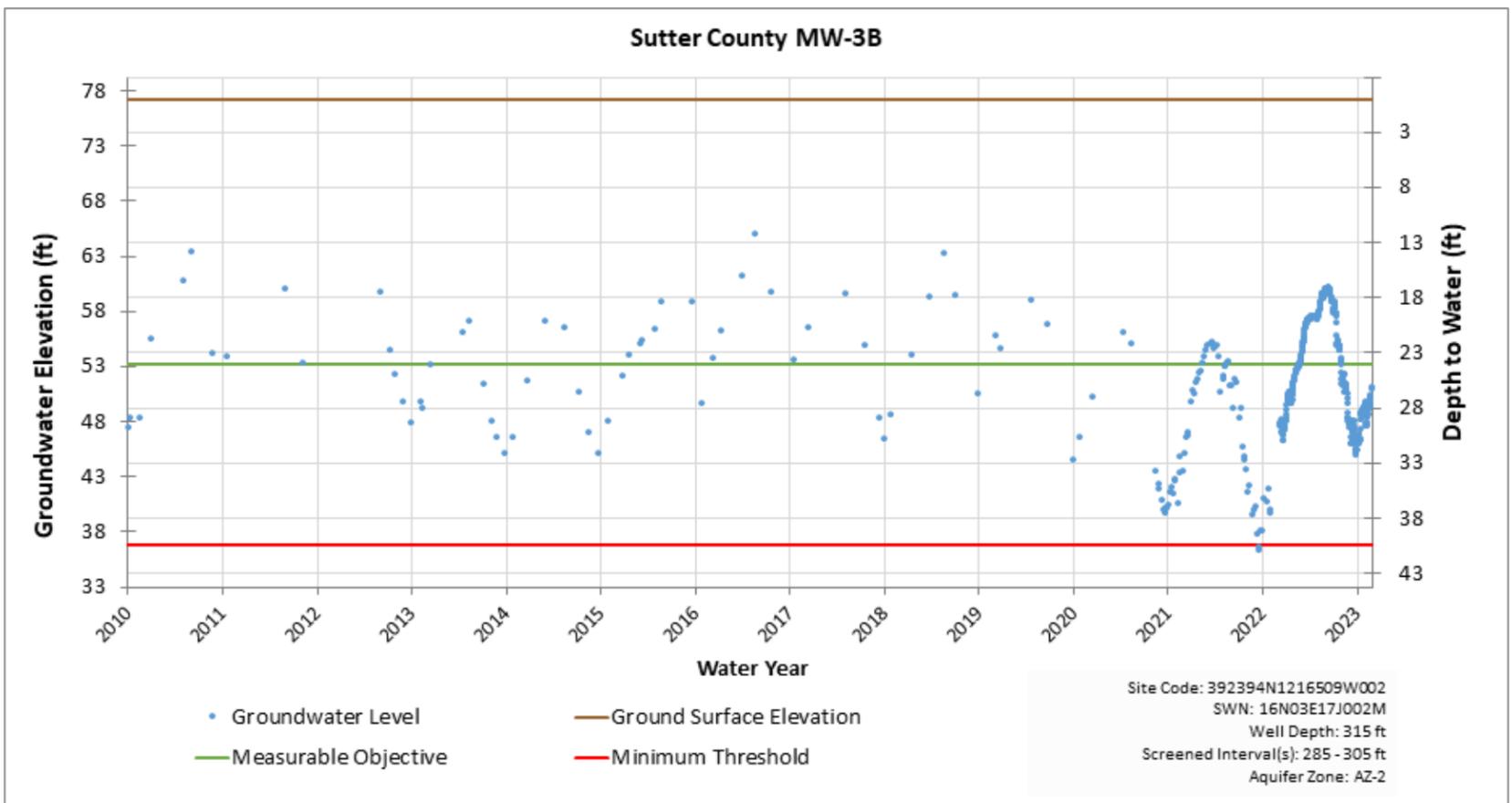
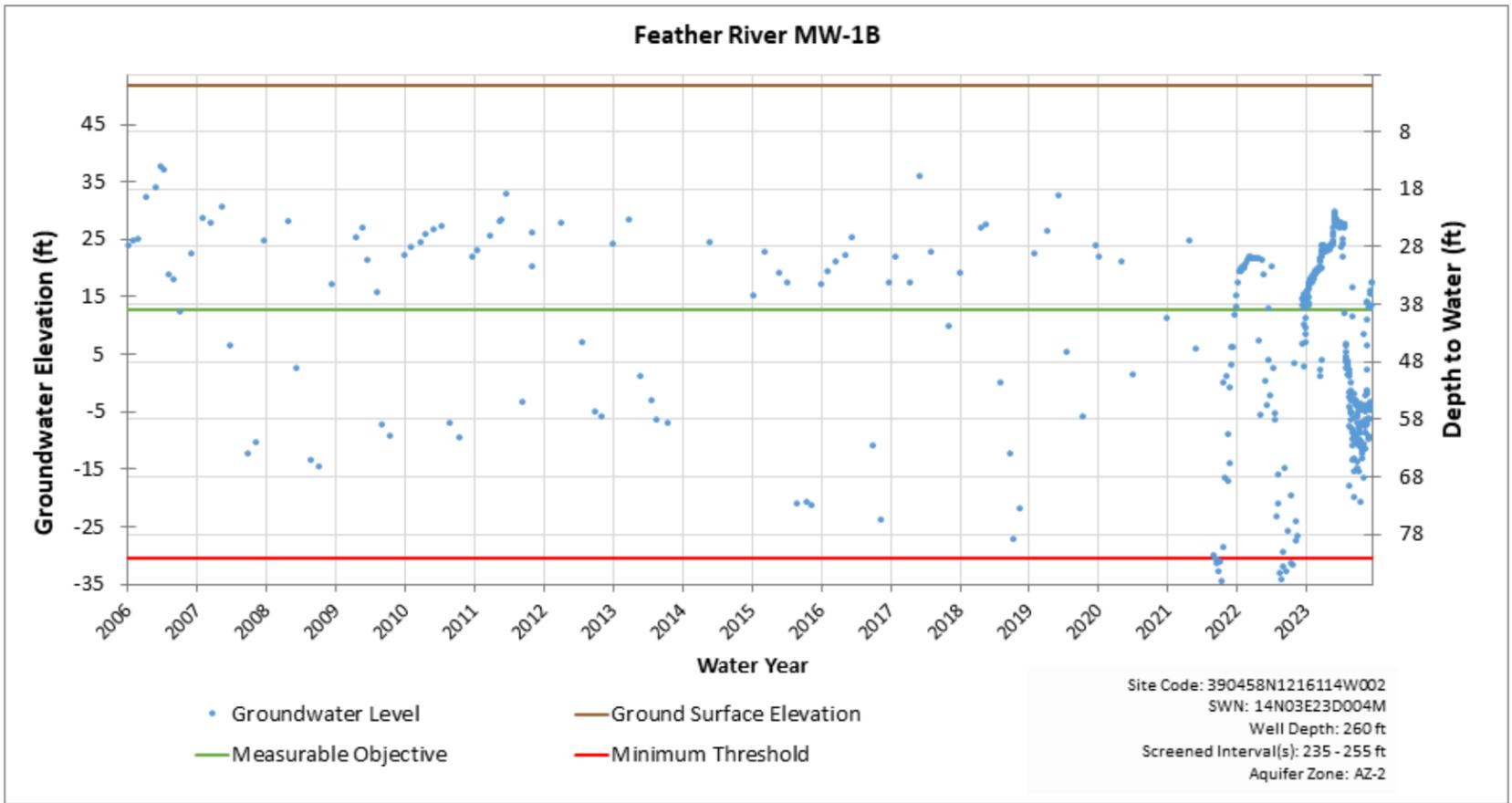


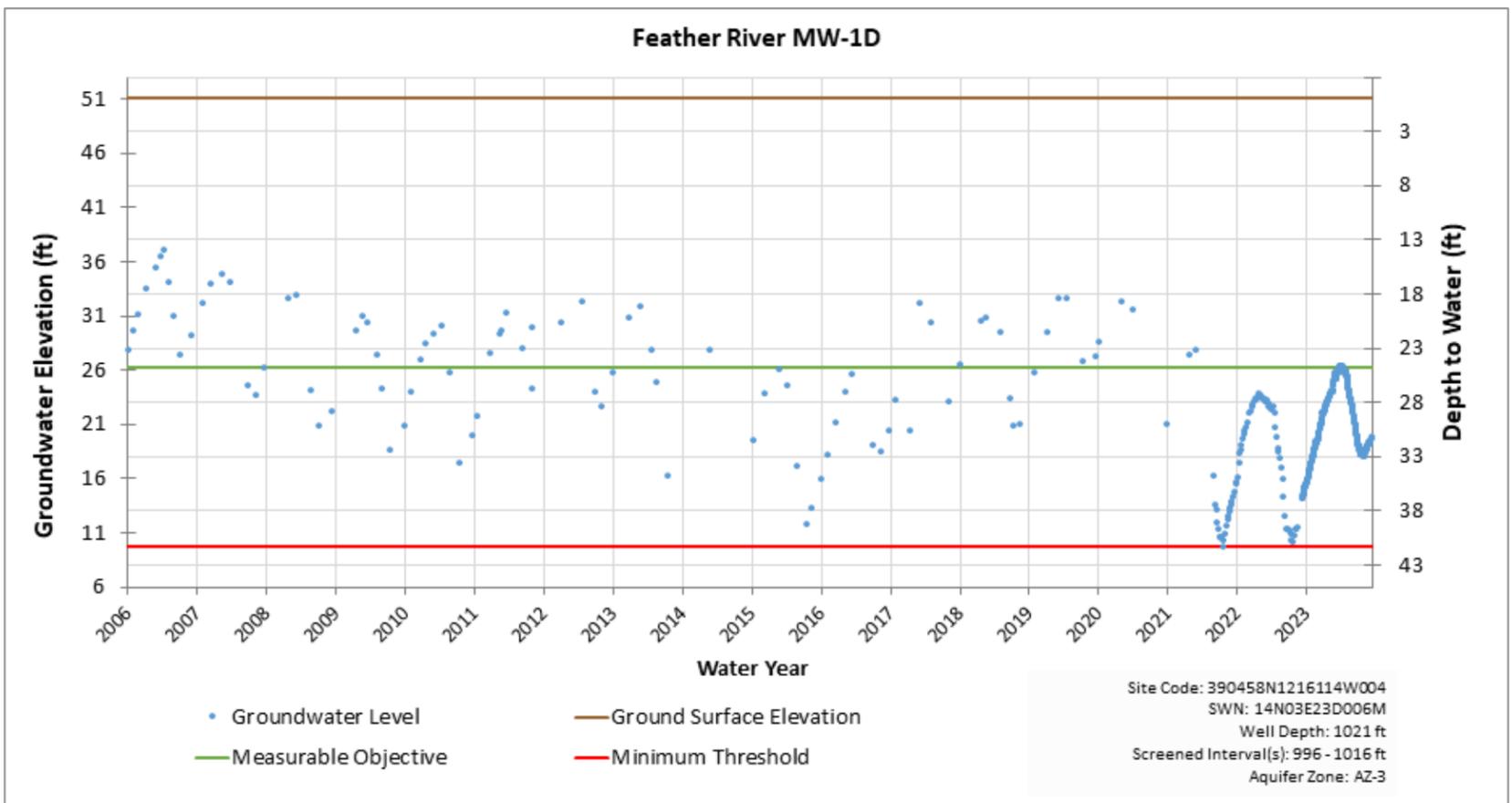
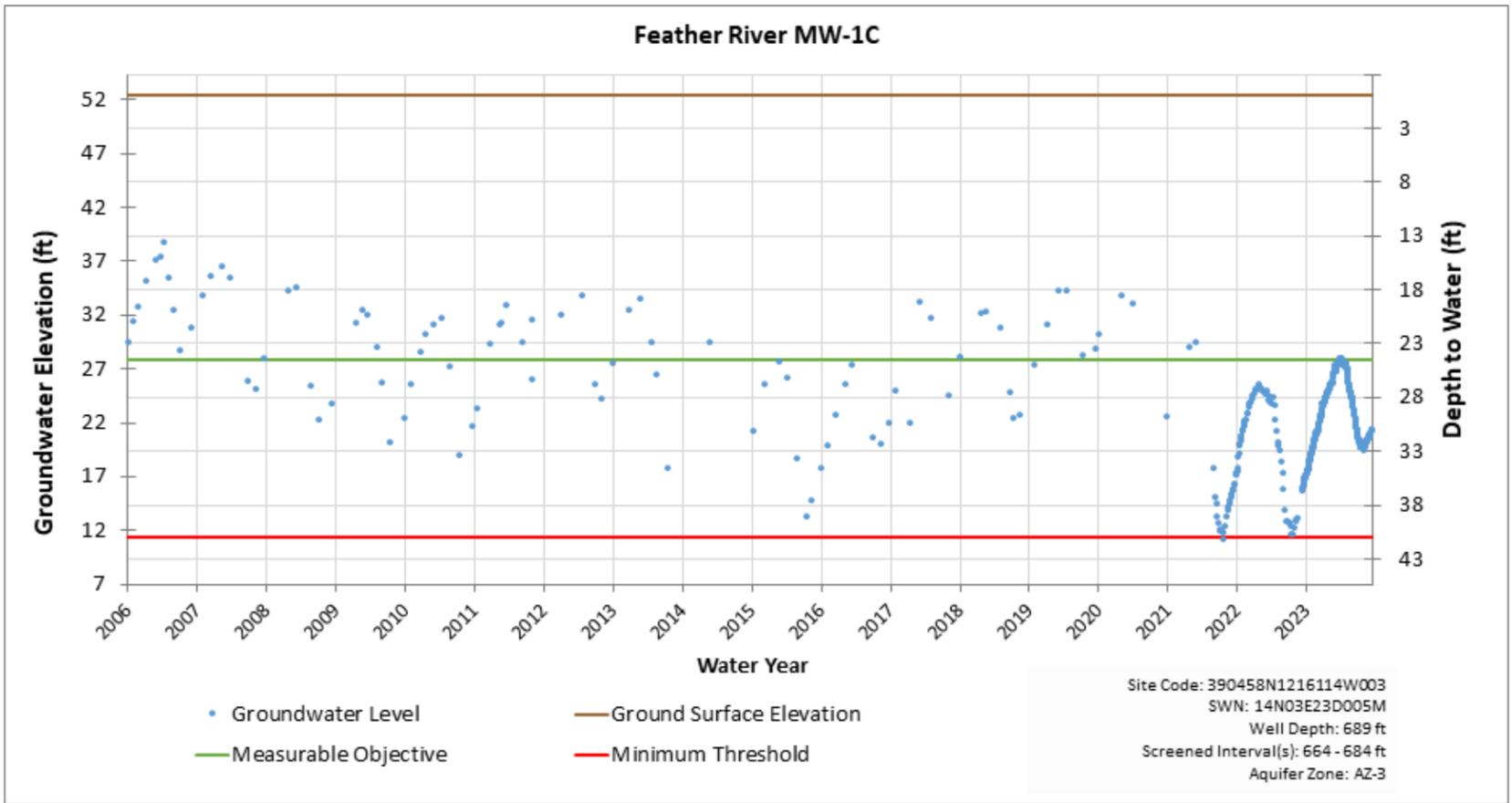


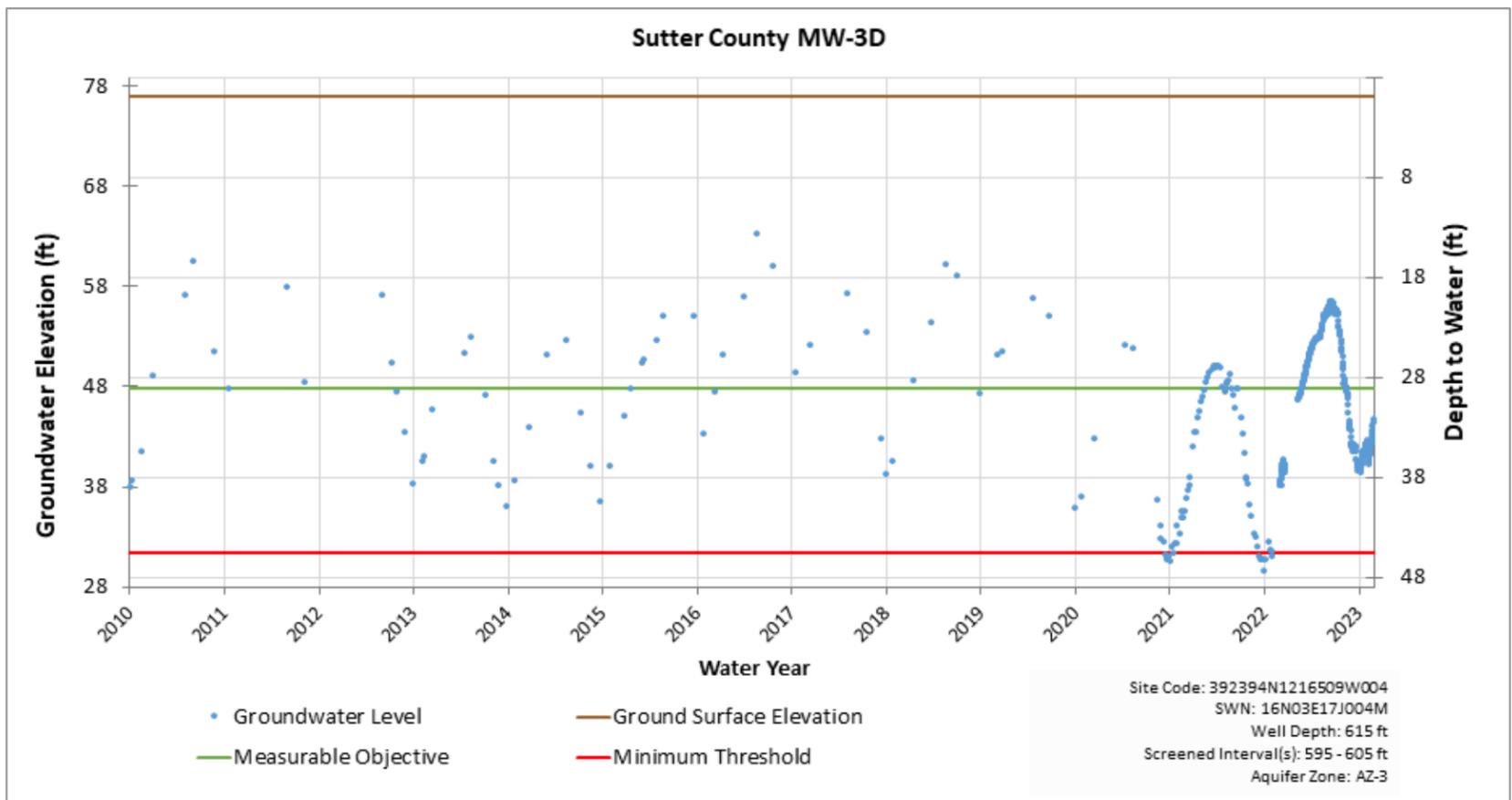
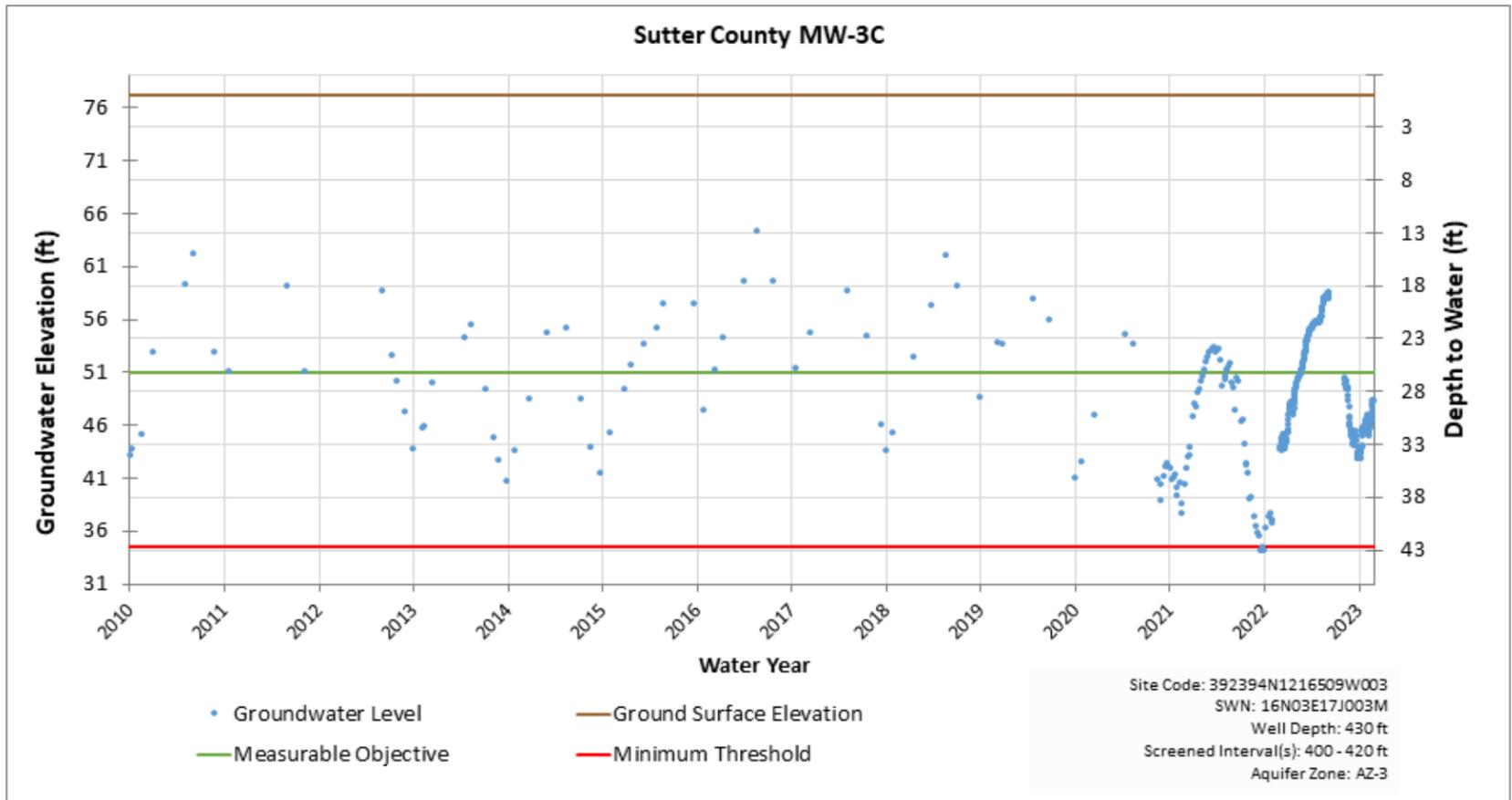


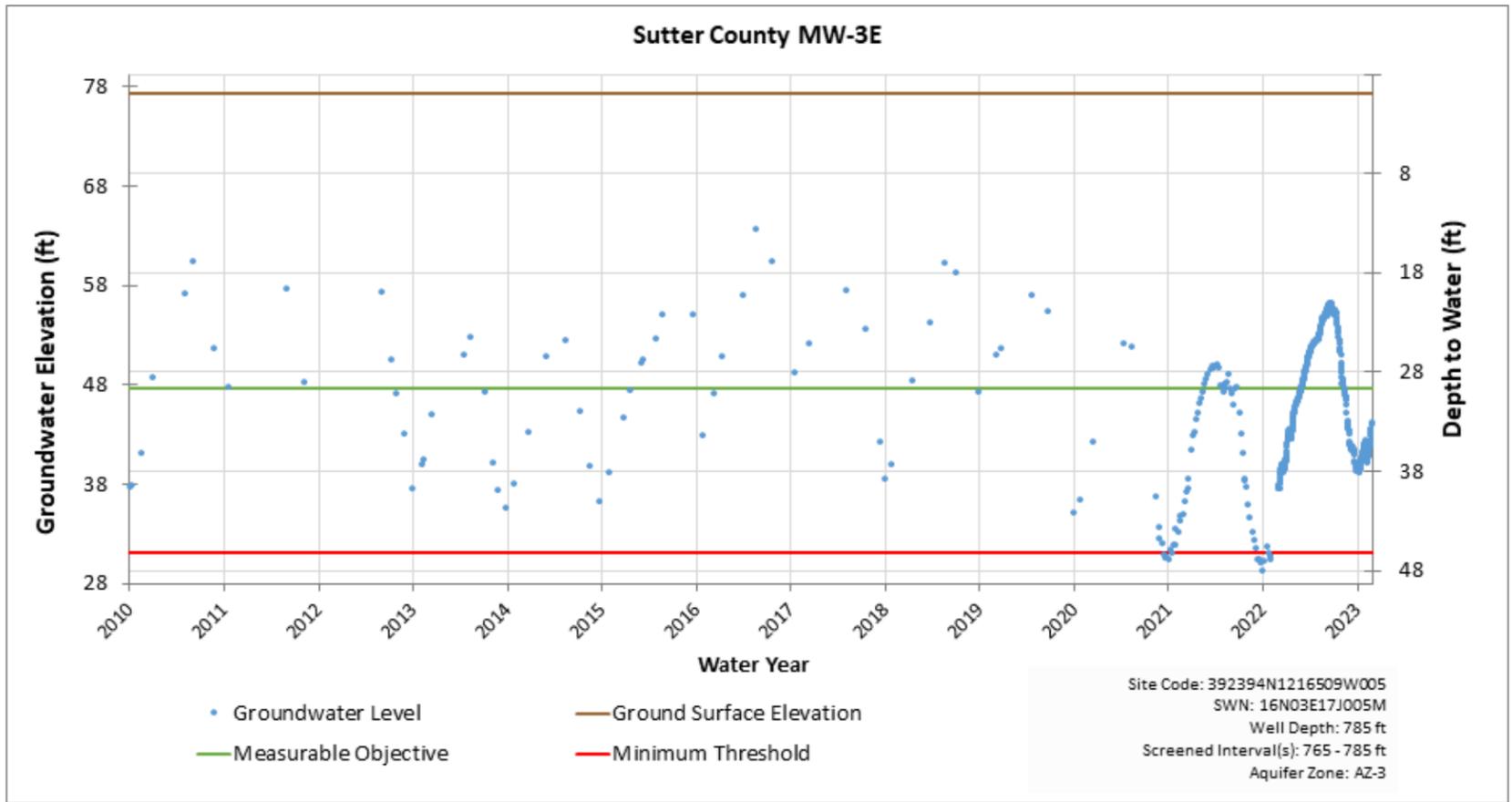












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**S U T T E R   S U B B A S I N**  
Water Year 2023 Annual Report to the  
GROUNDWATER SUSTAINABILITY PLAN