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Sutter Subbasin GSP Amendment

Chapter 6: Sustainable Management Criteria

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Acronyms

COC	constituents of concern
CVP	Central Valley Project
CV-SALTS	Central Valley Salinity Alternatives for Long-Term Sustainability
CWC	California Water Code
DPR	Department of Pesticide Regulation
DWR	California Department of Water Resources
EC	electrical conductivity
EPA	United States Environmental Protection Agency
ET	evapotranspiration
GSP	Groundwater Sustainability Plan
ILRP	Irrigated Lands Regulatory Program
MCL	maximum-contaminant level
MOA	Memorandum of Agreement
MSL	mean sea level
RWQCB	Regional Water Quality Control Board
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
SWRCB	State Water Resources Control Board
SWRCB-DDW	State Water Resources Control Board Division of Drinking Water
TDS	total dissolved solids
USBR	United States Bureau of Reclamation

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6. SUSTAINABLE MANAGEMENT CRITERIA

Sustainable Management Criteria define conditions that constitute sustainable groundwater management for the Sutter Subbasin. Sustainable Management Criteria, or SMC, include establishing the Subbasin's sustainability goal and setting numerical definitions of undesirable results, minimum thresholds, measurable objectives, and interim milestones for each sustainability indicator. This chapter contains information pursuant to the Groundwater Sustainability Plan (GSP) Emergency Regulations Article 5 *Plan Contents*, Subarticle 3 *Sustainable Management Criteria* (§354.22 through 354.30).

The Sustainable Groundwater Management Act (SGMA) defines sustainable groundwater management as "the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results" (California Water Code Section 10721). Sustainable Management Criteria for the Sutter Subbasin were developed using information presented in **Chapter 5** *Basin Setting*. Input from Subbasin stakeholders was accepted and incorporated into the established SMC through discussion and presentation at public workshops and meetings of the Sutter Subbasin Groundwater Management Coordination Committee (SSGMCC).

Developed SMC will be used to assess progress toward achieving the sustainability goal for the Sutter Subbasin. The quantitative nature of the SMC allows for demonstrated achievement of the sustainability goal for the Sutter Subbasin on or before the 20-year GSP implementation mark (established in the SGMA legislation as 2042 for non-critically overdrafted subbasins such as the Sutter Subbasin). The Sutter Subbasin GSAs will continue to coordinate with adjacent subbasins regarding SMC and related monitoring and ensure that subbasin management activities do not cause undesirable results in either the Sutter Subbasin or for adjacent subbasins.

6.1 Useful Terms

A list and description of technical terms used throughout this section to discuss SMC are presented below. **Figure 6-1** shows a graphic demonstrating the relationship between the SMC terms such as minimum thresholds and measurable objectives using groundwater elevation as an example. The terms and their descriptions are identified here to guide readers through this section and are not a definitive definition of each term.

- **Sustainability Goal** – The sustainability goal qualitatively describes the objectives and desired conditions for the Sutter Subbasin and how the goal will be met through implementation of the GSP.
- **Undesirable Result** – For each applicable sustainability indicator, the conditions at which significant and unreasonable impacts are likely to be observed. Avoidance of these conditions is used to guide development of GSP components.

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- **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 target that represents the desired condition at each representative monitoring site for an applicable sustainability indicator. Measurable objectives reflect the goal of the subbasin for the maintenance of conditions reflective of sustainable conditions.
- **Interim Milestones** – Numerical targets set in increments of five years over the 20-year implementation period of the GSP. These 'check-in' points are used to put the basin on a path towards achieving or maintaining sustainability by 2042 (as required for the Sutter Subbasin).
- **Margin of Operational Flexibility or Operating Range** – The range of active management between the measurable objective and minimum threshold.

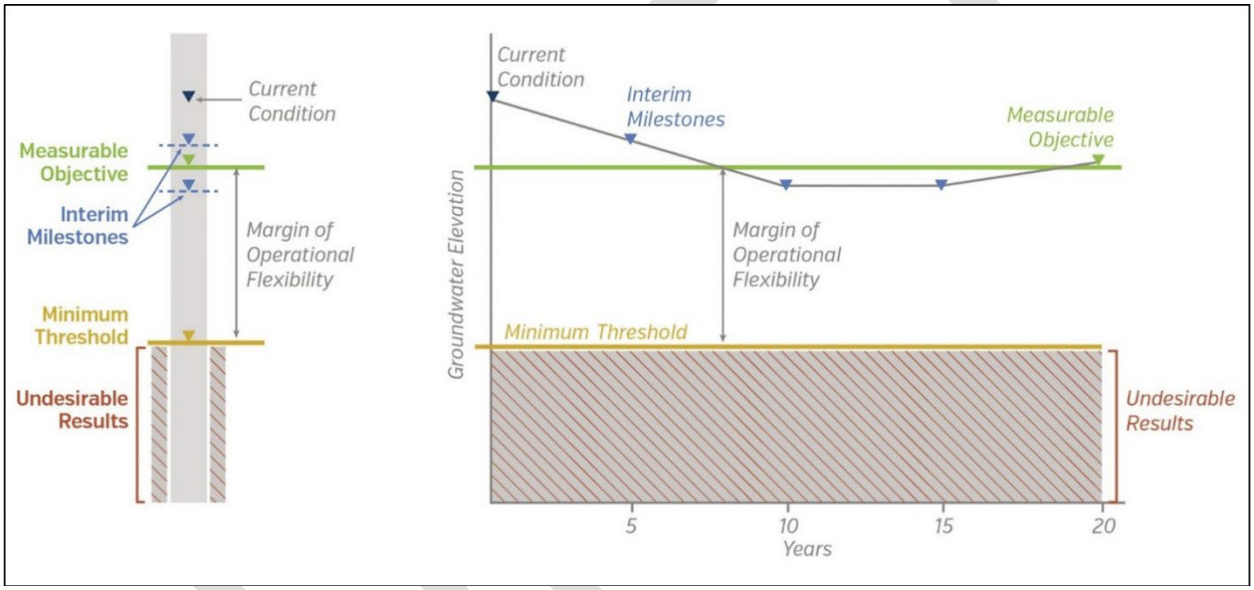

Figure 6-1. Sustainable Management Criteria Definitions Graphic

6.2 Sustainability Indicators

A sustainability indicator is defined under SGMA as one of six effects caused by groundwater conditions that, when significant and unreasonable, cause undesirable results. Undesirable results are one or more of the following effects:

- **Chronic lowering of groundwater levels** indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods

- Significant and unreasonable **reduction of groundwater storage**
- Significant and unreasonable **seawater intrusion**
- Significant and unreasonable **degraded water quality**, including the migration of contaminant plumes that impair water supplies
- Significant and unreasonable **land subsidence** that substantially interferes with surface land uses
- **Depletions of interconnected surface water** that have significant and unreasonable adverse impacts on beneficial uses of the surface water

SGMA allows several pathways to meet the distinct local needs of each basin or subbasin, including development of SMC, use of other sustainability indicators as proxy, and identification of indicators that are not applicable to the basin or subbasin. Details of these approaches are included in the following sections. Continued data collection and improved understanding of basin conditions in the future may lead to changes in the SMC discussed herein.

Future changes to SMC calculations or methodologies will be detailed in Annual Reports and Periodic Evaluations and will be evaluated using the same criteria contained herein to ensure that undesirable results are not caused as a result of revised SMC in the Sutter Subbasin or adjacent subbasins.

6.3 Sustainability Goal

The sustainability goal provides a succinct qualitative description of the objectives and desired conditions that culminates in the absence of undesirable results by 2042 in the Sutter Subbasin. It is supported by the SMC established herein.

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 sustainability goal was developed based on information presented in **Chapter 5** *Basin Setting*. As discussed in further detail in the **Section 5.3** *Water Budgets*, the Sutter Subbasin is anticipated to be sustainable relative to the chronic lowering of groundwater levels, reduction of groundwater storage, and depletions of interconnected surface water sustainability indicators over the 50-year planning horizon of this GSP

even with the potential impacts of climate change. Limited recent data relative to the degraded water quality sustainability indicator are available, and improvements to comprehensive groundwater quality monitoring throughout the Sutter Subbasin are detailed in **Section 7.1**. As noted in **Section 5.2** *Groundwater Conditions*, available land subsidence data indicates that inelastic land subsidence has not historically been observed in the Sutter Subbasin. Seawater intrusion is not considered an applicable sustainability indicator for the Sutter Subbasin as the subbasin is located inland and not adjacent to the Pacific Ocean.

In order to make progress in meeting the sustainability goal, locally-defined quantitative minimum thresholds and measurable objectives have been established for the Sutter Subbasin to define the operating range of the groundwater subbasin and ensure that the Subbasin will be operated within its sustainable yield. These criteria were developed in a coordinated fashion with adjacent subbasins by reviewing public drafts and final drafts of their respective SMC chapters at the time of initial GSP development in 2021 and associated revisions as available during the Periodic Evaluation process in 2026, as well as through discussion by consultant staff throughout the Sacramento Valley. Projects and management actions, as detailed in **Section 7.1**, were selected to avoid undesirable results, provide for adaptive management of the groundwater subbasin, and to fill identified data gaps within the Sutter Subbasin. For more information about sustainable yield and the projects and management actions to be implemented during the 20-year implementation period, refer to **Section 5.3** and **Section 7.1**, respectively.

Over the GSP planning and implementation horizon, Subbasin conditions are expected to fluctuate relative to minimum thresholds, measurable objectives, and interim milestones due to fluctuations in hydrologic conditions (both natural and human-influenced), future changes in land use, modification of basin operations, and implementation of projects and management actions. The Subbasin will be managed to prevent conditions from causing undesirable results. Demonstration of the absence of undesirable results will support a determination that the Subbasin is operating within its sustainable yield (discussed in **Section 5.3**) and support the conclusion that the sustainability goal has been achieved by 2042 and maintained beyond 2042.

6.4 Undesirable Results

Undesirable results are defined under SGMA as one or more significant and unreasonable effects caused by groundwater conditions occurring throughout a basin based on the six sustainability indicators of SGMA: chronic lowering of groundwater levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and depletions of interconnected surface water. A description of undesirable results as defined under SGMA and by the Sutter Subbasin GSAs, identification of undesirable results, potential causes for undesirable results, and potential effects of undesirable results relative to all applicable sustainability indicators for the Sutter Subbasin are detailed below.

6.4.1 Chronic Lowering of Groundwater Levels

The undesirable result related to groundwater levels is defined under SGMA as:

> *Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels in storage during other periods (California Water Code [CWC] Section 10721(x)(1)).*

6.4.1.1 Description of Undesirable Results

An undesirable result for chronic lowering of groundwater levels in the Sutter Subbasin is experienced when groundwater levels drop to a level that causes domestic or irrigation wells to go dry or lose functional pumping capacity, results in significantly higher pumping costs, and/or requires significant and unreasonable effort to maintain or deepen production wells.

6.4.1.2 Identification of Undesirable Results

An undesirable result is observed when groundwater elevations drop below the minimum threshold criteria in at least 25% of representative monitoring locations (13 out of 52 representative wells) concurrently over two consecutive seasonal low water level measurements. Impacts relating to this SMC will be evaluated both by aquifer zone and for the principal aquifer as a whole; however, the definition of undesirable results refers specifically to the principal aquifer. Minimum threshold exceedance patterns by aquifer zone will also be monitored and addressed as appropriate. For more information about how the identification of undesirable results for chronic lowering of groundwater levels was determined, refer to **Appendix 6-B**.

6.4.1.3 Potential Causes of Undesirable Results

Based on available information about projected changes in land use in the Subbasin, it is anticipated that the long-term average groundwater use in the Sutter Subbasin is not likely to change to the point where groundwater levels are impacted resulting in undesirable results. However, significantly increased groundwater pumping as a result of reduced surface water supplies due to instream flow requirements or other factors could impact groundwater levels to the point where undesirable results are observed. Other potential localized impacts to groundwater levels could be caused by increases in the consumptive use of groundwater due to increased agricultural productivity and changes in the hydrologic system, such as increases in impervious surfaces or significant changes to upstream reservoir releases.

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Undesirable results are intended to evaluate the overall basin conditions rather than performance of an individual project or management action. Groundwater levels can be influenced by a combination of hydrologic variability, drought conditions, surface water supply, and regional pumping patterns and water use. Many of these factors are outside the direct control of the GSAs, and occurrence of declining groundwater levels or threshold exceedances does not necessarily indicate a specific project or management action was ineffective. Instead, these conditions should be considered within the broader context of basin-wide and regional hydrologic conditions.

6.4.1.4 Potential Effects of Undesirable Results

If groundwater levels were to reach levels indicating undesirable results, potential effects could include the following:

- Dewatering of shallow wells
- Increased costs to pump groundwater
- Adverse effects on groundwater dependent ecosystems (GDEs) resulting from losses of connection with the principal aquifer, including difficulty for plants and animals to access groundwater
- Changes in irrigation practices and crops grown
- Adverse effects on property values and the regional economy

6.4.2 Reduction of Groundwater Storage

The undesirable result related to reduction of groundwater storage is defined under SGMA as:

> *Significant and unreasonable reduction of groundwater storage (CWC Section 10721(x)(2)).*

6.4.2.1 Identification of Undesirable Results

The same trigger for an undesirable result for the chronic lowering of groundwater levels is applicable to the long-term reduction of groundwater storage. Long-term reductions in storage are not anticipated as the Sutter Subbasin is already sustainable and due to the large volume of water currently in storage in the Subbasin. Therefore, as long as groundwater levels are managed above minimum thresholds, changes in storage should not be significant.

6.4.2.2 Potential Causes of Undesirable Results

Although groundwater has historically been used sustainably in the Sutter Subbasin, dramatic increases in the reliance on groundwater, severe drought, or other major changes in groundwater management over time could cause the volume of fresh groundwater in storage to decline to a significant and unreasonable level. Additionally, regulatory requirements placed on the Central Valley Project (CVP) and State Water Project (SWP) operations could impact the Sacramento River Settlement Contractors

and Feather River diverters, respectively. Instream flow requirements on the Sacramento and/or Feather Rivers and their tributaries may also result in negative impacts to surface water supplies. Reductions in surface water supplies would result in increased reliance on groundwater resources within the Sutter Subbasin and potentially result in the long-term reduction in groundwater storage.

This undesirable result is driven by the chronic lowering of groundwater levels sustainability indicator and established SMC, which have been determined to be protective of possible undesirable results for the long-term reduction of groundwater storage.

6.4.2.3 Potential Effects of Undesirable Results

If groundwater levels were to reach the point where undesirable results are observed, undesirable effects could include shallow wells going dry and/or losing production capacity resulting in the need to deepen or replace wells; increased pumping costs as deeper wells are required to access groundwater; and an overall reduction in beneficial uses of groundwater.

6.4.3 Seawater Intrusion

Seawater intrusion is not an applicable sustainability indicator for the Sutter Subbasin as the Subbasin is located inland from the Pacific Ocean and is not adjacent to the Sacramento-San Joaquin Delta. Therefore, SMC for seawater intrusion will not be established for the Sutter Subbasin GSP.

6.4.4 Degraded Water Quality

The undesirable result related to degraded water quality is defined under SGMA as:

> *Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies (CWC Section 10721(x)(4)).*

6.4.4.1 Description of Undesirable Results

An undesirable result for degraded water quality in the Sutter Subbasin would be the 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. The causal nexus reflects that the undesirable results are water quality issues associated with groundwater pumping and other groundwater management-related activities rather than water quality issues resulting from land use practices, naturally-occurring water quality issues, or other issues not associated with groundwater pumping and other groundwater-related activities.

Within the Sutter Subbasin, the causal nexus would be related to increased salinity (measured as total dissolved solids [TDS]) and nitrate (measured as nitrate as N)

concentrations resulting from groundwater pumping or implementation of projects and/or management actions. It should be noted that water quality issues outside of the causal nexus are generally covered by other regulatory frameworks. Contamination sites are regulated by the Regional Water Quality Control Board (RWQCB), California Department of Toxic Substances Control (DTSC), and the U.S. Environmental Protection Agency (EPA). Drinking water quality is regulated by the State Water Resources Control Board, Division of Drinking Water (SWRCB-DDW). Potential contamination by agricultural practices is regulated through Central Valley Salinity Alternatives for Long-term Sustainability (CV-SALTS), Irrigated Lands Regulatory Program (ILRP), and California Department of Pesticide Regulation (DPR).

Aside from TDS and nitrate related to anthropogenic activities (such as agricultural activities or septic systems), the Sutter Subbasin GSAs do not have control over the presence of naturally-occurring constituents in aquifer materials or changes in concentrations in groundwater resulting from the naturally-occurring fluctuations of groundwater levels. In the event that there is a causal nexus determined between elevated concentrations of other constituents of concern (COCs), or other COCs not presently identified and groundwater management activities, the Sutter Subbasin GSAs will consider establishing SMCs for such COCs. Management actions and studies are presented in **Section 7.1**. Because the Subbasin is considered sustainable, these are, for the most part, identified for adaptive basin management or to meet other needs. As such, implementation of these projects, management actions, and studies will be implemented pending the availability of grant or other funding, as appropriate research partners are identified and partnerships formed, or as needed for Subbasin management with the goal of further evaluating the fate and transport of COCs in the Sacramento Valley as a whole.

6.4.4.2 Identification of Undesirable Results

An undesirable result for degraded water quality is triggered, or considered “significant and unreasonable,” when at least 50% of representative monitoring wells (10 out of 19 representative wells) across all aquifer zones exceed the minimum threshold for two consecutive annual measurements at each location and where these minimum threshold exceedances can be tied to a causal nexus between SGMA-related activities and water quality. Water quality data collected in all water year types, including drought years, will be used in the evaluation. As with groundwater levels, water quality data will be assessed on an annual basis by both principal aquifer and by aquifer zones. Such criteria in identifying an undesirable result for degraded water quality would provide sufficient data to establish a trend or connection between degraded water quality and potential worsening groundwater levels as a result of GSP-related activities.

6.4.4.3 Potential Causes of Undesirable Results

TDS and nitrate have been identified as COCs in the Sutter Subbasin and are largely the result of non-point sources. Elevated TDS concentrations are primarily the result of

a combination of land use practices, the upwelling of seawater (connate) deposits within marine sediments, dissolvable materials within the alluvial fan complexes, and the naturally poor-draining conditions which tend to result in accumulation of salts. Elevated nitrate concentrations are largely the result of anthropogenic sources such as agricultural applications of fertilizer and septic systems in the Sutter Subbasin. For more information about groundwater quality in the Sutter Subbasin, refer to **Sections 5.1.9** and **5.2.5** of the *Basin Setting* chapter.

Conditions that may cause an undesirable result for degraded water quality include changes in the location (both vertically and horizontally) and volume of groundwater pumping or managed groundwater recharge, both resulting in the contribution to and/or potential mobilization of COCs as a result of these activities.

6.4.4.4 Potential Effects of Undesirable Results

If an undesirable result for degraded water quality were to occur, the effect could cause a reduction in economically usable groundwater supply for all beneficial users of groundwater and/or an increased need for groundwater treatment prior to use, with domestic wells being most vulnerable as costs for treatment or access to alternate supplies can be high for small users. For agricultural groundwater users, degraded water quality may cause potential changes in irrigation practices, crops grown, agricultural efficiencies, adverse effects on property values, and other economic impacts, with the potential to adversely impact the larger economy throughout the Subbasin. Water quality degradation could also impact GDEs and impact surface water quality and health of aquatic species. Additionally, reaching undesirable results concentrations for groundwater quality could adversely affect current and projected municipal uses, which could have to install treatment systems or seek alternate supplies.

6.4.5 Land Subsidence

The undesirable result related to land subsidence is defined under SGMA as:

> *Significant and unreasonable land subsidence that substantially interferes with surface land uses (CWC Section 10721(x)(5)).*

6.4.5.1 Description of Undesirable Results

An undesirable result for land subsidence would be a result due to groundwater extraction that causes a significant reduction in the viability of the use of critical infrastructure for water distribution and flood control (e.g., levees), including impacts to laterals from differential settlement that reduces the ability to deliver surface water supplies or inadequate freeboard on levee systems in wet years impacting conveyance of flood waters. Critical infrastructure in the Sutter Subbasin include levee systems along the Sacramento and Feather Rivers and the Sutter Bypass, the main distribution canal systems operated by the Subbasin's irrigation and reclamation districts, and major State highways such as Highways 20, 70, and 99.

6.4.5.2 Identification of Undesirable Results

The representative monitoring network for land subsidence consists of Subbasin-wide InSAR monitoring zones, CGPS Station 1500, and the Sutter Land Subsidence Extensometer. InSAR data will be evaluated within 5-square-mile monitoring zones across the Subbasin and supplemented by the CGPS station and extensometer. Undesirable results are considered to occur when at least 25% of representative monitoring sites exceed the minimum threshold over a five-year rolling average calculated by water year.

6.4.5.3 Potential Causes of Undesirable Results

As noted in **Section 5.2.6**, significant inelastic land subsidence has not historically been observed in the Sutter Subbasin. Available extensometer, CGPS, and InSAR data indicate that observed vertical displacement has generally been minimal, within measurement uncertainty, localized, or likely elastic. Potential undesirable results would occur if groundwater extraction caused sustained groundwater level declines sufficient to dewater compressible aquifer materials and produce inelastic land subsidence. The potential for this condition is considered limited under current hydrogeologic and groundwater use conditions but could increase with substantial increases in groundwater production.

6.4.5.4 Potential Effects of Undesirable Results

Undesirable results related to land subsidence could potentially cause differential changes in land surface elevation resulting in damage to water conveyance infrastructure, flood control facilities and other infrastructure, and/or causing decreased capacity to convey water or control flood waters by reducing levee freeboard to below three feet (DWR, 2012). The cost to convey surface water or control flood waters would likely increase as gradients of gravity-driven conveyance and/or flood control structures would require repair and modification or increased energy to pump and move surface or flood waters. These potential effects could result in significant economic costs and adversely impact property value as well as public safety.

6.4.6 Depletions of Interconnected Surface Water

The undesirable result related to the depletions of interconnected surface water is defined under SGMA as:

> *Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water (CWC Section 10721(x)(6)).*

6.4.6.1 Description of Undesirable Results

The undesirable result for the depletions of interconnected surface water is a result that causes significant and unreasonable adverse effects on the beneficial uses and users of

interconnected surface waters within the Sutter Subbasin over the GSP planning and implementation horizon.

6.4.6.2 Identification of Undesirable Results

The same trigger for an undesirable result for the chronic lowering of groundwater levels is applicable to the depletions of interconnected surface water sustainability indicator. Long-term depletions of interconnected surface water are not anticipated as the Sutter Subbasin is already sustainable and has not experienced any adverse effects on the beneficial uses and users of interconnected surface water. Therefore, as long as groundwater levels are managed above minimum thresholds, there should be no significant loss of aquifer contribution to the interconnected water course (if currently a gaining stream) and/or a reversal of stream connection from gaining to losing streams. The use of groundwater levels SMC as a proxy for the depletions of interconnected surface water is discussed further in **Section 6.5.6.2**.

6.4.6.3 Potential Causes of Undesirable Results

The potential causes of undesirable results for the depletions of interconnected surface water include increased groundwater demand along interconnected corridors, specifically the Sacramento and Feather Rivers and the Sutter Bypass, and/or significant changes in upstream reservoir releases (as both the Sacramento and Feather Rivers are controlled rivers). See **Section 5.2.7** for identification of interconnected surface waters.

6.4.6.4 Potential Effects of Undesirable Results

If depletions of interconnected surface water were to reach levels causing undesirable results, the adverse effects could potentially include the reduced ability of surface water flows to meet instream flow requirements or to deliver surface water supplies to users in the Subbasin. Fisheries, riparian habitat, and recreational opportunities within the Sutter Subbasin could also be impacted by lower instream flows and by increased temperatures. This could also result in increased groundwater production to offset the availability of surface water, changes in irrigation practices and crops grown, and could cause adverse effects on property values and the Subbasin-wide economy.

6.5 Minimum Thresholds

Minimum thresholds are the quantitative values that represent groundwater conditions at a representative monitoring site that, when exceeded in combination with minimum thresholds at other monitoring sites, may cause an undesirable result in the basin or subbasin. This section documents the numeric minimum thresholds established for all applicable sustainability indicators in the Sutter Subbasin by describing how minimum thresholds were identified and different methodologies considered; the relationship of other applicable sustainability indicators in the Subbasin; effects on neighboring

subbasins and beneficial uses/users; relevant local, state, or federal standards; and the method of quantitative measurement selected.

6.5.1 Chronic Lowering of Groundwater Levels

6.5.1.1 Identification and Methodology

Minimum thresholds for the chronic lowering of groundwater levels are established as the deepest groundwater elevation by the following two methods:

1. The historic low for the available record at each representative monitoring site; or
2. The average operating range (difference between measurable objective and minimum threshold) for all representative monitoring sites using the above criterion for the following aquifer zones (AZs), applied based on the available screen interval or well depth information for each representative monitoring site:
    a. Shallow AZ and AZ-1 = 8.0 feet
    b. AZ-2 and AZ-3 = 16.5 feet

Table 6-1 reflects the minimum thresholds established for the chronic lowering of groundwater levels at each representative monitoring site. Refer to **Appendix 6-A** for hydrographs for all representative monitoring sites for the chronic lowering of groundwater levels plotted with the established minimum thresholds and measurable objectives.

In the Sutter Subbasin, groundwater levels have been sustainable over time as the aquifer rebounds during all water year types following the irrigation season, returning to pre-pumping levels on a seasonal basis (see **Section 5.2** *Groundwater Conditions*). Therefore, undesirable results relative to the chronic lowering of groundwater levels have not historically been observed in the Sutter Subbasin.

For representative monitoring sites with small operating ranges as a result of the application of the first minimum threshold methodology listed above, a minimum operating range was applied. The average operating range for the Shallow AZ and AZ-1 were combined with the goal of being protective of interconnected surface waters, GDEs, and shallow domestic wells, where the average operating range of AZ-2 and AZ-3 were combined because most groundwater is pumped from these aquifer zones by municipal and agricultural production wells in the Sutter Subbasin. A minimum operating range is applied where applicable in order to allow for a reasonable use of groundwater by all beneficial users in the Sutter Subbasin.

Throughout GSP implementation, additional data collected at each representative monitoring site will be evaluated to determine that the minimum operating range applied does not cause an undesirable result in the Sutter Subbasin or adjacent subbasins. At the time of GSP development, it is not anticipated this method will cause an undesirable result.

Table 6-1. Minimum Thresholds for Chronic Lowering of Groundwater Levels

Site Code	State Well Number	Local ID / Other ID	Aquifer Zone	Minimum Threshold (feet above MSL, NAVD88)
390696N1217778W001	14N02E17C001M	Sutter County MW-1A	Shallow	21.50
387859N1216565W001	11N03E20H003M	RD 1500 Karnak	AZ-1	10.51
388761N1217094W001	12N02E23H001M	Sutter County MW-2A	AZ-1	7.58
389605N1218102W003	13N01E24G004M	Flood MW-1C (shall)	AZ-1	13.00
390087N1216722W001	13N03E06A001M	Sutter County MW-6A	AZ-1	21.13
390682N1216901W001	14N02E13A003M	SEWD MW-3A	AZ-1	37.37
390588N1217004W001	14N02E13L001M	-	AZ-1	15.93
390176N1217902W001	14N02E31K001M	-	AZ-1	19.08
390244N1217813W001	14N02E32D001M	SMWC MW-1A	AZ-1	18.34
390458N1216114W001	14N03E23D003M	Feather River MW-1A	AZ-1	15.78
391051N1217012W001	15N02E36L001M	-	AZ-1	33.09
392394N1216509W001	16N03E17J001M	Sutter County MW-3A	AZ-1	59.82
392970N1216907W003	17N02E25J003M	BWD MW-1C	AZ-1	60.03
391456N1218904W001	-	MFWC Prop 50	AZ-1	27.72
389605N1218102W001	13N01E24G002M	Flood MW-1A (deep)	AZ-2	7.20
389605N1218102W002	13N01E24G003M	Flood MW-1B (int)	AZ-2	-7.90
391078N1216244W002 [1]	-	La Grande	AZ-2	17.34
391068N1216464W002 [2]	-	Edwin	AZ-2	14.35
390087N1216722W002	13N03E06A002M	Sutter County MW-6B	AZ-2	10.21
390087N1216722W003	13N03E06A003M	Sutter County MW-6C	AZ-2	9.91
389452N1215992W001	13N03E26J002M	Sutter County MW-4A	AZ-2	5.09
390682N1216901W002	14N02E13A004M	SEWD MW-3B	AZ-2	21.16
390696N1217778W002	14N02E17C002M	Sutter County MW-1B	AZ-2	12.33

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Site Code	State Well Number	Local ID / Other ID	Aquifer Zone	Minimum Threshold (feet above MSL, NAVD88)
388761N1217094W002	12N02E23H002M	Sutter County MW-2B	AZ-2	-0.08
390244N1217813W002	14N02E32D002M	SMWC MW-1B	AZ-2	10.01
390458N1216114W002	14N03E23D004M	Feather River MW-1B	AZ-2	-30.19
391658N1217070W001	15N02E12E001M	SEWD MW-1A	AZ-2	15.66
391658N1217070W002	15N02E12E002M	SEWD MW-1B	AZ-2	23.14
391414N1217442W001	15N02E22D001M	-	AZ-2	24.00
391279N1216989W001	15N02E24P001M	SEWD MW-2A	AZ-2	24.51
391279N1216989W002	15N02E24P002M	SEWD MW-2B	AZ-2	-16.30
392394N1216509W002	16N03E17J002M	Sutter County MW-3B	AZ-2	36.89
392970N1216907W002	17N02E25J002M	BWD MW-1B	AZ-2	3.90
391283N1218286W001	-	BS2-Franklin	AZ-2	16.77
391613N1216237W001	-	WTP well	AZ-2 and AZ-3	21.51
388761N1217094W003	12N02E23H003M	Sutter County MW-2C	AZ-3	-0.12
388761N1217094W004	12N02E23H004M	Sutter County MW-2D	AZ-3	-0.41
389452N1215992W002	13N03E26J003M	Sutter County MW-4B	AZ-3	4.12
389452N1215992W003	13N03E26J004M	Sutter County MW-4C	AZ-3	2.82
389452N1215992W004	13N03E26J005M	Sutter County MW-4D	AZ-3	0.34
390682N1216901W003	14N02E13A005M	SEWD MW-3C	AZ-3	18.52
390696N1217778W003	14N02E17C003M	Sutter County MW-1C	AZ-3	5.77
390696N1217778W004	14N02E17C004M	Sutter County MW-1D	AZ-3	11.91
390244N1217813W003	14N02E32D003M	SMWC MW-1C	AZ-3	8.85
390458N1216114W003	14N03E23D005M	Feather River MW-1C	AZ-3	11.05
390458N1216114W004	14N03E23D006M	Feather River MW-1D	AZ-3	9.49
391658N1217070W003	15N02E12E003M	SEWD MW-1C	AZ-3	22.91

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Site Code	State Well Number	Local ID / Other ID	Aquifer Zone	Minimum Threshold (feet above MSL, NAVD88)
391279N1216989W003	15N02E24P003M	SEWD MW-2C	AZ-3	-13.80
392394N1216509W003	16N03E17J003M	Sutter County MW-3C	AZ-3	34.68
392394N1216509W004	16N03E17J004M	Sutter County MW-3D	AZ-3	31.78
392394N1216509W005	16N03E17J005M	Sutter County MW-3E	AZ-3	31.21
392970N1216907W001	17N02E25J001M	BWD MW-1A	AZ-3	10.10

[1] Previously identified as Hillcrest Well #8

[2] Previously identified as Hillcrest Well #9

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6.5.1.2 Relationship to Other Sustainability Indicators

The relationship between minimum thresholds for each sustainability indicator, including an explanation of how it was determined that basin conditions at the minimum thresholds for the chronic lowering of groundwater levels will avoid undesirable results for each of the other applicable sustainability indicators to the Sutter Subbasin, is described herein. Minimum thresholds for the chronic lowering of groundwater levels were selected to avoid undesirable results for the other applicable sustainability indicators in the Sutter Subbasin as follows.

- **Reduction of Groundwater Storage.** Groundwater levels are used as a proxy for the reduction of groundwater storage sustainability indicator, where the chronic lowering of groundwater levels monitoring network and numeric SMC are also used to evaluate conditions relative to reduction of groundwater storage. In the Sutter Subbasin, there is approximately 49 million acre-feet of groundwater in storage. Pumping of groundwater in storage is not projected to reach unsustainable levels in the Sutter Subbasin, even with anticipated impacts of climate change (refer to **Section 5.3** for more information about projected conditions in the Sutter Subbasin). As such, the lowering of groundwater levels is more likely to result in undesirable conditions than the loss of groundwater in storage, and these impacts would be felt sooner. For example, lowered groundwater levels could result in shallow domestic wells going dry without causing any significant impact on the overall amount of groundwater in storage. This typically would occur due to potential localized effects described in **Section 6.5.1.4**.
- **Seawater Intrusion.** This sustainability indicator is not applicable to the Sutter Subbasin.
- **Degraded Water Quality.** Currently, there are limited groundwater quality data available in the Sutter Subbasin to support a connection between groundwater pumping and elevated concentrations of COCs that would cause an undesirable result or exceed drinking water standards or agricultural water quality objectives. Through implementation of the Sutter Subbasin GSP, groundwater quality could potentially be affected by implementation of projects and management actions that have a direct impact on groundwater resources, such as groundwater recharge projects that could potentially result in localized changes in groundwater elevations or gradients and result in mobilization of contaminants. Overall, current groundwater quality in the Sutter Subbasin is considered to be generally good and suitable for all beneficial uses, although localized groundwater quality concerns may occur.
- **Land Subsidence.** Land subsidence as a result of groundwater pumping has not historically been observed in the Sutter Subbasin. Therefore, based on current understanding and the best available science at the time of GSP development, the chronic lowering of groundwater levels and land subsidence sustainability indicators are not considered to be directly related and the minimum thresholds established for either indicator are not anticipated to cause undesirable results for the other.

- **Depletions of Interconnected Surface Water.** Groundwater levels are currently being used as proxy for the depletions of interconnected surface water sustainability indicator, where the chronic lowering of groundwater levels monitoring network and numeric SMC are also used to evaluate conditions relative to depletions of interconnected surface water. Groundwater levels are intended to be protective of interconnected surface waters to avoid reversing the direction of interconnected surface waters from gaining to losing or reducing the groundwater gains by interconnected surface waters. Therefore, management of groundwater levels is anticipated to be most protective of beneficial uses of groundwater in the Sutter Subbasin.

6.5.1.3 Effects on Neighboring Subbasins

All seven of the groundwater subbasins adjacent to the Sutter Subbasin (the Butte, Wyandotte Creek, North Yuba, South Yuba, North American, Yolo, and Colusa Subbasins) were required to develop and adopt GSPs by January 31, 2022. A GSP for the North Yuba and South Yuba Subbasins, collectively referred to as the Yuba Subbasins, was adopted by Yuba Water Agency and submitted to DWR ahead of the regulatory deadline for non-critically overdrafted high- and medium-priority basins in early 2020. The Yuba Subbasins GSP was amended and the first Periodic Evaluation was submitted to DWR in January 2025. The remaining adjacent subbasins developed their respective GSPs in tandem with the Sutter Subbasin and subsequent analyses are based on information contained in the approved 2022 GSPs or draft amended GSPs/Periodic Evaluations as applicable and available.

Minimum thresholds for chronic lowering of groundwater levels in the Sutter Subbasin have been selected to avoid causing undesirable results in adjacent subbasins or affect the ability of adjacent subbasins to achieve sustainability goals, where a description of such is contained herein. The Sutter Subbasin GSAs will continue to coordinate with neighboring subbasins throughout GSP development and implementation to ensure groundwater management activities and established minimum thresholds do not cause undesirable results or affect the ability of adjacent subbasins to achieve their sustainability goals.

6.5.1.3.1 Butte Subbasin

In the Butte Subbasin Periodic Evaluation, published in August 2026, minimum thresholds are established as the shallower of either:

1. The shallowest 7th percentile of nearby domestic wells, or
2. The range of measured groundwater levels, or 20 feet (whichever is greater), below the observed historic low.

If the resulting value is shallower than the observed historic low, the minimum threshold is set 10 feet deeper than the observed historic low.

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Overall, it appears that the thresholds established for the Butte Subbasin are comparable to those for the Sutter Subbasin. As such, minimum thresholds for the chronic lowering of groundwater levels in the Sutter Subbasin are not anticipated to cause undesirable results or affect the ability of the Butte Subbasin in achieving its sustainability goal relative to the chronic lowering of groundwater levels.

6.5.1.3.2 Wyandotte Creek Subbasin

The Sutter and Wyandotte Creek Subbasins share a boundary less than one mile in length and comprised roughly of the Feather River in the very northeastern corner of the Sutter Subbasin where groundwater-related activities are not known to occur. Therefore, it is not anticipated that activities in the Sutter Subbasin will cause an undesirable result for chronic lowering of groundwater levels in the Wyandotte Creek Subbasin.

6.5.1.3.3 North Yuba and South Yuba Subbasins

In the Yuba Subbasins GSP published in December 2024, the minimum threshold for the chronic lowering of groundwater levels is set at the deeper of (1) the bottom of the shallowest domestic well near a monitoring well, adjusted for March measurements, or (2) the historical low March groundwater level from 1985 to present at the monitoring well, where a 75-foot minimum value was applied to the threshold. The Yuba Subbasins have not experienced an undesirable result for the chronic lowering of groundwater levels since GSP implementation began in 2020. Given the role of the Feather River as a 'regulating reservoir' that largely forms the boundary between the Sutter Subbasin and Yuba Subbasins, it is not anticipated that minimum thresholds in the Sutter Subbasin for the chronic lowering of groundwater levels will cause an undesirable result or affect the ability of the Yuba Subbasins to achieve their sustainability goal.

6.5.1.3.4 North American Subbasin

In the North American Subbasin Draft 2026 GSP, published in September 2026, the minimum thresholds for the chronic lowering of groundwater levels are established as 20 feet above the total well depth of the shallowest domestic well within a one-mile radius of a representative monitoring site. Where the proposed minimum threshold using this methodology was greater than 20 feet below historical low groundwater levels at the representative monitoring site, the following limits were applied:

- Minimum thresholds at representative monitoring sites adjacent to interconnected surface water bodies were not established more than five feet below historical low groundwater levels. This more conservative limit at these locations is intended to minimize the potential for changes in hydraulic gradients, stream-aquifer connectivity, or groundwater levels that could adversely impact interconnected surface water beneficial uses, such as GDEs.

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- Minimum thresholds at the remaining representative monitoring sites are not to exceed 20 feet below historical low groundwater levels. This limit reduces potential changes in groundwater levels for areas where existing domestic wells are consistently and substantially deeper than historical low groundwater levels. This 20-foot management buffer incorporates uncertainty and limitations in historical groundwater observations and domestic well information while maintaining operational flexibility during drought conditions and keeps groundwater levels within a range representative of sustainable groundwater management conditions in the North American Subbasin.

Given the role of the Feather River as a 'regulating reservoir' that forms the boundary between the Sutter Subbasin and North American Subbasin, and the fact that, on average, groundwater use in the North American Subbasin, like the Sutter Subbasin, is presently under its sustainable yield, it is not anticipated that minimum thresholds in the Sutter Subbasin for the chronic lowering of groundwater levels will cause an undesirable result or affect the ability of the North American Subbasin to achieve its sustainability goal.

6.5.1.3.5 Yolo Subbasin

In the Yolo Subbasin Draft Periodic Evaluation, published in September 2026, there are no proposed revisions to the minimum threshold methodology for the chronic lowering of groundwater levels sustainability indicator. In the 2022 Yolo Subbasin GSP, management areas were established for the chronic lowering of groundwater levels sustainability indicator and minimum thresholds have been defined for each management area. The North Yolo management area borders the Sutter Subbasin. The minimum threshold value for the North Yolo management area is equal to the historic minimum groundwater elevation in the period of record (pre-2016) plus 20% of the depth between the historic maximum and historic minimum elevation for the period of record (pre-2016) at each representative monitoring well.

Based on a similar methodology used to establish minimum thresholds in the North Yolo management area as compared to the Sutter Subbasin (using the minimum historic elevation plus some additional operating buffer) and the role of the Sacramento River (adjoining both subbasins) in maintaining groundwater elevations in the Sutter Subbasin, minimum thresholds in the Sutter Subbasin are not anticipated to cause undesirable results or affect the ability of the Yolo Subbasin in achieving its sustainability goal relative to chronic lowering of groundwater levels.

6.5.1.3.6 Colusa Subbasin

In the Colusa Subbasin 2024 Revised GSP, adopted in April 2024, minimum thresholds for the chronic lowering of groundwater levels were calculated for focus and non-focus representative monitoring wells. For focus wells (areas where undesirable results have previously occurred, as observed by nearby subsidence and/or domestic well impacts

during the 2020-2022 drought), minimum thresholds are established as the minimum elevation between 2020 and 2022. For non-focus wells (areas where undesirable results have not occurred), the same criteria is used for focus wells minus a margin of 15-25 feet selected for each representative monitoring well to be protective of drinking water well impacts and subsidence (whichever is more limiting).

Overall, it appears that the minimum thresholds established for the Colusa Subbasin are comparable to those for the Sutter Subbasin. As such, the minimum thresholds for the chronic lowering of groundwater levels in the Sutter Subbasin are not anticipated to cause undesirable results or affect the ability of the Colusa Subbasin from achieving its sustainability goal relative to chronic lowering of groundwater levels.

6.5.1.4 Effects on Beneficial Uses and Users

Beneficial uses and users of groundwater are identified in **Section 4.1** of the *Outreach and Communication* chapter and generally include the following uses or users: domestic, municipal, agricultural, and environmental. All beneficial uses and users of groundwater, and their associated land uses and property interests, were considered in establishing minimum thresholds for the chronic lowering of groundwater levels. Stakeholders, including the public, were invited to provide feedback on minimum thresholds during SSGMCC meetings (noticed according to the Brown Act) and a public workshop held on August 11, 2021. Municipal and agricultural representatives are members of the SSGMCC and participated in the development of minimum thresholds.

A beneficial uses and users analysis for the chronic lowering of groundwater levels under the undesirable result definition was performed to assess how the selected minimum thresholds would impact domestic wells, public supply wells, and public supply wells within Community Water Systems, in addition to GDEs (**Appendix 6-C**). Under undesirable results conditions, less than 1% of the domestic wells analyzed may be potentially impacted. No public supply wells, public supply wells within Community Water Systems, or GDEs are expected to be impacted under defined undesirable results conditions. Therefore, the analysis showed that the undesirable results definition and minimum thresholds established for the chronic lowering of groundwater levels are protective of beneficial uses and users of groundwater in the Sutter Subbasin.

A description of how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests is contained herein.

- **Domestic.** Minimum thresholds for the chronic lowering of groundwater levels are established to avoid undesirable results for domestic well users, where domestic wells are typically screened in the Shallow AZ or AZ-1. If minimum thresholds are exceeded (even if an undesirable result is not observed), there may be some areas of the Subbasin where shallow domestic wells could temporarily go dry or experience other adverse impacts. This may require the lowering of well pumps in these shallow wells, access to alternative water supplies until water levels recover (in emergency situations only), or the deepening of domestic wells.

- **Municipal.** Municipal wells tend to be deeper than domestic wells, with groundwater pumped typically from the lower portion of AZ-1 as well as from AZ-2 and AZ-3. Municipal water supply systems are also designed to include redundancy to adapt to changes in groundwater conditions. Minimum thresholds for the chronic lowering of groundwater levels are established to be protective of municipal groundwater production needs. Additionally, exceedances of minimum thresholds are not anticipated to negatively impact municipal groundwater production due to the redundancy and operating flexibility designed into municipal systems.
- **Agricultural.** Similar to municipal users of groundwater, minimum thresholds for chronic lowering of groundwater levels are established to be protective of agricultural groundwater production needs as a primary user of groundwater in the Sutter Subbasin. Minimum threshold exceedances are not anticipated to negatively impact groundwater production for agricultural uses due to seasonal aquifer rebound and the availability of surface water supplies for agricultural irrigation purposes.
- **Environmental.** Environmental users of groundwater typically rely on shallow groundwater (within 50 feet of ground surface or less) for recharge to interconnected streams and access by GDEs. If minimum thresholds for the chronic lowering of groundwater levels are exceeded (even if an undesirable result is not observed), reduced groundwater recharge to streams and groundwater levels too deep for GDE species to access may be observed.

6.5.1.5 Relevant Federal, State, or Local Standards

Currently, there are no other federal, State, or local standards that relate to the chronic lowering of groundwater levels sustainability indicator in the Sutter Subbasin. SGMA is the prevailing legislation dictating requirements and standards for the chronic lowering of groundwater levels sustainability indicator. Any future federal, State, or local standards relating to the chronic lowering of groundwater levels will be evaluated and considered in potential modifications to minimum thresholds during subsequent GSP updates.

6.5.1.6 Method for Quantitative Measurement

For information regarding how minimum thresholds for the chronic lowering of groundwater levels will be quantitatively measured, including monitoring protocols as well as frequency and timing of measurement, refer to **Section 7.2** *Monitoring*.

6.5.2 Reduction of Groundwater Storage

The Sutter Subbasin GSP uses minimum thresholds for the chronic lowering of groundwater levels as a proxy for the reduction of groundwater storage sustainability indicator. As such, the minimum thresholds for the reduction of groundwater storage are the same as the minimum thresholds for the chronic lowering of groundwater levels sustainability indicator.

GSP regulations allow GSAs to use groundwater levels as a proxy metric for any sustainability indicator provided the GSP demonstrates that there is a significant correlation between groundwater levels and other metrics. In order to rely on groundwater levels as a proxy, one approach suggested by DWR is to:

> *Demonstrate that the minimum thresholds and measurable objectives for chronic declines of groundwater levels are sufficiently protective to ensure significant and unreasonable occurrences of other sustainability indicators will be prevented. In other words, demonstrate that setting a groundwater level minimum threshold satisfies the minimum threshold requirements for not only chronic lowering of groundwater levels but other sustainability indicators at a given site (DWR, 2017).*

Minimum thresholds for the chronic lowering of groundwater levels sustainability indicator will effectively avoid undesirable results for reduction of groundwater in storage by ensuring that groundwater elevations (and therefore the volume of groundwater in storage) do not chronically decline in the future and has a demonstrated ability to rebound annually, with greater cumulative increases in storage during wetter years. The minimum thresholds can therefore be used as a proxy for reduction of groundwater storage because the minimum thresholds set for groundwater levels are sufficiently protective against occurrences of significant and unreasonable reductions of groundwater storage and, given the large volume of water in storage in the Sutter Subbasin, it is likely that significant declines in groundwater elevations are likely to result in undesirable results before the loss of groundwater storage is considered significant.

6.5.3 Seawater Intrusion

Seawater intrusion is not an applicable sustainability indicator for the Sutter Subbasin as the Subbasin is located inland from the Pacific Ocean and is not adjacent to the Sacramento-San Joaquin Delta. Therefore, SMC for seawater intrusion will not be established for the Sutter Subbasin GSP.

6.5.4 Degraded Water Quality

6.5.4.1 Identification and Methodology

The minimum threshold for degraded water quality is established as the highest of: (1) the upper Secondary Maximum Contaminant Level (SMCL) for TDS (1,000 mg/L) and Primary Maximum Contaminant Level (MCL) for nitrate as N (10 mg/L) or (2) current water quality conditions for TDS and nitrate as N based on data available from 2000 to the time of GSP development or amendment (Summer 2021 and Summer 2026, respectively) at the representative monitoring well, using the maximum concentration detected of each constituent. **Table 6-2** reflects the minimum thresholds for degraded water quality at each representative monitoring site.

Minimum thresholds for degraded water quality are established consistent with California drinking water standards and California's Antidegradation Policy (State Board Resolution 68-16). Local input through SSGMCC meetings, as well as the August 11, 2021 public workshop, were applied in setting the minimum threshold for degraded water quality. The selected minimum thresholds reflect input from local water purveyors as well as the local agricultural community and are expected to avoid undesirable results in the Sutter Subbasin. It should be noted that the concentrations presented for minimum thresholds reflect ambient groundwater quality, where additional treatment may be necessary to meet state and federal MCLs for drinking water.

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Table 6-2. Minimum Thresholds for Degraded Water Quality

Site Code	State Well Number	Local ID / Other ID	Aquifer Zone	Minimum Threshold (TDS; mg/L)	Minimum Threshold (nitrate as N; mg/L)
390682N1216901W001	14N02E13A003M	SEWD MW-3A	AZ-1	1,000	10
392970N1216907W003	17N02E25J003M	BWD MW-1C	AZ-1	1,000	10
-	-	Well 2-C	AZ-1	1,000	10
391456N1218904W001	-	MFWC Prop 50	AZ-1	1,000	10
390682N1216901W002	14N02E13A004M	SEWD MW-3B	AZ-2	1,000	10
391658N1217070W001	15N02E12E001M	SEWD MW-1A	AZ-2	1,000	10
391658N1217070W002	15N02E12E002M	SEWD MW-1B	AZ-2	1,000	10
391279N1216989W001	15N02E24P001M	SEWD MW-2A	AZ-2	1,000	10
391279N1216989W002	15N02E24P002M	SEWD MW-2B	AZ-2	1,000	10
391012N1218222W001	-	BS1-McClatchy	AZ-2	1,000	10
392970N1216907W002	17N02E25J002M	BWD MW-1B	AZ-2	1,000	10
-	-	Well-1A / 5110001-011	AZ-2	1,000	10
-	-	Well-2A / 5110001-013	AZ-2	1,000	11
-	-	Akins Well	AZ-2	1,000	10
391613N1216236W001	-	WTP Well	AZ-2 and AZ-3	1,000	10
390682N1216901W003	14N02E13A005M	SEWD MW-3C	AZ-3	1,000	10
391658N1217070W003	15N02E12E003M	SEWD MW-1C	AZ-3	1,000	10
391279N1216989W003	15N02E24P003M	SEWD MW-2C	AZ-3	1,000	10
392970N1216907W001	17N02E25J001M	BWD MW-1A	AZ-3	1,000	10

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6.5.4.2 Relationship to Other Sustainability Indicators

Described below is the relationship between minimum thresholds for each sustainability indicator, including an explanation of how it was determined that basin conditions at the minimum thresholds for degraded water quality will avoid undesirable results to the Sutter Subbasin for each of the other applicable sustainability indicators. Minimum thresholds for degraded water quality were selected to avoid undesirable results for the other applicable sustainability indicators in the Sutter Subbasin.

- **Chronic Lowering of Groundwater Levels and Reduction of Groundwater Storage.** As previously stated, there are limited groundwater quality data available in the Sutter Subbasin to support a connection between groundwater pumping and elevated concentrations of COCs. Additionally, projects and management actions are not required to maintain sustainability in the Sutter Subbasin. However, the minimum thresholds established for degraded water quality could impact direct use of supplemental water supplies for groundwater recharge projects, where ambient water quality may constrain supplies available for recharge or require additional treatment prior to land application or injection, and could thus limit the ability to maintain the measurable objectives established for the chronic lowering of groundwater levels or reduction of groundwater storage sustainability indicator if such projects were to be deemed necessary.
- **Seawater Intrusion.** This sustainability indicator is not applicable to the Sutter Subbasin.
- **Land Subsidence.** Based on local knowledge and the best available science, degraded water quality and land subsidence minimum thresholds are not related in the Sutter Subbasin. Therefore, minimum thresholds for degraded water quality are not anticipated to cause undesirable results for land subsidence.
- **Depletions of Interconnected Surface Water.** Minimum thresholds for degraded water quality were established to be protective of drinking water standards or current water quality (based on available data from 2000 to present) where current conditions exceed drinking water standards (the highest beneficial use of water in California), consistent with California's Antidegradation Policy. Additionally, the volume of surface water in the interconnected surface water courses is much larger than the volume of water the aquifer is contributing to those streams. As such, while surface water quality is not within the purview of SGMA, the minimum thresholds for degraded water quality are not anticipated to degrade the quality of interconnected surface water.

6.5.4.3 Effects on Neighboring Subbasins

As noted in **Section 6.5.1.3**, there are seven groundwater subbasins adjacent to the Sutter Subbasin. Yuba Water Agency adopted and submitted an amended GSP covering the North Yuba and South Yuba Subbasins to DWR in early 2025. Butte, Wyandotte Creek, North American, Yolo, and Colusa Subbasins developed their

respective GSPs in tandem with the Sutter Subbasin and the subsequent analyses are based on information contained in the approved 2022 GSPs or draft amended GSPs or Periodic Evaluations as applicable and available.

Minimum thresholds for degraded water quality in the Sutter Subbasin have been selected to avoid causing undesirable results in adjacent subbasins or affect the ability of adjacent subbasins to achieve sustainability goals. The Sutter Subbasin GSAs will continue to coordinate with neighboring subbasins throughout GSP development and implementation to ensure groundwater management activities and established minimum thresholds do not cause undesirable results or affect the ability of adjacent subbasins to achieve their sustainability goals.

6.5.4.3.1 Butte Subbasin

In the Butte Subbasin, a minimum threshold for degraded water quality has been set at the higher of 900 microSiemens per centimeter (µS/cm) for electrical conductivity (EC; the recommended SMCL) or measured historical high EC concentration at each representative monitoring site. The methodology used to establish the minimum thresholds for degraded water quality in the Butte Subbasin is similar to that of the Sutter Subbasin, using drinking water standards and California's Antidegradation Policy. Therefore, it is not anticipated that minimum thresholds for degraded water quality in the Sutter Subbasin will cause undesirable results or affect the ability of the Butte Subbasin to achieve its sustainability goal.

6.5.4.3.2 Wyandotte Creek Subbasin

The Sutter and Wyandotte Creek Subbasins share a less than one mile boundary, comprised roughly of the Feather River in the very northeastern corner of the Sutter Subbasin where groundwater-related activities are not known to occur. Therefore, it is not anticipated that activities in the Sutter Subbasin will cause an undesirable result for degraded water quality in the Wyandotte Creek Subbasin.

6.5.4.3.3 North Yuba and South Yuba Subbasins

In the North Yuba and South Yuba Subbasins, minimum thresholds for EC, as a measure of salinity, is established at 1,000 µS/cm at each representative monitoring well, a value similar to the recommended SMCL of 900 µS/cm but below the Upper SMCL of 2,200 µS/cm. Where historical conditions are above 1,000 µS/cm, the minimum threshold is set at a value approximately 10% above historical concentrations. The methodology used to establish the minimum thresholds for degraded water quality in the Yuba Subbasins is similar to that of the Sutter Subbasin; therefore, it is not anticipated that minimum thresholds for degraded water quality in the Sutter Subbasin will cause undesirable results or affect the ability of the Yuba Subbasins to achieve its sustainability goal.

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6.5.4.3.4 North American Subbasin

In the North American Subbasin, minimum thresholds are established for TDS and nitrate as N, where the minimum threshold is a concentration that exceeds the Upper SMCL of 1,000 mg/L for TDS and the Primary MCL of 10 mg/L for nitrate as N. This methodology is similar to that used by the Sutter Subbasin in establishing minimum thresholds for degraded water quality. Therefore, it is not anticipated that minimum thresholds for degraded water quality in the Sutter Subbasin will cause undesirable results or affect the ability of the North American Subbasin to achieve its sustainability goal.

6.5.4.3.5 Yolo Subbasin

In the Yolo Subbasin, minimum thresholds are established for TDS where an exceedance occurs when the TDS concentration at a representative monitoring well exceeds 1,000 parts per million (ppm) over a three-year rolling average. This methodology is similar to that used by the Sutter Subbasin in establishing minimum thresholds for degraded water quality. Therefore, it is not anticipated that minimum thresholds for degraded water quality in the Sutter Subbasin will cause undesirable results or affect the ability of the Yolo Subbasin to achieve its sustainability goal.

6.5.4.3.6 Colusa Subbasin

In the Colusa Subbasin, a similar methodology to that used in the Butte Subbasin is used for establishing minimum thresholds for degraded groundwater quality. For EC, minimum thresholds are set using either the higher of 900 µS/cm for EC or the pre-2015 historical maximum recorded EC value. The methodology used to establish the minimum thresholds for degraded water quality in the Colusa Subbasin is similar to that of the Sutter Subbasin; therefore, it is not anticipated that minimum thresholds for degraded water quality in the Sutter Subbasin will cause undesirable results or affect the ability of the Colusa Subbasin to achieve its sustainability goal.

6.5.4.4 Effects on Beneficial Uses and Users

As noted in **Section 6.5.1.4**, the beneficial uses and users of groundwater in the Sutter Subbasin generally include domestic, municipal, agricultural, and environmental uses and users, where all beneficial uses and users of groundwater are identified in **Section 4.1** of the *Outreach and Communication* chapter. All beneficial uses and users of groundwater, and their associated land uses and property interests, were considered in establishing minimum thresholds for degraded water quality.

Stakeholders, including the public, were invited to provide feedback on minimum thresholds during SSGMCC meetings (noticed according to the Brown Act) and a public workshop held on August 11, 2021. Municipal and agricultural representatives are members of the SSGMCC and participated in the development of minimum thresholds, indicating that ambient groundwater quality consistent with drinking water standards or

current water quality were sufficiently protective of the beneficial uses of groundwater as they are consistent with regulatory requirements.

A description of how minimum thresholds for the degraded water quality may affect the interests of beneficial uses and users of groundwater or land uses and property interests is contained herein.

- **Domestic.** Minimum thresholds for degraded water quality will protect groundwater quality accessed by domestic well users in some areas of the Sutter Subbasin, ensuring that the groundwater quality is maintained such that treatment is not required to meet drinking water standards. In areas of the Sutter Subbasin where ambient water quality is presently above drinking water standards for TDS and nitrate as N, minimum thresholds are established to be consistent with California's Antidegradation Policy and not result in additional burden of treatment for domestic well users.
- **Municipal.** Similar to domestic uses and users, minimum thresholds established for degraded water quality will preserve groundwater quality accessed by municipal well users in some areas of the Sutter Subbasin, ensuring that treatment is not necessary to meet drinking water standards, are consistent with California's Antidegradation Policy, and will reduce the need for additional treatment of TDS and/or nitrate as N in areas where groundwater quality currently exceeds drinking water standards.
- **Agricultural.** Drinking water standards for TDS and nitrate as N tend to require higher quality water than for many agricultural uses, which can vary by crop type. Growers in the Sutter Subbasin have adapted to current groundwater quality by either blending groundwater with surface water to dilute elevated concentrations of constituents of concern, installing wellhead treatment, or changing crop types grown. Therefore, minimum thresholds for degraded water quality are not anticipated to negatively impact agricultural uses and users of groundwater and will preserve the quality of groundwater for agricultural use.
- **Environmental.** Similar to domestic uses and users, environmental users of groundwater typically rely on shallow groundwater where accumulation of salts from applied water or nitrates from applied fertilizers or septic systems are most likely to impact these users. As with agricultural uses, drinking water standards for TDS and nitrate as N typically result in higher quality water than what is required for environmental uses. Therefore, minimum thresholds for degraded water quality will maintain ambient groundwater quality in areas with elevated ambient concentrations and will preserve groundwater quality for its highest and best use as a drinking water supply.

6.5.4.5 Relevant Federal, State, or Local Standards

Minimum thresholds for degraded water quality incorporate both federal and State drinking water standards, including Primary and Secondary MCLs, and California's

Antidegradation Policy (State Board Resolution 68-16), where existing groundwater quality will be maintained to ensure the highest water quality to the maximum benefit to the people of the State (SWRCB, 1968). Under the Central Valley Regional Water Quality Control Board's (CV-RWQCB) *Water Quality Control Plan for the Sacramento and San Joaquin River Basins* (or Basin Plan) (SWRCB, May 2018), beneficial use designations are assigned to water bodies denoting the water quality objectives for ambient water quality consistent with drinking water standards which are passed down through the various regulatory permitting programs (such as in Waste Discharge Requirements). The Statewide Recycled Water Policy Regulations sets forth water quality standards for recycled water-related projects, in the event recycled water is utilized for groundwater recharge projects. Finally, CV-SALTS sets forth discharge standards for salts and nitrate as part of the Central Valley-wide salt and nutrient management program as does the Irrigated Lands Regulatory Program.

6.5.4.6 Method for Quantitative Measurement

For information regarding how minimum thresholds for degraded water quality will be quantitatively measured, including monitoring protocols as well as frequency and timing of measurement, refer to **Section 7.2** *Monitoring*.

6.5.5 Land Subsidence

6.5.5.1 Identification and Methodology

As discussed in **Section 5.2.6** of the *Basin Setting* chapter, inelastic land subsidence has not historically been observed in the Sutter Subbasin. The minimum thresholds for land subsidence have been established for the Sutter Subbasin based on available data from the Sacramento Valley Subsidence Network, developed and monitored jointly by DWR, the U.S. Bureau of Reclamation (USBR), and local partners, as the only publicly available historical land elevation data in the Sutter Subbasin.

The minimum threshold for land subsidence is set at 0.5 feet of subsidence over a five-year rolling average calculated by water year. As Sacramento Valley Subsidence Network monitoring was discontinued in 2022 following the 2017 survey, monitoring zones of 5 square miles (mi^2) have been established to use available Interferometric Synthetic Aperture Radar (InSAR) data available through DWR's SGMA Data Portal. These data will be validated using available extensometer and continuous global positioning system (CGPS) station data (see **Section 7.2** *Monitoring* for more detail). The minimum threshold is intended to prevent inelastic subsidence that could affect water conveyance, levee, and other critical infrastructure while allowing time for adaptive mitigation if monitoring indicates a developing concern.

The minimum threshold for land subsidence is directly tied to avoiding undesirable results, which is the point at which differential settlement reduces the ability to deliver surface water supplies or maintain adequate freeboard on levee systems in wet years, impacting conveyance of flood waters. A value of 0.5 feet of subsidence over a five-year

rolling average was selected to represent the point at which water conveyance and levee infrastructure become sensitive to land subsidence within the Sutter Subbasin. Using a rolling average takes into account the delay in subsidence that can occur following groundwater pumping. Additionally, 0.5 feet is approximately twice the operational error of measurements taken by DWR and USBR [0.17 feet margin of error (DWR North Region Office, 2018)] in monitoring the Sacramento Valley Subsidence Network, allowing for operational flexibility in the event subsidence is observed in the future in the Sutter Subbasin.

Table 6-3 reflects the minimum thresholds for land subsidence at each representative monitoring site.

Table 6-3. Minimum Threshold for Land Subsidence

Name	Station Zone/ID	Minimum Threshold (feet of subsidence over five-year rolling average)
Sutter Land Subsidence Extensometer	Station No. 11N04E04N005M	0.5
DWR 1500	DWR 1500	0.5
InSAR Monitoring Zones (five mi^2 grid)	InSAR Zones 1 to 125	0.5

6.5.5.2 Relationship to Other Sustainability Indicators

The relationship between minimum thresholds for each sustainability indicator, including an explanation of how it was determined that basin conditions at the minimum threshold for land subsidence will avoid undesirable results for each of the other applicable sustainability indicators to the Sutter Subbasin, is described herein. Minimum thresholds for land subsidence were selected to avoid undesirable results for other applicable sustainability indicators in the Sutter Subbasin.

- **Chronic Lowering of Groundwater Levels.** Minimum thresholds established for the chronic lowering of groundwater levels are also protective of levels of subsidence that could cause an undesirable result in the Sutter Subbasin, as no historic subsidence has been observed in the Sutter Subbasin and the groundwater level minimum thresholds are based on historic groundwater level data.
- **Reduction of Groundwater Storage.** The minimum threshold for land subsidence does not directly impact the reduction of groundwater storage sustainability indicator.
- **Seawater Intrusion.** This sustainability indicator is not applicable to the Sutter Subbasin.
- **Degraded Water Quality.** The minimum threshold for land subsidence does not directly impact the degraded water quality sustainability indicator in the Sutter Subbasin.

- **Depletions of Interconnected Surface Water.** The minimum threshold for land subsidence does not directly impact the depletions of interconnected surface water sustainability indicator in the Sutter Subbasin.

6.5.5.3 Effects on Neighboring Subbasins

As noted in **Section 6.5.1.3**, there are seven groundwater subbasins adjacent to the Sutter Subbasin. Yuba Water Agency adopted and submitted an amended GSP covering the North Yuba and South Yuba Subbasins to DWR in early 2025. Butte, Wyandotte Creek, North American, Yolo, and Colusa Subbasins developed their respective GSPs in tandem with the Sutter Subbasin, and subsequent analyses are based on information contained in the approved 2022 GSPs or draft amended GSPs or Periodic Evaluations as applicable and available.

Minimum thresholds for land subsidence in the Sutter Subbasin have been selected to avoid causing undesirable results in adjacent subbasins or affect the ability of adjacent subbasins to achieve sustainability goals, where a description of such is included herein. The Sutter Subbasin GSAs will continue to coordinate with neighboring subbasins throughout GSP development and implementation to ensure groundwater management activities and established minimum thresholds do not cause undesirable results or affect the ability of adjacent subbasins to achieve their sustainability goals.

6.5.5.3.1 Butte Subbasin

The minimum threshold for land subsidence in the Butte Subbasin is 0.5 foot of subsidence over a five-year period within the same InSAR pixel. Given the similarities in methodology, no potential undesirable result in the Butte Subbasin is anticipated as a result of the established minimum threshold for land subsidence in the Sutter Subbasin.

6.5.5.3.2 Wyandotte Creek Subbasin

The Sutter and Wyandotte Creek Subbasins share a less than one mile boundary, comprised roughly of the Feather River, in the very northeastern corner of the Sutter Subbasin where groundwater-related activities are not known to occur. Therefore, it is not anticipated that activities in the Sutter Subbasin will cause an undesirable result for land subsidence in the Wyandotte Creek Subbasin.

6.5.5.3.3 North Yuba and South Yuba Subbasins

The minimum threshold for the Sutter Subbasin is the same value in the North Yuba and South Yuba Subbasins – 0.5 feet of subsidence per five-year period over a five mi^2 area using a rolling average by water year. Therefore, no potential undesirable result in the North Yuba and South Yuba Subbasins is anticipated as a result of the established minimum threshold for land subsidence in the Sutter Subbasin.

6.5.5.3.4 North American Subbasin

The minimum threshold for the Sutter Subbasin is the same value as the North American Subbasin – 0.5 feet over a five-year period and the affected area encompassing 5 or more square miles within the North American Subbasin. Therefore, no potential undesirable result in the North American Subbasin is anticipated as a result of the established minimum threshold for land subsidence in the Sutter Subbasin.

6.5.5.3.5 Yolo Subbasin

As previously noted, the North Yolo management area of the Yolo Subbasin borders the Sutter Subbasin. The minimum threshold value for land subsidence in the North Yolo Subbasin has been established as 0.1 feet/year, or a total of 2 feet of subsidence that would occur between 2022 and 2042. The methodology used is similar to that used by the Sutter Subbasin in establishing minimum threshold for land subsidence. Therefore, it is not anticipated that minimum threshold for land subsidence in the Sutter Subbasin will cause undesirable results or affect the ability of the Yolo Subbasin to achieve its sustainability goal.

6.5.5.3.6 Colusa Subbasin

In the Colusa Subbasin, a similar methodology is used as in the Yolo Subbasin for establishing minimum thresholds for land subsidence (a rate of 0.1 feet/year of subsidence or cumulative subsidence of 2 feet from January 2024). The methodology used is similar to that used by the Sutter Subbasin in establishing minimum threshold for land subsidence. Therefore, it is not anticipated that minimum threshold for land subsidence in the Sutter Subbasin will cause undesirable results or affect the ability of the Colusa Subbasin to achieve its sustainability goal.

6.5.5.4 Effects on Beneficial Uses and Users

As noted in **Section 6.5.1.4**, beneficial uses and users of groundwater in the Sutter Subbasin generally include domestic, municipal, agricultural, and environmental uses and users, where all beneficial uses and users of groundwater are identified in **Section 4.1** of the *Outreach and Communication* chapter. All beneficial uses and users of groundwater, and their associated land uses and property interests, were considered in establishing minimum thresholds for land subsidence.

Stakeholders, including the public, were invited to provide feedback on minimum thresholds during SSGMCC meetings (noticed according to the Brown Act) and a public workshop held on August 11, 2021. Municipal and agricultural representatives are members of the SSGMCC and participated in the development of minimum thresholds.

A description of how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests is contained herein. The minimum threshold for land subsidence was established to avoid undesirable results for all beneficial uses and users of groundwater. Inelastic subsidence has not been

observed in the Sutter Subbasin. Potential effects of inelastic land subsidence on the beneficial uses and users in the Subbasin as a result of minimum threshold exceedances are unlikely but are considered in the event such impacts are observed.

- **Domestic.** Land subsidence resulting from compaction of fine-grained materials may damage domestic well casings and/or introduce fine-grained materials into wells, necessitating well repairs or replacement.
- **Municipal.** Similar to domestic well owners, effects on municipal users may also result in failure of well casings. Additionally, differential settlement of the land surface may negatively impact distribution of water to customers in gravity-fed distribution systems or reduced ability to divert or convey flood water away from population centers.
- **Agricultural.** Effects on agricultural users may also result in failure of well casings, similar to domestic well owners and municipal users. Additionally, differential settlement of the land surface may negatively impact gravity-fed water conveyance systems. Flood management may also be impacted by differential settlement with the reduced ability to protect against, divert, or convey flood water, impacting crop production and/or resulting in flood-related damages.
- **Environmental.** The slope of streambeds may be impacted as a result of minimum threshold exceedances, causing changes in flow regimes and the creation of pools that can change in-stream temperatures.

6.5.5.5 Relevant Federal, State, or Local Standards

Currently, there are no other federal, State, or local standards within the Sutter Subbasin related to the land subsidence sustainability indicator. SGMA is the prevailing legislation dictating requirements and standards for land subsidence monitoring and management as they relate to GSP implementation.

6.5.5.6 Method for Quantitative Measurement

For information regarding how minimum thresholds for land subsidence will be quantitatively measured, including monitoring protocols as well as frequency and timing of measurement, refer to **Section 7.2** *Monitoring*.

6.5.6 Depletions of Interconnected Surface Water

6.5.6.1 Identification and Methodology

The Sutter Subbasin GSP currently uses minimum thresholds for the chronic lowering of groundwater levels as a proxy for the depletions of interconnected surface water sustainability indicator. As such, the minimum thresholds for the depletions of interconnected surface water are the same as the minimum thresholds for the chronic lowering of groundwater levels sustainability indicator.

GSP regulations allow GSAs to use groundwater levels as a proxy metric for any sustainability indicator provided the GSP demonstrates that there is a significant correlation between groundwater levels and other metrics. In order to rely on groundwater levels as a proxy, one approach suggested by DWR is to:

> *Demonstrate that the minimum thresholds and measurable objectives for chronic declines of groundwater levels are sufficiently protective to ensure significant and unreasonable occurrences of other sustainability indicators will be prevented. In other words, demonstrate that setting a groundwater level minimum threshold satisfies the minimum threshold requirements for not only chronic lowering of groundwater levels but other sustainability indicators at a given site (DWR, 2017).*

Minimum thresholds for the chronic lowering of groundwater levels sustainability indicator will effectively avoid undesirable results for depletions of interconnected surface water by ensuring that groundwater elevations (and therefore the stream-aquifer interaction) do not chronically change in the future. The minimum thresholds for groundwater levels can therefore be used as a proxy for depletions of interconnected surface water because the minimum thresholds are sufficiently protective against occurrences of significant and unreasonable depletions of interconnected surface water (among other potential impacts).

In the Sutter Subbasin, groundwater levels have been sustainable over time as the aquifer rebounds during all water year types following the irrigation season, returning to pre-pumping levels on a seasonal basis (see **Section 5.2** *Groundwater Conditions*). The Sacramento and Feather Rivers act as 'regulating reservoirs' in the Sutter Subbasin, providing recharge to the Subbasin as groundwater levels are lowered through natural fluctuations and groundwater pumping. Available stream gage data and modeling indicate that groundwater-surface water exchanges represent a relatively small component of Sacramento and Feather River flows and have not historically resulted in substantial changes in river flows or states throughout the Subbasin. Therefore, undesirable results relative to depletions of interconnected surface water have not historically been observed in the Sutter Subbasin.

6.5.6.2 Information and Criteria Used to Establish Minimum Thresholds & Justification for Groundwater Levels as a Proxy

Groundwater pumping changes hydraulic gradients between groundwater aquifers and interconnected surface water. Lower groundwater levels can reduce groundwater discharge to a stream, increase recharge from the stream to groundwater, or both. Groundwater levels (used to calculate hydraulic gradients) are therefore directly related to depletions of interconnected surface water and may serve as a proxy. The analysis below demonstrates the correlation between groundwater elevations and depletions of interconnected surface water.

Current depletions are quantified in **Section 5.2.7.1**. In order to prove that groundwater levels minimum thresholds are protective of interconnected surface waters, the C2VSimFG-Sutter Version 2.0 model was used to simulate groundwater level undesirable result conditions where groundwater levels at least 13 groundwater level representative monitoring network wells exceed minimum thresholds over two consecutive seasonal low water level measurements. The Projected Conditions scenario described in **Section 5.3** was used as the basis for this analysis. The additional groundwater pumping required to create this undesirable result condition was induced by artificially raising the evapotranspiration across the model area to increase demand for additional groundwater pumping until an undesirable result was achieved (as defined in **Section 6.4.1.2**). The evapotranspiration increase that ultimately caused this effect was 136% of the baseline evapotranspiration. The Projected Conditions scenario and analyses related to depletions of interconnected surface water are described in more detail in the model report in **Appendix 5-F**.

Depletions during a groundwater level undesirable result were calculated by running a No Pumping scenario of the evapotranspiration increase that caused the groundwater level undesirable results. Similar to the Without-Pumping scenario created to calculate current depletions, as described in **Section 5.2.7.1**, the No Pumping scenario removes all groundwater pumping in the entire model. This includes groundwater pumping for agriculture (including groundwater substitution transfer pumping), rural residential, urban, and managed wetlands. The entire model is impacted, which includes areas outside of Sutter Subbasin in Butte Subbasin and Colusa Subbasin. The sections below summarize the quantity, timing, and location of depletions of interconnected surface water when a groundwater level undesirable result was simulated.

6.5.6.2.1 Depletions of Interconnected Surface Water Quantity

Depletion quantities that occurred when groundwater level undesirable results were simulated were based on a twelve-year average (Baseline Years 49-60), totaling 193 TAF per year. **Table 6-4** summarizes the average Sutter Subbasin interconnected surface water depletion for the last twelve years of the model period and is referenced further in the sections below.

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Table 6-4. 12-Year (Baseline Years 49-60) Average Annual Depletions by Stream

Baseline Year	Year Type	Average Annual Depletion (TAF per year)			
		Sutter Bypass	Sacramento River	Feather River	Sutter Subbasin*
49	Below Normal	91	66	44	202
50	Above Normal	94	69	45	208
51	Wet	99	64	44	207
52	Dry	88	56	42	185
53	Critical	84	55	40	180
54	Dry	82	52	40	174
55	Below Normal	83	59	42	184
56	Wet	91	66	44	200
57	Below Normal	94	69	45	207
58	Dry	97	62	43	202
59	Critical	88	57	42	186
60	Critical	85	56	41	181
12-Year Average*					
Baseline Year 49-60		90	61	43	193

*Note: Summations and averages may not match the numbers in the table. This is due to the rounding of model results.

6.5.6.2.2 Depletions of Interconnected Surface Water Timing

Depletions of interconnected surface waters in the Sutter Subbasin occur in every water year type and in every month of the simulation. A twelve-year (Baseline Years 49-60) average period was used to estimate depletions for each water year type. **Table 6-5** twelve-year averages by water year type shows that generally wetter years have slightly higher depletions and drier years have slightly lower depletions. The twelve-year period (Baseline Years 49-60) was used to calculate average depletions by month (**Table 6-6**). **Table 6-6** shows that monthly depletions are between 6% and 11% of the annual total, with slightly lower depletions in December through April and slightly higher depletions in May through August. Both water year type and monthly averages do not present strong trends in terms of the timing of depletions of interconnected surface water. This is because depletions in any given month or water year reflect pumping over many prior years, not just the pumping occurring in that month or year.

Table 6-5. 12-Year (Baseline Years 49-60) Average Annual Depletions by Water Year Type

Water Year Type	Average Annual Depletion (TAF per year)
Wet	204
Above Normal	208
Below Normal	198
Dry	187
Critical	182

Table 6-6. 12-Year (Baseline Years 49-60) Average Depletions by Month

Month	Average Depletion (TAF per year)
October	15.9 (8%)
November	14.7 (8%)
December	13.7 (7%)
January	12.6 (7%)
February	12.0 (6%)
March	11.9 (6%)
April	13.6 (7%)
May	21.1 (11%)
June	20.5 (11%)
July	20.7 (11%)
August	19.0 (10%)
September	17.5 (9%)
Total	*193.0 (100%)*

6.5.6.2.3 Depletions of Interconnected Surface Water Location

Averaged over the most recent twelve years of the simulation period (Baseline Years 49-60), depletions of interconnected surface waters within the Sutter Subbasin are distributed as follows (**Table 6-4**):

- Sutter Bypass: 46% or 90 TAF per year
- Sacramento River: 32% or 61 TAF per year
- Feather River: 22% or 43 TAF per year

Sutter Bypass, which is almost wholly within Sutter Subbasin, is most impacted by the Without-Pumping scenario and therefore has a greater overall volume of depletion as compared to Sacramento River and Feather River. Since Sacramento River and Feather River are both on the border of Sutter Subbasin and share boundaries with adjacent groundwater subbasins, depletions from those streams may also be included in shallow subsurface flows between subbasins in the model. Similarly, depletions occurring within the Sutter Subbasin may also be the result of groundwater pumping within other groundwater subbasins.

6.5.6.2.4 Depletions of Interconnected Surface Water and Groundwater Level Sustainability Indicator

The analysis conducted to quantify the volume, timing, and location of depletions from the Subbasin's interconnected surface waters indicates that groundwater level-based undesirable results would occur with stream depletions at 193 TAF per year. Because the depletion threshold is derived directly from conditions at a groundwater level undesirable result, the SMC for chronic lowering of groundwater levels are protective against undesirable results for depletions of interconnected surface water and will be used as a proxy.

Additionally, the analysis was undertaken to determine if the undesirable result conditions for groundwater levels would cause significant and unreasonable impacts to the beneficial uses and users of interconnected surface water. To evaluate this, depletions at groundwater level undesirable result conditions were (1) compared to streamflow and instream flow requirements in each stream, (2) evaluated for changes in the direction of stream-aquifer exchange by reach, and (3) compared to the surface water users and environmental resources that rely on each stream during the months of highest depletion.

Though the estimated depletions of interconnected surface waters represent impacts from groundwater pumping that occurred over many previous years and times of the year, monthly depletions are slightly higher in May through August under undesirable result conditions. Under undesirable result conditions, average total depletion in August is approximately 310 cubic feet per second (cfs). By comparison, August flows from Water Year (WY) 2021-2025 at measured stream gages are approximately 5,883 cfs in the Sacramento River below Wilkins Slough and 6,009 cfs in the Feather River at Olivehurst. Depletions at undesirable results groundwater levels therefore represent approximately 1.7% and 1.1% of August flows in each stream, indicating that agricultural season stream flows are protective of the environmental uses of the rivers. Additionally, Feather River instream flow requirements under SWRCB Order WQ 2010-0016 and the Sacramento River instream flow requirements below Keswick Dam under SWRCB Order 90-05 are a minimum of 1,000 cfs and 3,250 cfs, respectively, during August. Because both rivers are regulated by upstream reservoir releases operated to meet these requirements, the total depletion of 310 cfs in August under groundwater level undesirable result conditions would not measurably affect the ability to meet these instream requirements.

To assess whether changes in direction of stream-aquifer interaction occur, simulated net stream-aquifer exchange was compared by reach between current conditions and undesirable result conditions. Under current conditions (WY 2021-2025), the Sacramento River and Feather River are overall gaining and the Sutter Bypass is slightly losing. Under undesirable result conditions for groundwater levels, the Sutter Bypass becomes losing in almost all months, and both the Sacramento River and Feather River switch from mixed to losing or gaining to mixed conditions in over half the months. The following streams change from gaining to losing in the following months: Sutter Bypass (April) and Feather River (May and July). Since Sacramento River and Feather River both feed water into the Subbasin as groundwater levels are lowered, they become less gaining and trend more towards losing under groundwater level undesirable result conditions. For reaches that are already losing under current conditions (like Sutter Bypass), additional pumping increases stream losses rather than reversing the direction of flow.

Surface water diversions from the Sacramento and Feather Rivers are supported by regulated reservoir releases and senior water rights, and the Thermalito Afterbay

deliveries originate upstream of the Subbasin's stream reaches. Because simulated depletions at undesirable result conditions represent only approximately 2% of peak-season flow, they are not expected to measurably affect the availability of these supplies.

Unlike the Sacramento and Feather Rivers, summer flows in the Sutter Bypass are not sustained by reservoir releases and Bypass diverters rely on lower-priority supplies. Simulated depletions at undesirable result conditions for groundwater levels represent approximately 17% of simulated August Sutter Bypass flow. The overlap of Sutter Bypass flows with peak agricultural demand is limited, but depletions in September and October may coincide with refuge flood-up.

The Sacramento and Feather Rivers collectively support Sacramento River winter-run Chinook salmon (federally and state endangered), Central Valley spring-run Chinook salmon (federally and state threatened), California Central Valley steelhead (federally threatened), the southern distinct population segment of North American green sturgeon (federally threatened), and fall-run Chinook salmon. The Sutter Bypass provides floodplain rearing habitat for juvenile fish during winter and spring flood events, serves as a migration corridor for adult spring-run Chinook salmon traveling to Butte Creek, and provides habitat for North American green sturgeon. During August, use of all the river reaches adjacent to the Sutter Subbasin is limited for environmental users and water temperature is the primary habitat constraint. As previously mentioned, August depletions under undesirable result conditions for groundwater levels total approximately 310 cfs across the three interconnected surface waters, of which about 134-145 cfs is attributed to the Sutter Bypass. Because summer flows in the Sutter Bypass are not supported by reservoir releases, there is a limited ability to regulate flow or temperature. Depletions of this volume could measurably impact flows and temperature in the Sutter Bypass and no fish habitat flow threshold or minimum requirement has been established for Sutter Bypass. In the Sacramento River and Feather River, reductions in August streamflow (less than 2%) would remain well above the instream flow requirements under SWRCB orders. Therefore, impacts to fish habitat in these rivers are expected to be minimal.

During future Periodic Evaluations, the GSAs will revisit the use of groundwater level SMC as a proxy for the depletions of interconnected surface waters using updated data, will evaluate whether the correlation remains valid, and assess whether pumping close to interconnected surface water may produce localized depletions not fully represented by the groundwater level monitoring network. Additionally, guidance from DWR will be considered for future updates to the depletions of interconnected surface water SMC.

6.5.6.3 Relationship to Other Sustainability Indicators

Described below is the relationship between the minimum thresholds for each sustainability indicator, including an explanation of how it was determined that basin conditions at minimum thresholds will avoid undesirable results for each of the other

applicable sustainability indicators to the Sutter Subbasin. Minimum thresholds for depletions of interconnected surface water use the chronic lowering of groundwater levels as a proxy and were selected to avoid undesirable results for the other applicable sustainability indicators in the Sutter Subbasin.

- **Chronic Lowering of Groundwater Levels and Reduction of Groundwater Storage.** Minimum thresholds for depletions of interconnected surface water use the chronic lowering of groundwater level minimum thresholds as proxy (also used as proxy for reduction of groundwater storage). The Sacramento and Feather Rivers are key interconnected surface water sources in the Sutter Subbasin, feeding water into the Subbasin as groundwater levels are lowered through natural fluctuations and groundwater pumping. Therefore, minimum thresholds for the chronic lowering of groundwater levels are also protective of interconnected surface water.
- **Seawater Intrusion.** This sustainability indicator is not applicable to the Sutter Subbasin.
- **Degraded Water Quality.** There is no current evidence indicating that connection between interconnected surface waters and the Subbasin's aquifer system has any impact on groundwater quality, and the volume of surface water flowing through the interconnected surface water courses is much larger than the volume of water the aquifer is contributing to those streams. Therefore, based on local knowledge and best available science, it is not anticipated that minimum thresholds for the depletions of interconnected surface water (using the chronic lowering of groundwater levels as a proxy) will cause undesirable results for degraded water quality.
- **Land Subsidence.** Based on local knowledge and the best available science, depletions of interconnected surface water and land subsidence minimum thresholds are not related in the Sutter Subbasin. Historically, minimal inelastic subsidence has been observed in the Sutter Subbasin. There is no evidence to support large-scale compaction of clay layers in the Sutter Subbasin that may impact interconnections between the underlying aquifer system and surface water courses. Therefore, minimum thresholds for the depletions of interconnected surface water (using the chronic lowering of groundwater levels as a proxy) are not anticipated to cause undesirable results for land subsidence.

6.5.6.4 Effects on Neighboring Subbasins

As noted in **Section 6.5.1.3**, there are seven groundwater subbasins adjacent to the Sutter Subbasin. Yuba Water Agency adopted and submitted an amended GSP covering the North Yuba and South Yuba Subbasins to DWR in early 2025. Butte, Wyandotte Creek, North American, Yolo, and Colusa Subbasins developed their respective GSPs in tandem with the Sutter Subbasin and subsequent analyses are based on information contained in the approved 2022 GSPs or draft amended GSPs or Periodic Evaluations as applicable and available.

Minimum thresholds for the chronic lowering of groundwater levels in the Sutter Subbasin (and used as a proxy for minimum thresholds for the depletions of interconnected surface waters) have been selected to avoid causing undesirable results in adjacent subbasins or affect the ability of adjacent subbasins to achieve sustainability goals, where a description of such is contained herein. The Sutter Subbasin GSAs will continue to coordinate with neighboring subbasins throughout GSP development and implementation to ensure groundwater management activities and established minimum thresholds do not cause undesirable results or affect the ability of adjacent subbasins to achieve their sustainability goals.

6.5.6.4.1 Butte Subbasin

In the Butte Subbasin, minimum thresholds for the depletion of interconnected surface water were set at 10 feet below the measured historical low for each representative monitoring well. This method was selected to be protective of the beneficial use of interconnected surface water and shallow groundwater near streams and rivers, including those of shallower domestic users and potential groundwater dependent ecosystems. The additional 10 feet in depth below the measured historical low is intended to provide an appropriate margin of operational flexibility during GSP implementation. Since the portion of the Feather River bordering the Butte Subbasin is located upstream from the Sutter Subbasin, it is not anticipated that minimum thresholds set for depletions of interconnected surface water (using the chronic lowering of groundwater levels as a proxy) along the Feather River in the Sutter Subbasin will cause undesirable results or impact the ability of the Butte Subbasin to achieve its sustainability goal.

6.5.6.4.2 Wyandotte Creek Subbasin

The Sutter and Wyandotte Creek Subbasins share a less than one mile boundary, comprised roughly of the Feather River in the very northeastern corner of the Sutter Subbasin where groundwater-related activities are not known to occur. Therefore, it is not anticipated that activities in the Sutter Subbasin will cause an undesirable result for depletions of interconnected surface water in the Wyandotte Creek Subbasin.

6.5.6.4.3 North Yuba and South Yuba Subbasins

In the North Yuba and South Yuba Subbasins, management of depletions of interconnected surface water are performed using groundwater levels as a proxy, using the same monitoring network and numeric SMC as chronic lowering of groundwater levels to identify undesirable results relative to depletions of interconnected surface water. Since numeric SMC for chronic lowering of groundwater levels are used as proxy in the Sutter Subbasin, minimum thresholds in the Sutter Subbasin are anticipated to avoid causing an undesirable result or affect the ability of the North Yuba and South Yuba subbasins to achieve their sustainability goal.

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6.5.6.4.4 North American Subbasin

In the North American Subbasin, minimum thresholds for depletions of interconnected surface water are established using groundwater levels as proxy using the same values and monitoring network as established for the chronic lowering of groundwater sustainability indicator. Since numeric SMC for chronic lowering of groundwater levels are used as proxy in the Sutter Subbasin, minimum thresholds in the Sutter Subbasin are anticipated to avoid causing an undesirable result or affect the ability of the North American Subbasin in achieving its sustainability goal.

6.5.6.4.5 Yolo Subbasin

Minimum thresholds for the depletions of interconnected surface water sustainability indicator along the Upper Sacramento River (defined in the Yolo Subbasin GSP as from the northern subbasin boundary to the southern boundary of the North Yolo management area, which borders the Sutter Subbasin) are established using the same criteria as for the chronic lowering of groundwater levels sustainability indicator in the North Yolo management area. The minimum threshold value is equal to the historic minimum groundwater elevation plus 20% of the depth between the historic maximum and historic minimum elevation for the period of record at each representative monitoring well.

Based on similar methodologies used to establish minimum thresholds along the Upper Sacramento River portion of the North Yolo management area as compared to the Sutter Subbasin (the use of historic minimum groundwater elevations plus some additional buffer) and the role of the Sacramento River (adjoining both subbasins) as a ‘regulating reservoir’ in the Sutter Subbasin, minimum thresholds in the Sutter Subbasin are not anticipated to cause undesirable results or affect the ability of the Yolo Subbasin in achieving its sustainability goal relative to depletions of interconnected surface water.

6.5.6.4.6 Colusa Subbasin

In the Colusa Subbasin, a similar methodology to the Butte Subbasin was used to set minimum thresholds for depletions of interconnected surface water, where the groundwater elevation at each representative monitoring well closest to October 15, 2015 (considered to be the lowest groundwater elevations during the last drought based on review of historical groundwater levels and hydrologic data) was selected with an additional 10 feet added to this groundwater elevation to provide an appropriate margin of operational flexibility in the future during GSP implementation. Based on the role of the Sacramento River (adjoining both subbasins) as a ‘regulating reservoir’ in the Sutter Subbasin, minimum thresholds in the Sutter Subbasin are not anticipated to cause undesirable results or affect the ability of the Colusa Subbasin in achieving its sustainability goal relative to depletions of interconnected surface water.

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6.5.6.5 Effects on Beneficial Uses and Users

As noted in **Section 6.5.1.4**, the beneficial uses and users of groundwater in the Sutter Subbasin generally include domestic, municipal, agricultural, and environmental uses and users, where all beneficial uses and users of groundwater are identified in **Section 4.1** of the *Outreach and Communication* chapter. All beneficial uses and users of groundwater, and their associated land uses and property interests, were considered in establishing minimum thresholds for depletions of interconnected surface water (using the chronic lowering of groundwater levels as a proxy).

Stakeholders, including the public, were invited to provide feedback on minimum thresholds during SSGMCC meetings (noticed according to the Brown Act) and a public workshop held on August 11, 2021. Municipal and agricultural representatives are members of the SSGMCC and participated in the development of minimum thresholds.

A description of how the minimum thresholds for the depletions of interconnected surface water using the chronic lowering of groundwater levels as a proxy may affect the interests of beneficial uses and users of groundwater or land uses and property interests is contained herein.

- **Domestic.** Minimum thresholds for the depletions of interconnected surface water use the chronic lowering of groundwater levels as a proxy and are established to avoid undesirable results for domestic well users as domestic wells are typically screened in the Shallow AZ or AZ-1. Domestic well users are typically considered to be *de minimis* groundwater users (2 acre-feet or less per year) and are not anticipated to cause an undesirable result for depletions of interconnected surface water. Alternatively, due to the interconnection of the Sacramento and Feather Rivers with the Sutter Subbasin, it is not anticipated that negative impacts on domestic well users near interconnected surface waters will be observed if established minimum thresholds are exceeded.
- **Municipal.** As previously noted, municipal water supply systems are designed to include redundancy to adapt to changes in groundwater conditions. Minimum thresholds for depletions of interconnected surface water use the chronic lowering of groundwater levels as a proxy and are established to be protective of municipal groundwater and surface water production needs. If an undesirable result were observed, a reversal of gaining to losing streams could result in decreased water supply available in streams utilized for municipal use in the Sutter Subbasin.
- **Agricultural.** Similar to municipal users, minimum thresholds for the depletions of interconnected surface water use the chronic lowering of groundwater levels as a proxy and are established to be protective of agricultural water needs as the primary use of water in the Sutter Subbasin. If an undesirable result were observed, a reversal of gaining to losing streams could result in decreased water supply available in streams utilized for agricultural purposes in the Sutter Subbasin.

- **Environmental.** If an undesirable result for the depletions of interconnected surface water is observed and presently gaining streams become losing streams, this reversal of stream interconnection would affect aquatic systems and potentially GDEs. Overall water supply utilized by environmental beneficial users of water would be reduced, thereby reducing suitable habitat through reduced stream depth, flow velocity, cover, and dissolved oxygen as well as increased temperature.

6.5.6.6 Relevant Federal, State, or Local Standards

Currently, there are no federal, State, or local standards directly related to the depletions of interconnected surface water sustainability indicator. SGMA is the prevailing legislation dictating requirements and standards for the depletions of interconnected surface water sustainability indicator. DWR has released three technical papers providing guidance on the analysis of depletions of interconnected surface water and plans to release a fourth guidance document specifically related to establishing SMC for depletions of interconnected surface water.

In December 2010, the SWRCB adopted Order WQ 2010-0016, a water quality certification that contains instream flow and temperature requirements for the Feather River's reaches downstream of Oroville Dam (NCWA, November 2019). For the High Flow Channel, which is the reach between the Thermalito Afterbay's outlet and the Feather River's confluence with the Sacramento River, instream flow requirements are required to be maintained so long as they are not projected to cause Oroville Reservoir to be drawn below 733 feet (or approximately 1.5 million acre-feet in storage), with reduced instream flow requirements to prevent drawdown below 733 feet provided stream flows would not be reduced more than 25% below requirements. The certification also requires DWR to operate the Oroville project to meet temperature standards in Feather River.

In April 1960, a Memorandum of Agreement (MOA) between USBR and California Department of Fish and Game (now California Department of Fish and Wildlife) originally established flow objectives in the Sacramento River for the protection and preservation of fish and wildlife resources, providing for minimum releases into the natural channel of the Sacramento River at Keswick Dam for normal and critically dry years. Modifications to the flow schedule in the MOA were made in October 1981. In 1990 and 1991, the SWRCB issued Water Rights Orders 90-05 and 91-01 modifying USBR's water rights for the Sacramento River. The orders states USBR shall operate Keswick and Shasta Dams and the Spring Creek Powerplant to meet temperature requirements as far downstream in the Sacramento River as practicable during periods when high temperature would be harmful to fisheries. Pursuant to these orders, USBR configured and implemented the Sacramento-Trinity Water Quality Monitoring Network to monitor temperature and other parameters at key locations in the Sacramento and Trinity Rivers.

6.5.6.7 Method for Quantitative Measurement

For information regarding how depletions of interconnected surface water will be quantitatively measured, including monitoring protocols as well as frequency and timing of measurement, refer to **Section 7.2** *Monitoring*.

6.6 Measurable Objectives and Interim Milestones

Measurable objectives are quantitative goals that reflect the subbasin's desired groundwater conditions and reflect the Sutter Subbasin's sustainability goal. Measurable objectives are set such that there is a reasonable margin of operational flexibility that will accommodate droughts, climate change, conjunctive use operations, and other groundwater management activities. 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 are included in **Section 7.1** and are designed to allow for adaptive management of the groundwater basin, maintenance of sustainable conditions and to improve overall groundwater conditions.

Interim milestones are target values representing measurable groundwater conditions, in increments of 5 years set to help move a basin towards the sustainability goal over a 20-year period or as check-in points for sustainable basins. Interim milestones are set equal to the measurable objective for each applicable sustainability indicator as the Sutter Subbasin is in a sustainable state; this provides a means of ensuring that the sustainable conditions are maintained.

This section describes the methodology used to develop numeric measurable objectives/interim milestones and how the established values will maintain sustainable conditions in the Sutter Subbasin.

6.6.1 Chronic Lowering of Groundwater Levels

The measurable objective for the chronic lowering of groundwater levels is set at the average of the available historical record at each representative monitoring site. The average groundwater level calculated over the historic record for each representative monitoring site reflects a long-term, varied hydrologic record and, along with the identification of undesirable results, is anticipated to maintain sustainable conditions in the Sutter Subbasin (see **Section 5.3** of the *Basin Setting* chapter for more information about sustainable conditions in the Sutter Subbasin). Refer to **Appendix 6-A** for hydrographs for all representative monitoring sites for the chronic lowering of groundwater levels plotted with the established measurable objective.

In the process of developing the measurable objectives for the chronic lowering of groundwater levels, several methods were considered. Other methods considered included the average of measurements between Water Year (WY) 2015 and 2020, average of seasonal high groundwater levels over the historic record at each representative monitoring site, and 10 feet below ground surface elevation as

established in the Sutter Subbasin Alternative Plan (GEI, 2016). Refer to **Appendix 6-B** for more information about the development of measurable objectives for the chronic lowering of groundwater levels and a comparison of considered methodologies.

Table 6-7 reflects the measurable objectives and interim milestones for the chronic lowering of groundwater levels at each representative monitoring site.

Local input through SSGMCC meetings as well as public workshops was considered in setting the measurable objectives for chronic lowering of groundwater levels. The selected measurable objectives reflect input from local water purveyors as well as the agricultural community, and are expected to maintain economically-viable groundwater levels for all beneficial users of groundwater. Interim milestones are equal to the measurable objectives for the chronic lowering of groundwater levels.

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Table 6-7. Measurable Objectives and Interim Milestones for the Chronic Lowering of Groundwater Levels

Site Code	State Well Number	Local ID / Other ID	Aquifer Zone	Measurable Objective / Interim Milestone (feet above MSL, NAVD88)
390696N1217778W001	14N02E17C001M	Sutter County MW-1A	Shallow	29.50
387859N1216565W001	11N03E20H003M	RD 1500 Karnak	AZ-1	18.51
388761N1217094W001	12N02E23H001M	Sutter County MW-2A	AZ-1	15.58
389605N1218102W003	13N01E24G004M	Flood MW-1C (shall)	AZ-1	23.33
390087N1216722W001	13N03E06A001M	Sutter County MW-6A	AZ-1	29.13
390682N1216901W001	14N02E13A003M	SEWD MW-3A	AZ-1	45.37
390588N1217004W001	14N02E13L001M	-	AZ-1	35.80
390176N1217902W001	14N02E31K001M	-	AZ-1	27.08
390244N1217813W001	14N02E32D001M	SMWC MW-1A	AZ-1	26.34
390458N1216114W001	14N03E23D003M	Feather River MW-1A	AZ-1	25.14
391051N1217012W001	15N02E36L001M	-	AZ-1	41.09
392394N1216509W001	16N03E17J001M	Sutter County MW-3A	AZ-1	67.82
392970N1216907W003	17N02E25J003M	BWD MW-1C	AZ-1	68.03
391456N1218904W001	-	MFWC Prop 50	AZ-1	35.72
389605N1218102W001	13N01E24G002M	Flood MW-1A (deep)	AZ-2	24.50
389605N1218102W002	13N01E24G003M	Flood MW-1B (int)	AZ-2	21.89
391078N1216244W002 [1]	-	La Grande	AZ-2	33.84
391068N1216464W002 [2]	-	Edwin	AZ-2	30.85
390087N1216722W002	13N03E06A002M	Sutter County MW-6B	AZ-2	26.71
390087N1216722W003	13N03E06A003M	Sutter County MW-6C	AZ-2	26.41
389452N1215992W001	13N03E26J002M	Sutter County MW-4A	AZ-2	21.59
390682N1216901W002	14N02E13A004M	SEWD MW-3B	AZ-2	37.66
390696N1217778W002	14N02E17C002M	Sutter County MW-1B	AZ-2	28.83
388761N1217094W002	12N02E23H002M	Sutter County MW-2B	AZ-2	16.42

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Site Code	State Well Number	Local ID / Other ID	Aquifer Zone	Measurable Objective / Interim Milestone (feet above MSL, NAVD88)
390244N1217813W002	14N02E32D002M	SMWC MW-1B	AZ-2	26.51
390458N1216114W002	14N03E23D004M	Feather River MW-1B	AZ-2	13.00
391658N1217070W001	15N02E12E001M	SEWD MW-1A	AZ-2	46.28
391658N1217070W002	15N02E12E002M	SEWD MW-1B	AZ-2	39.64
391414N1217442W001	15N02E22D001M	-	AZ-2	40.50
391279N1216989W001	15N02E24P001M	SEWD MW-2A	AZ-2	41.01
391279N1216989W002	15N02E24P002M	SEWD MW-2B	AZ-2	29.31
392394N1216509W002	16N03E17J002M	Sutter County MW-3B	AZ-2	53.39
392970N1216907W002	17N02E25J002M	BWD MW-1B	AZ-2	43.89
391283N1218286W001	-	BS2-Franklin	AZ-2	33.27
391613N1216237W001	-	WTP well	AZ-2 and AZ-3	38.01
388761N1217094W003	12N02E23H003M	Sutter County MW-2C	AZ-3	16.38
388761N1217094W004	12N02E23H004M	Sutter County MW-2D	AZ-3	16.09
389452N1215992W002	13N03E26J003M	Sutter County MW-4B	AZ-3	20.62
389452N1215992W003	13N03E26J004M	Sutter County MW-4C	AZ-3	19.32
389452N1215992W004	13N03E26J005M	Sutter County MW-4D	AZ-3	16.84
390682N1216901W003	14N02E13A005M	SEWD MW-3C	AZ-3	35.02
390696N1217778W003	14N02E17C003M	Sutter County MW-1C	AZ-3	25.72
390696N1217778W004	14N02E17C004M	Sutter County MW-1D	AZ-3	28.41
390244N1217813W003	14N02E32D003M	SMWC MW-1C	AZ-3	25.35
390458N1216114W003	14N03E23D005M	Feather River MW-1C	AZ-3	27.55
390458N1216114W004	14N03E23D006M	Feather River MW-1D	AZ-3	25.99
391658N1217070W003	15N02E12E003M	SEWD MW-1C	AZ-3	39.41
391279N1216989W003	15N02E24P003M	SEWD MW-2C	AZ-3	29.80

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Site Code	State Well Number	Local ID / Other ID	Aquifer Zone	Measurable Objective / Interim Milestone (feet above MSL, NAVD88)
392394N1216509W003	16N03E17J003M	Sutter County MW-3C	AZ-3	51.18
392394N1216509W004	16N03E17J004M	Sutter County MW-3D	AZ-3	48.28
392394N1216509W005	16N03E17J005M	Sutter County MW-3E	AZ-3	47.71
392970N1216907W001	17N02E25J001M	BWD MW-1A	AZ-3	35.01

[1] Previously identified as Hillcrest Well #8

[2] Previously identified as Hillcrest Well #9

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6.6.2 Reduction of Groundwater Storage

Since the chronic lowering of groundwater levels is used as a proxy for the reduction in groundwater storage, the measurable objectives and interim milestones for the reduction of groundwater storage sustainability indicator are the same as the measurable objectives and interim milestones for the chronic lowering of groundwater levels sustainability indicator as set forth in **Section 6.6.1** and will utilize the same monitoring networks and collected data (in addition to C2VSimFG-Sutter) to evaluate performance and sustainability metrics.

6.6.3 Seawater Intrusion

Seawater intrusion is not an applicable sustainability indicator for the Sutter Subbasin as the Subbasin is located inland from the Pacific Ocean and is not adjacent to the Sacramento-San Joaquin Delta. Therefore, SMC for seawater intrusion will not be established for the Sutter Subbasin GSP.

6.6.4 Degraded Water Quality

The measurable objectives for degraded water quality are set as the current water quality conditions for TDS and nitrate as N based on data available from 2000 to the time of GSP development or amendment (Summer 2021 and Summer 2026, respectively) at the representative monitoring well (as described in **Section 5.2.5** of the *Basin Setting* chapter) using the maximum concentration detected for each constituent of concern. In the event that well-specific data are not present, the measurable objective has been set at 500 mg/L for TDS (the Recommended SMCL) and 7 mg/L for nitrate as N [70% of the Primary MCL, per the adaptive management trigger system described in the *Framework for a Drinking Water Well Impact Mitigation Program* (Self-Help Enterprises et al., n.d.)]. Similar to the interim milestones set for the chronic lowering of groundwater levels representative monitoring sites, interim milestones for the degraded water quality representative monitoring sites have been set to each site's measurable objective. **Table 6-8** reflects the measurable objectives and interim milestones for degraded water quality at each representative monitoring site.

Local input through SSGMCC meetings, as well as public workshops, were also used in setting the measurable objectives for degraded water quality. The selected measurable objectives reflect input from local drinking water purveyors as well as the local agricultural community, and are expected to maintain beneficial uses of groundwater. It should be noted that the concentrations presented for measurable objectives reflect ambient groundwater quality, where additional treatment may currently be necessary to meet State and federal MCLs for drinking water. As noted above, interim milestones are equal to the measurable objective for the degradation of water quality. Measurable objectives/interim milestones have been established consistent with California's Antidegradation Policy.

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Table 6-8. Measurable Objectives and Interim Milestones for Degraded Water Quality

Site Code	State Well Number	Local ID / Other ID	Aquifer Zone	Measurable Objective (TDS; mg/L)	Measurable Objective (Nitrate as N; mg/L)
390682N1216901W001	14N02E13A003M	SEWD MW-3A	AZ-1	500	7
392970N1216907W003	17N02E25J003M	BWD MW-1C	AZ-1	500	7
-	-	Well 2-C	AZ-1	500	7
391456N1218904W001	-	MFWC Prop 50	AZ-1	500	7
390682N1216901W002	14N02E13A004M	SEWD MW-3B	AZ-2	500	7
391658N1217070W001	15N02E12E001M	SEWD MW-1A	AZ-2	500	7
391658N1217070W002	15N02E12E002M	SEWD MW-1B	AZ-2	500	7
391279N1216989W001	15N02E24P001M	SEWD MW-2A	AZ-2	500	7
391279N1216989W002	15N02E24P002M	SEWD MW-2B	AZ-2	500	7
391012N1218222W001	-	BS1-McClatchy	AZ-2	500	7
392970N1216907W002	17N02E25J002M	BWD MW-1B	AZ-2	500	7
-	-	Well-1A / 5110001-011	AZ-2	420	8
-	-	Well-2A / 5110001-013	AZ-2	450	11
-	-	Akins Well	AZ-2	500	7
391613N1216236W001	-	WTP Well	AZ-2 and AZ-3	170	1
390682N1216901W003	14N02E13A005M	SEWD MW-3C	AZ-3	500	7
391658N1217070W003	15N02E12E003M	SEWD MW-1C	AZ-3	500	7
391279N1216989W003	15N02E24P003M	SEWD MW-2C	AZ-3	500	7
392970N1216907W001	17N02E25J001M	BWD MW-1A	AZ-3	500	7

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6.6.5 Land Subsidence

The measurable objective for land subsidence reflects desired conditions and is set at 0.25 feet of subsidence over a five-year rolling average calculated by water year (0.05 feet over 1 year or 1 foot over 20 years), a rate that is small but reflects the range of error inherent in measurements collected for the Sacramento Valley Subsidence Network as the only historical land elevation data in the Sutter Subbasin [measured with an accuracy of 0.17 feet (DWR North Region Office, 2018)]. Because subsidence has not historically been detected in the Sutter Subbasin, interim milestones are set at the measurable objective value of 0.25 feet over a five-year rolling average calculated by water year. **Table 6-9** reflects the measurable objectives and interim milestones for the land subsidence sustainability indicator.

Local input through SSGMCC meetings as well as public workshops were used in setting the measurable objective for land subsidence. The selected measurable objective reflects input from local water purveyors, water and reclamation districts, and the agricultural community who operate and maintain critical infrastructure within the Subbasin that would be directly impacted by inelastic land subsidence. Interim milestones are equal to the measurable objective for land subsidence.

Table 6-9. Measurable Objective and Interim Milestone for Land Subsidence

Name	Station Zone/ID	Measurable Objective / Interim Milestone (feet of subsidence over five-year rolling average)
Sutter Land Subsidence Extensometer	Station No. 11N04E04N005M	0.25
DWR 1500	DWR 1500	0.25
InSAR Monitoring Zones (five mi^2 grid)	InSAR Zones 1 to 125	0.25

6.6.6 Depletions of Interconnected Surface Water

Since the chronic lowering of groundwater levels is used as a proxy for the depletions of interconnected surface water, the measurable objectives and interim milestones for the depletions of interconnected surface water sustainability indicator are the same as the measurable objectives and interim milestones for the chronic lowering of groundwater levels sustainability indicator as set forth in **Section 6.6.1** and will utilize the same monitoring networks and collected data to evaluate performance and sustainability metrics.

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6.7 References

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Appendix 6-A
Hydrographs with Numeric SMCs for Chronic Lowering of Groundwater Levels and Depletions of Interconnected Surface Water Representative Monitoring Sites

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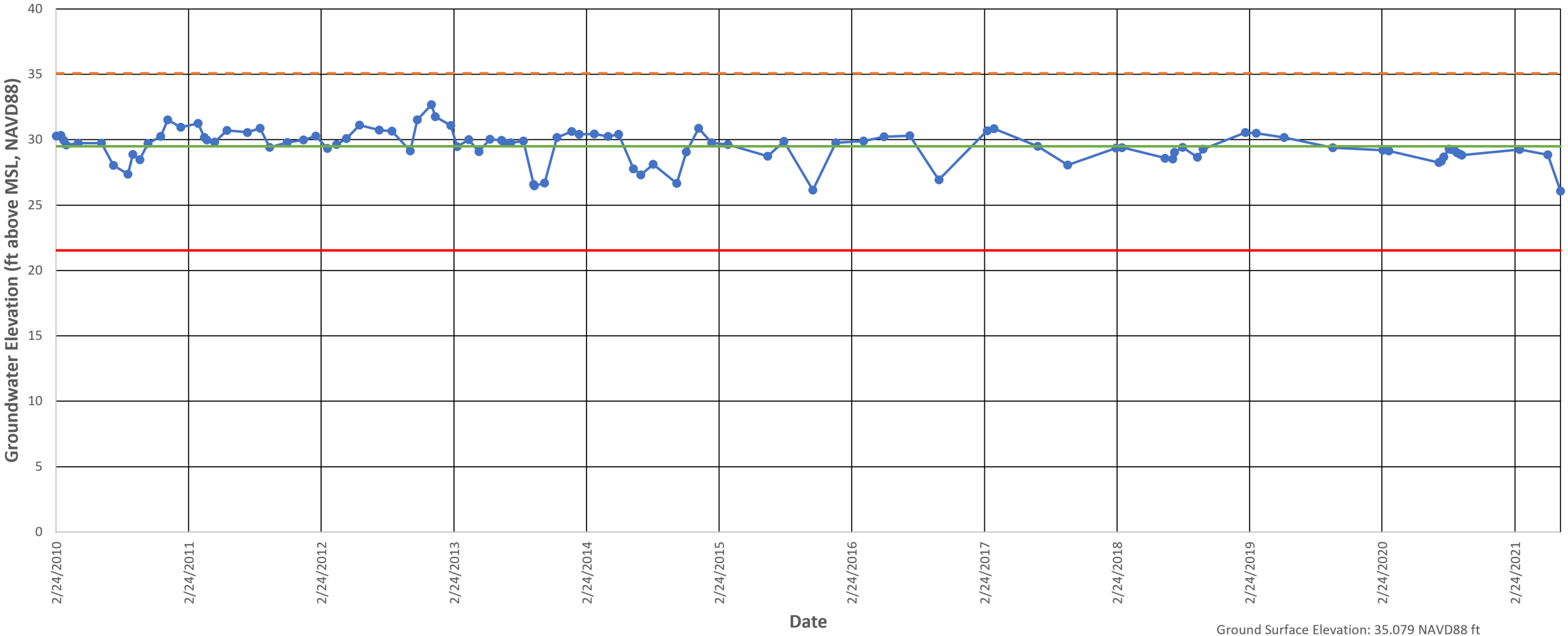
Sutter County MW-1A



Groundwater Level
Ground Surface Elevation
Measurable Objective
Minimum Threshold

Operational Range: 7.96 ft

MT Method Selected: Minimum Operating Range

Site Code: 390696N1217778W001

SWN: 14N02E17C001M

Local ID: Sutter County MW-1A

Other ID: N/A

Ground Surface Elevation: 35.079 NAVD88 ft

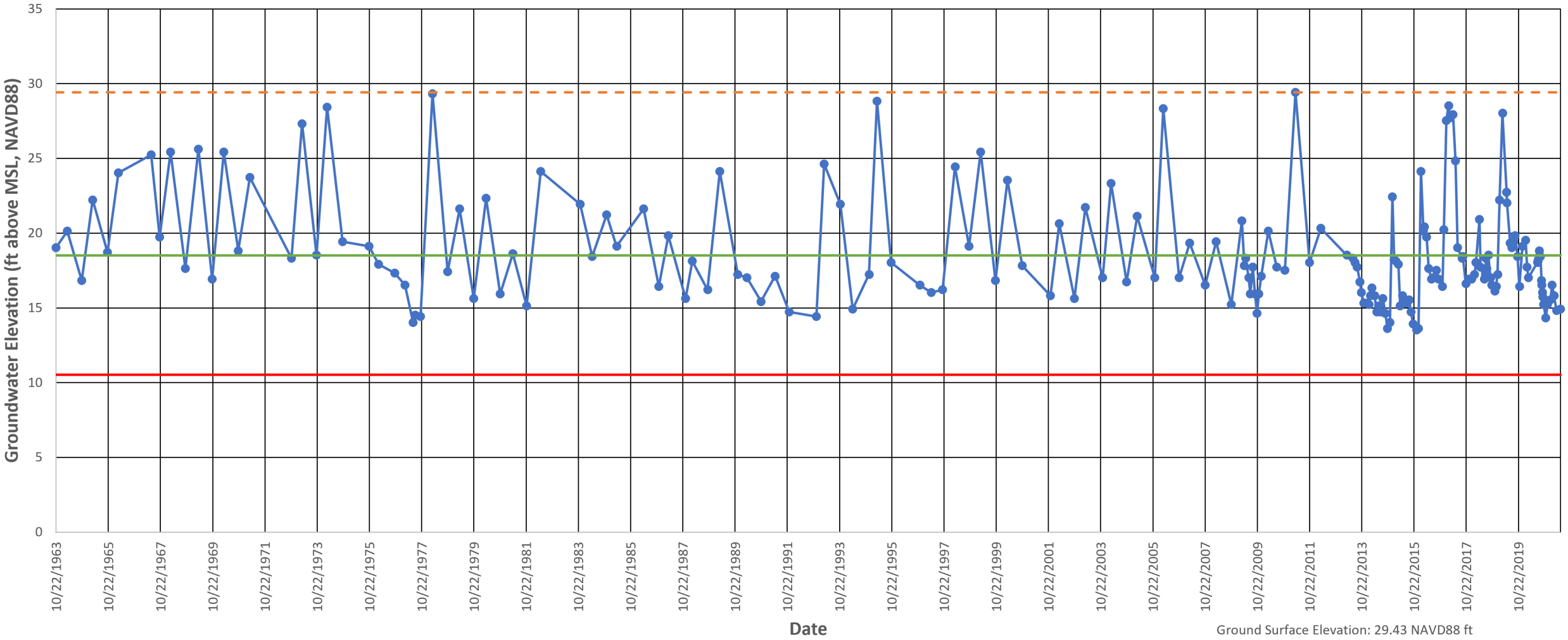
Depth: 60 ft bgs

Screen Interval - 1: 30 - 50 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: Shallow

RD 1500 Karnak



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 7.96 ft

MT Method Selected: Minimum Operating Range

Site Code: 387859N1216565W001

SWN: 11N03E20H003M

Local ID: RD 1500 Karnak

Other ID: N/A

Ground Surface Elevation: 29.43 NAVD88 ft

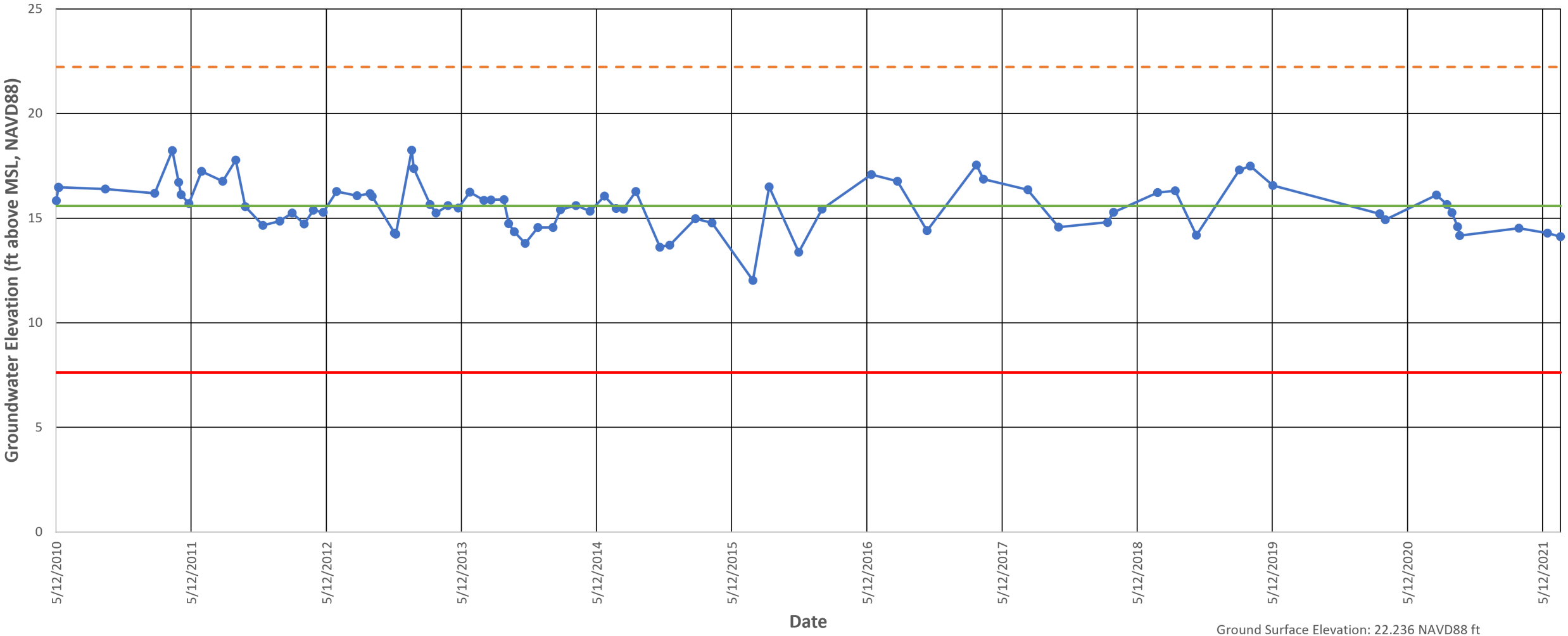
Depth: 165 ft bgs

Screen Interval - 1: 135 - 156 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-1

Sutter County MW-2A



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 7.96 ft

MT Method Selected: Minimum Operating Range

Site Code: 388761N1217094W001

SWN: 12N02E23H001M

Local ID: Sutter County MW-2A

Other ID: N/A

Ground Surface Elevation: 22.236 NAVD88 ft

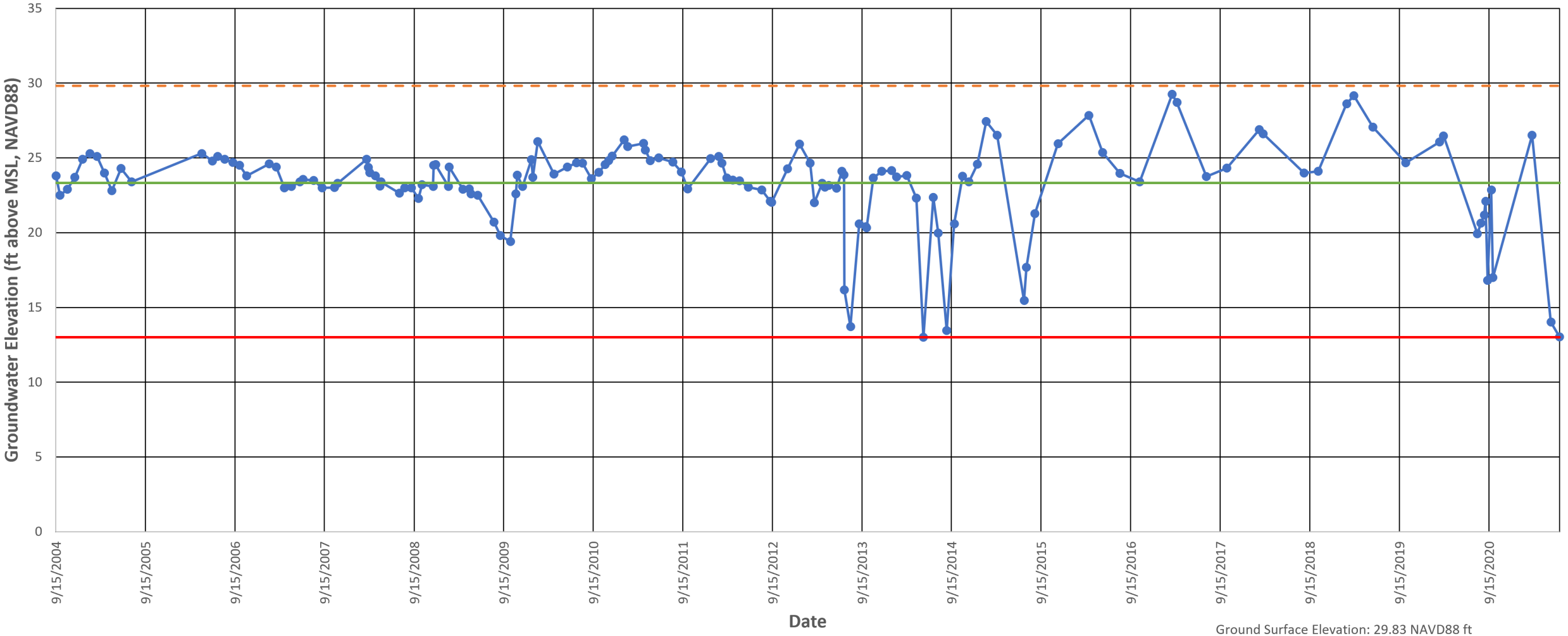
Depth: 150 ft bgs

Screen Interval - 1: 120 - 140 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-1

Flood MW-1C (shall)



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 10.33 ft

MT Method Selected: Historic Low

Site Code: 389605N1218102W003

SWN: 13N01E24G004M

Local ID: Flood MW-1C (shall)

Other ID: N/A

Ground Surface Elevation: 29.83 NAVD88 ft

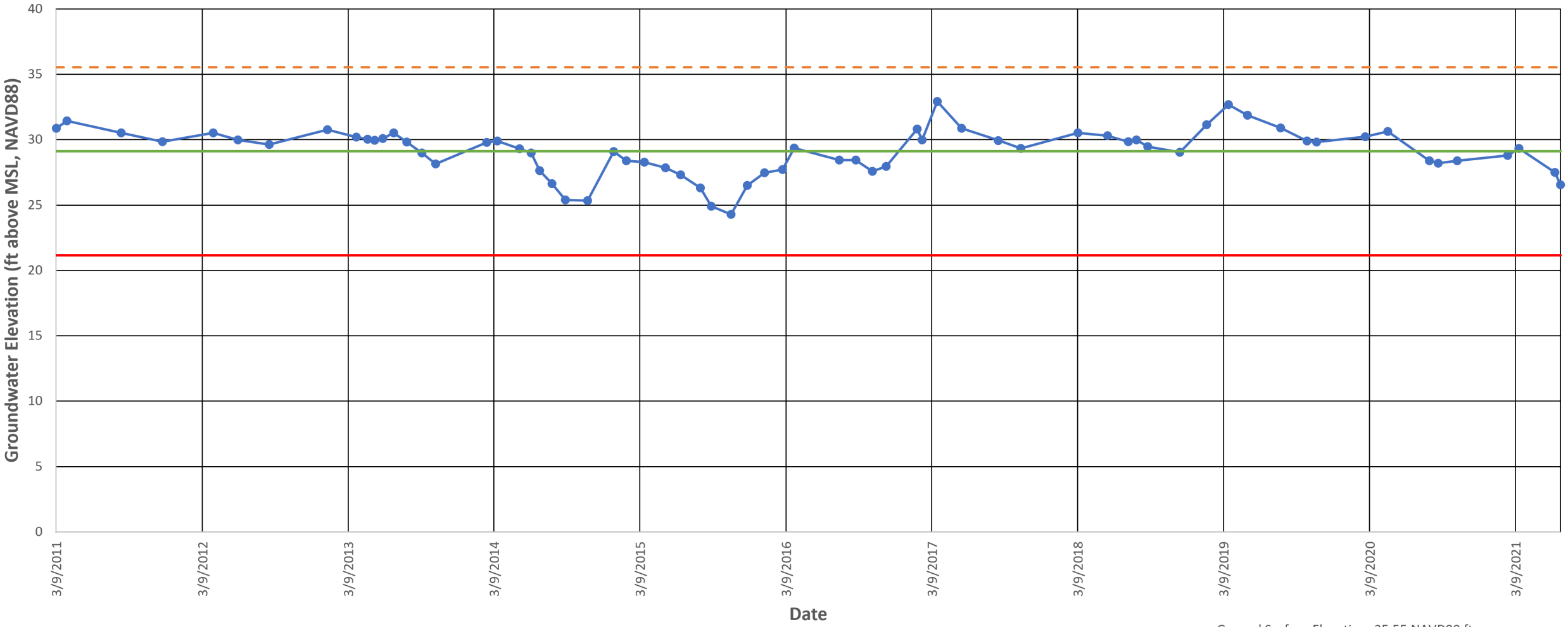
Depth: 100 ft bgs

Screen Interval - 1: 70 - 90 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-1

Sutter County MW-6A



Operational Range: 7.96 ft

MT Method Selected: Minimum Operating Range

Site Code: 390087N1216722W001

SWN: 13N03E06A001M

Local ID: Sutter County MW-6A

Other ID: N/A

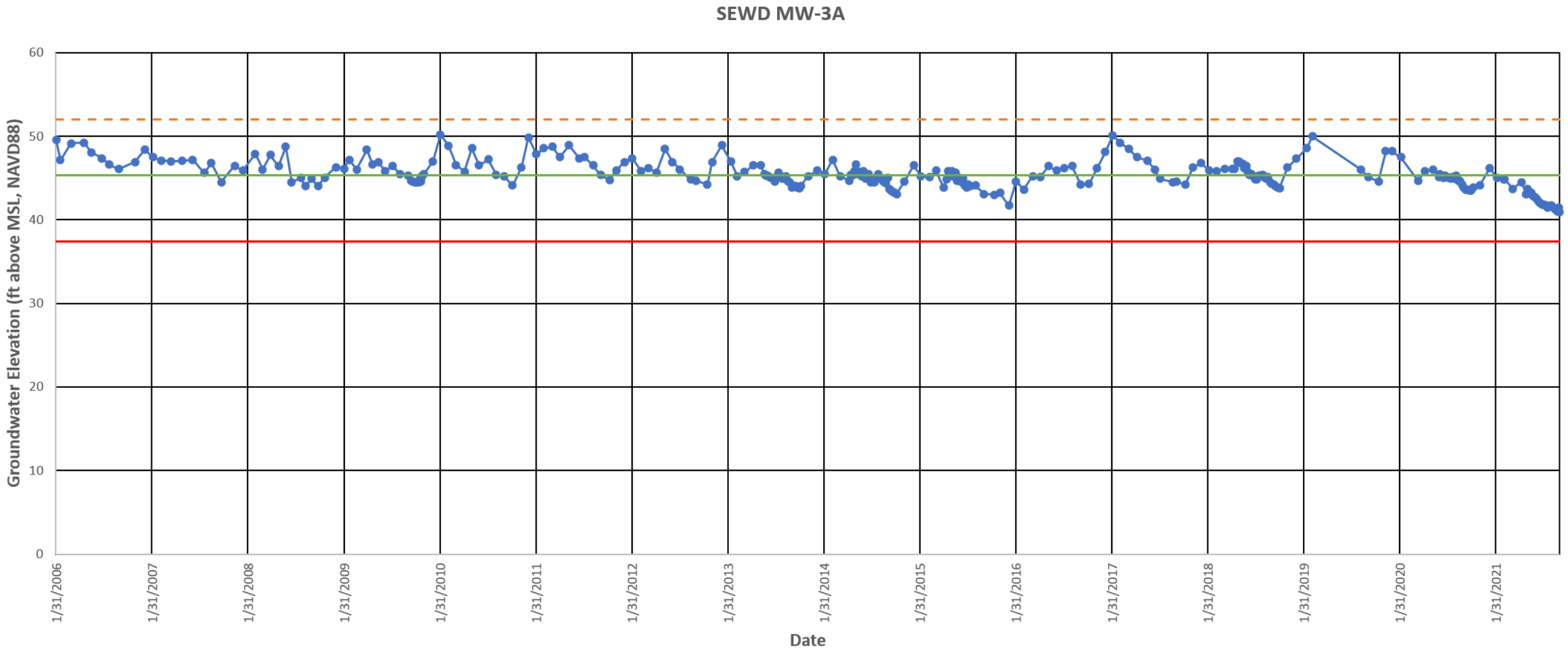
Ground Surface Elevation: 35.55 NAVD88 ft

Depth: 65 ft bgs

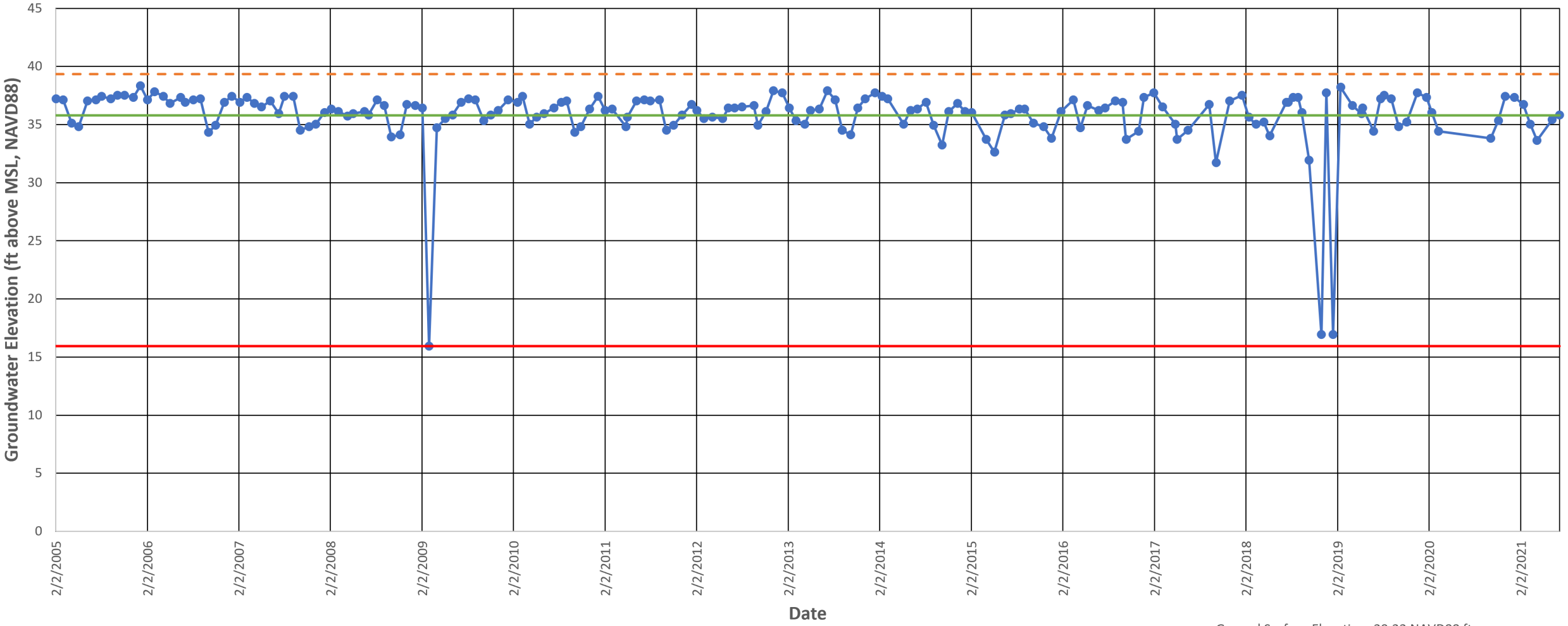
Screen Interval - 1: 45 - 55 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-1


SEWD MW-3A
Groundwater Elevation (ft above MSL, NAVD88)
60
50
40
30
20
10
0
1/31/2006
1/31/2007
1/31/2008
1/31/2009
1/31/2010
1/31/2011
1/31/2012
1/31/2013
1/31/2014
1/31/2015
1/31/2016
1/31/2017
1/31/2018
1/31/2019
1/31/2020
1/31/2021
Date
Groundwater Level
Ground Surface Elevation
Measurable Objective
Minimum Threshold
Operational Range: 8 ft
MT Method Selected: Minimum Operating Range
Site Code: 390682N1216901W001
SWN: 14N02E13A003M
Local ID: SEWD MW-3A
Other ID: N/A
Ground Surface Elevation: 52 NAVD88 ft
Depth: 115 ft bgs
Screen Interval - 1: 90 - 110 ft bgs
Screen Interval - 2: N/A - N/A ft bgs
Screen Interval - 3: N/A - N/A ft bgs
Aquifer Zone: AZ-1

14N02E13L001M



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 19.87 ft

MT Method Selected: Historic Low

Site Code: 390588N1217004W001

SWN: 14N02E13L001M

Local ID: N/A

Other ID: N/A

Ground Surface Elevation: 39.33 NAVD88 ft

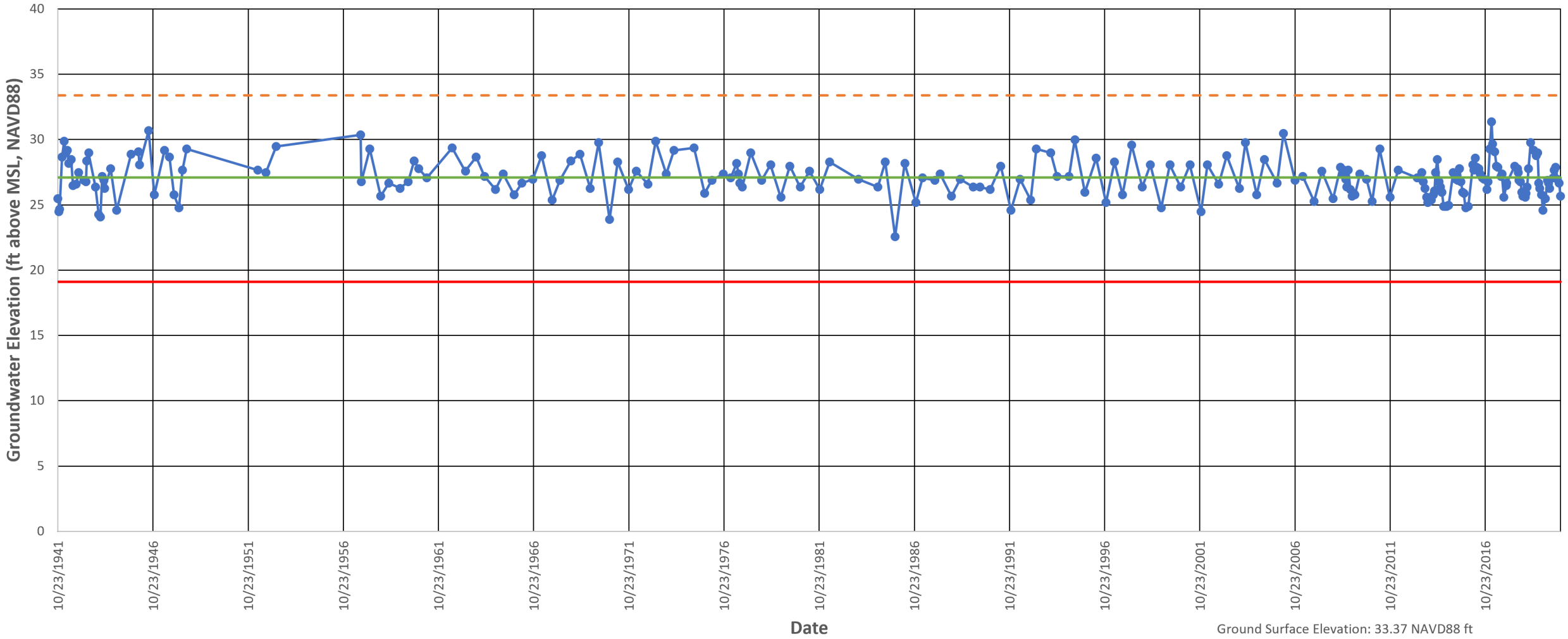
Depth: 82 ft bgs

Screen Interval - 1: 68 - 82 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-1

14N02E31K001M



Operational Range: 7.96 ft

MT Method Selected: Minimum Operating Range

Site Code: 390176N1217902W001

SWN: 14N02E31K001M

Local ID: N/A

Other ID: N/A

Ground Surface Elevation: 33.37 NAVD88 ft

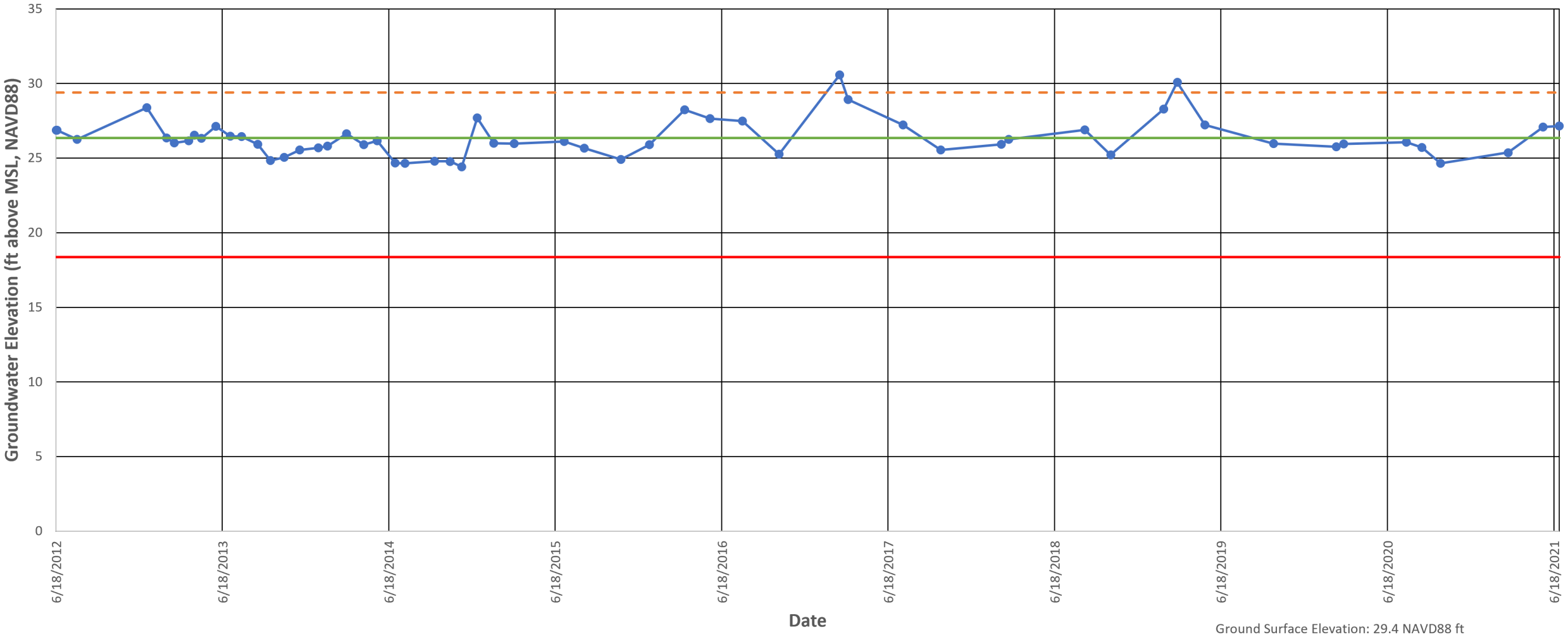
Depth: 131 ft bgs

Screen Interval - 1: N/A - N/A ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-1

SMWC MW-1A



Operational Range: 7.96 ft

MT Method Selected: Minimum Operating Range

Site Code: 390244N1217813W001

SWN: 14N02E32D001M

Local ID: SMWC MW-1A

Other ID: N/A

Ground Surface Elevation: 29.4 NAVD88 ft

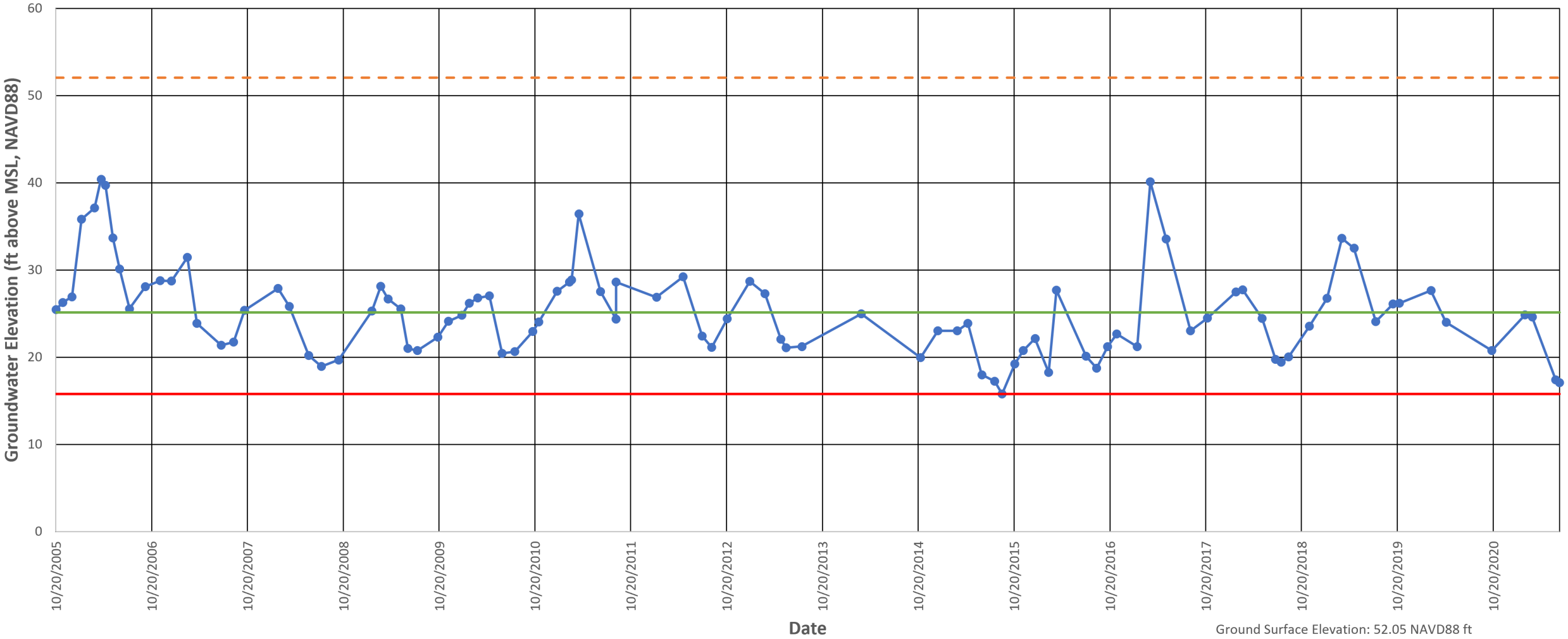
Depth: 64 ft bgs

Screen Interval - 1: 34 - 54 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-1

Feather River MW-1A



Operational Range: 9.36 ft

MT Method Selected: Historic Low

Site Code: 390458N1216114W001

SWN: 14N03E23D003M

Local ID: Feather River MW-1A

Other ID: N/A

Ground Surface Elevation: 52.05 NAVD88 ft

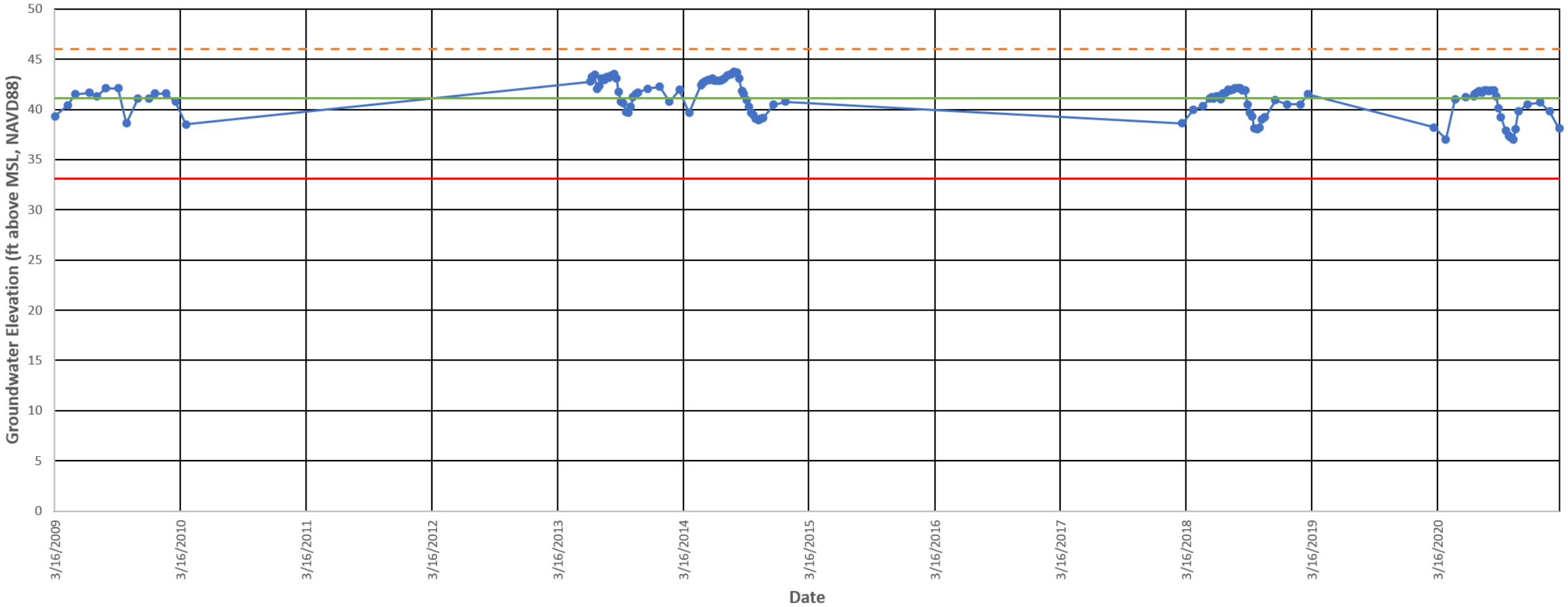
Depth: 65 ft bgs

Screen Interval - 1: 40 - 60 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-1

15N02E36L001M



Groundwater Level
Ground Surface Elevation
Measurable Objective
Minimum Threshold

Operational Range: 8 ft

MT Method Selected: Minimum Operating Range

Site Code: 391051N1217012W001

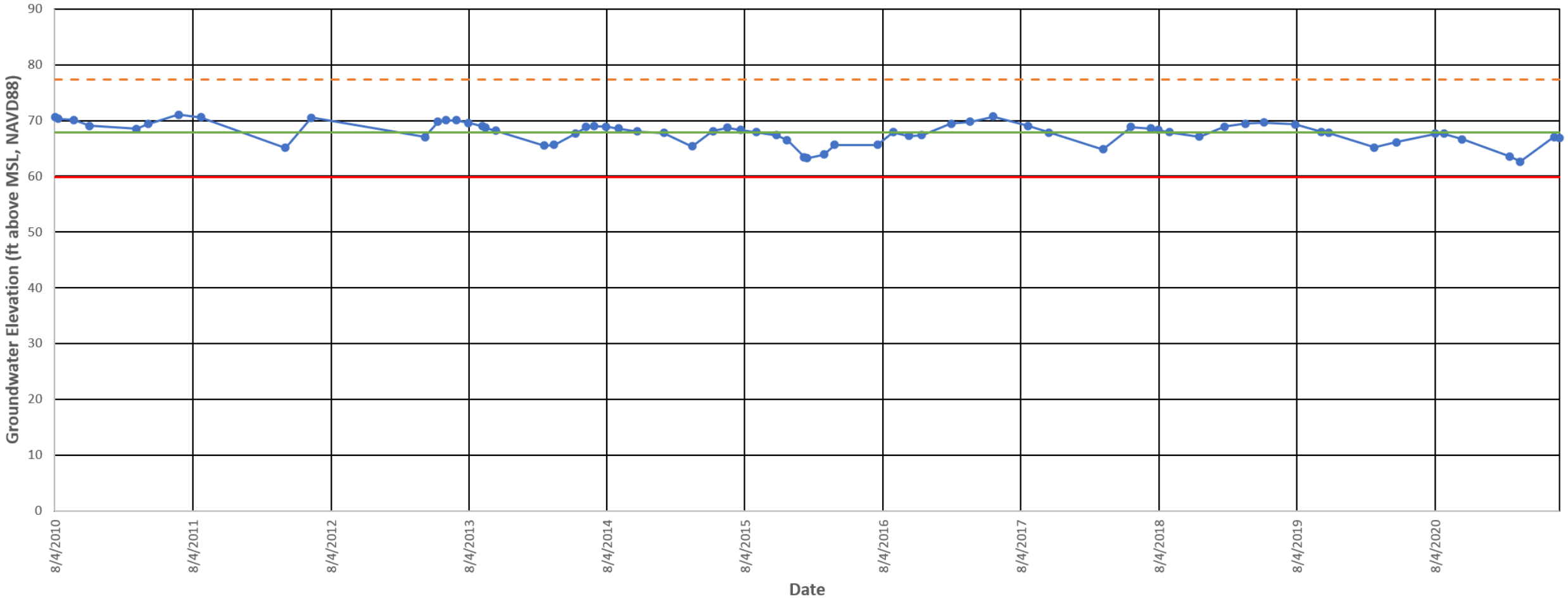
SWN: 15N02E36L001M

Local ID: N/A

Other ID: N/A

Ground Surface Elevation: 46 NAVD88 ft
Depth: 150 ft bgs
Screen Interval - 1: 100 - 150 ft bgs
Screen Interval - 2: N/A - N/A ft bgs
Screen Interval - 3: N/A - N/A ft bgs
Aquifer Zone: AZ-1

Sutter County MW-3A



Groundwater Level
Ground Surface Elevation
Measurable Objective
Minimum Threshold

Operational Range: 8 ft

MT Method Selected: Minimum Operating Range

Site Code: 392394N1216509W001

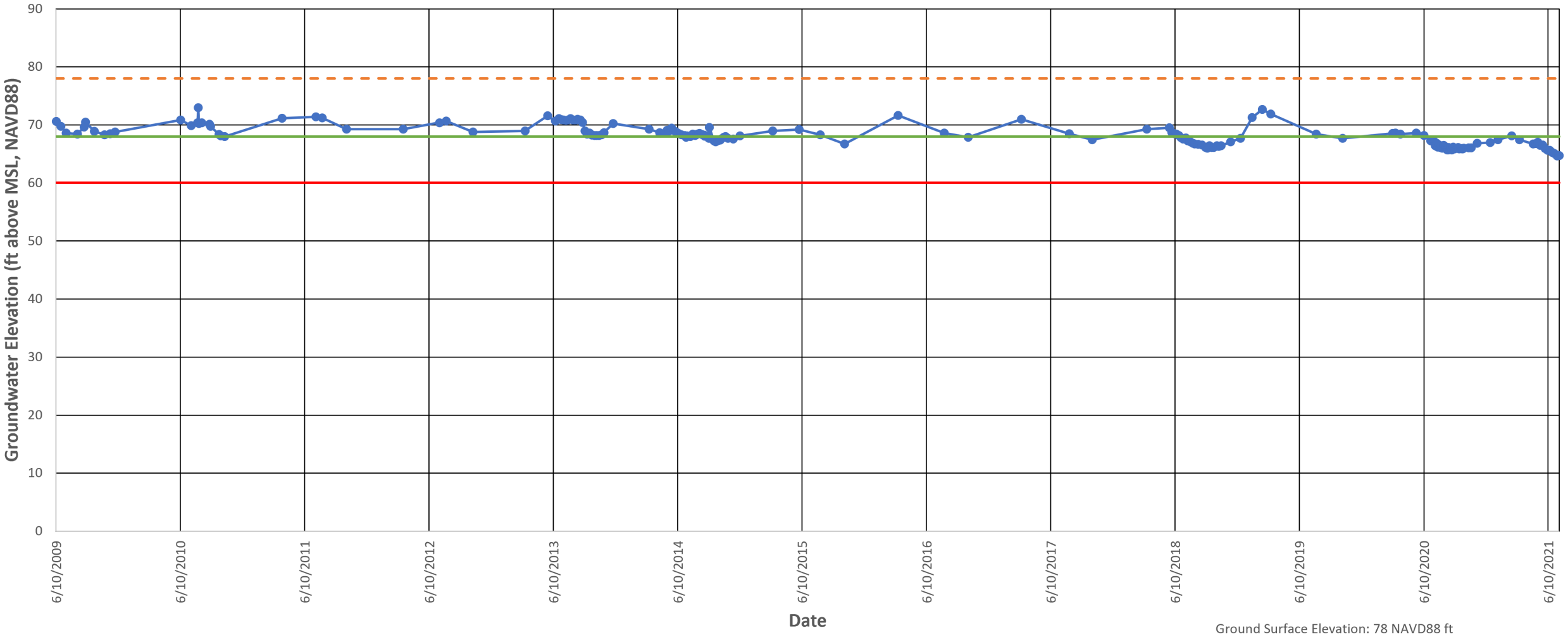
SWN: 16N03E17J001M

Local ID: Sutter County MW-3A

Other ID: N/A

Ground Surface Elevation: 77.35 NAVD88 ft
Depth: 85 ft bgs
Screen Interval - 1: 65 - 75 ft bgs
Screen Interval - 2: N/A - N/A ft bgs
Screen Interval - 3: N/A - N/A ft bgs
Aquifer Zone: AZ-1

BWD MW-1C



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 7.96 ft

MT Method Selected: Minimum Operating Range

Site Code: 392970N1216907W003

SWN: 17N02E25J003M

Local ID: BWD MW-1C

Other ID: N/A

Ground Surface Elevation: 78 NAVD88 ft

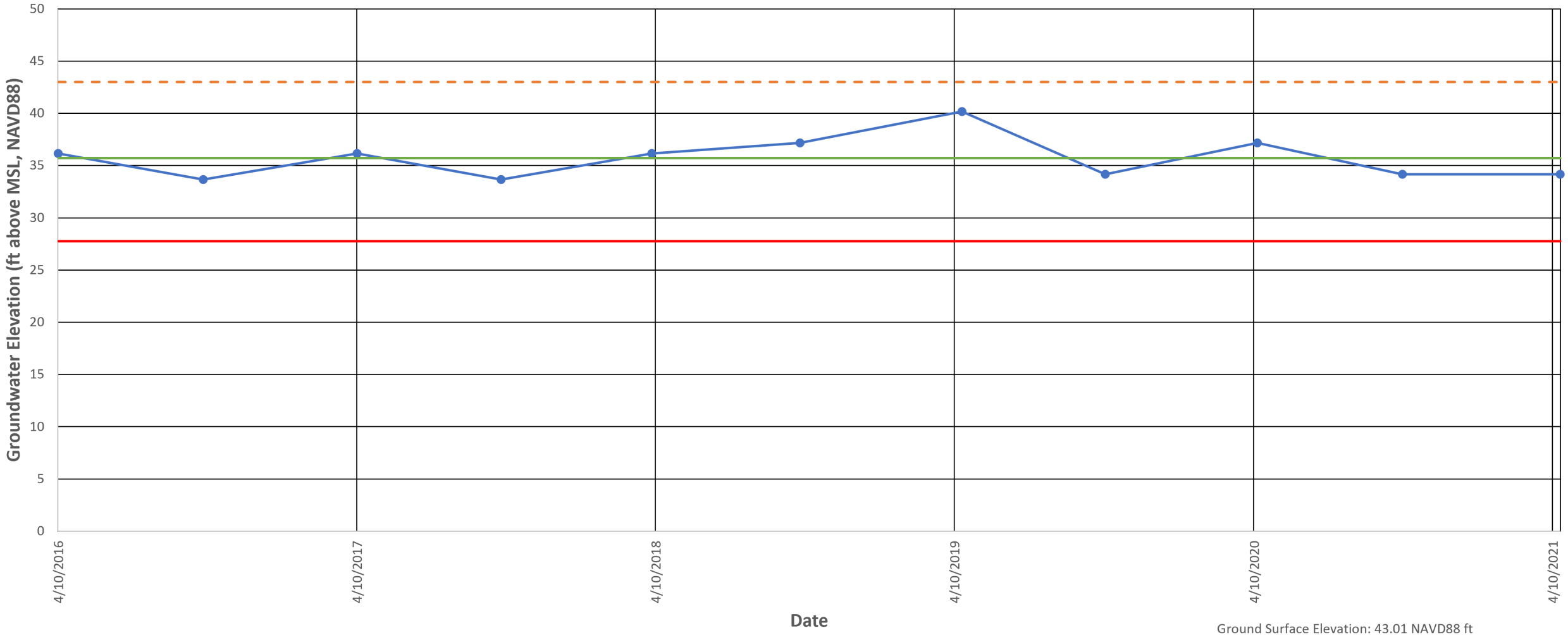
Depth: 127 ft bgs

Screen Interval - 1: 70 - 90 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-1

MFWC Prop 50



Operational Range: 7.96 ft

MT Method Selected: Minimum Operating Range

Site Code: 391456N1218904W001

SWN: N/A

Local ID: MFWC Prop 50

Other ID: N/A

Ground Surface Elevation: 43.01 NAVD88 ft

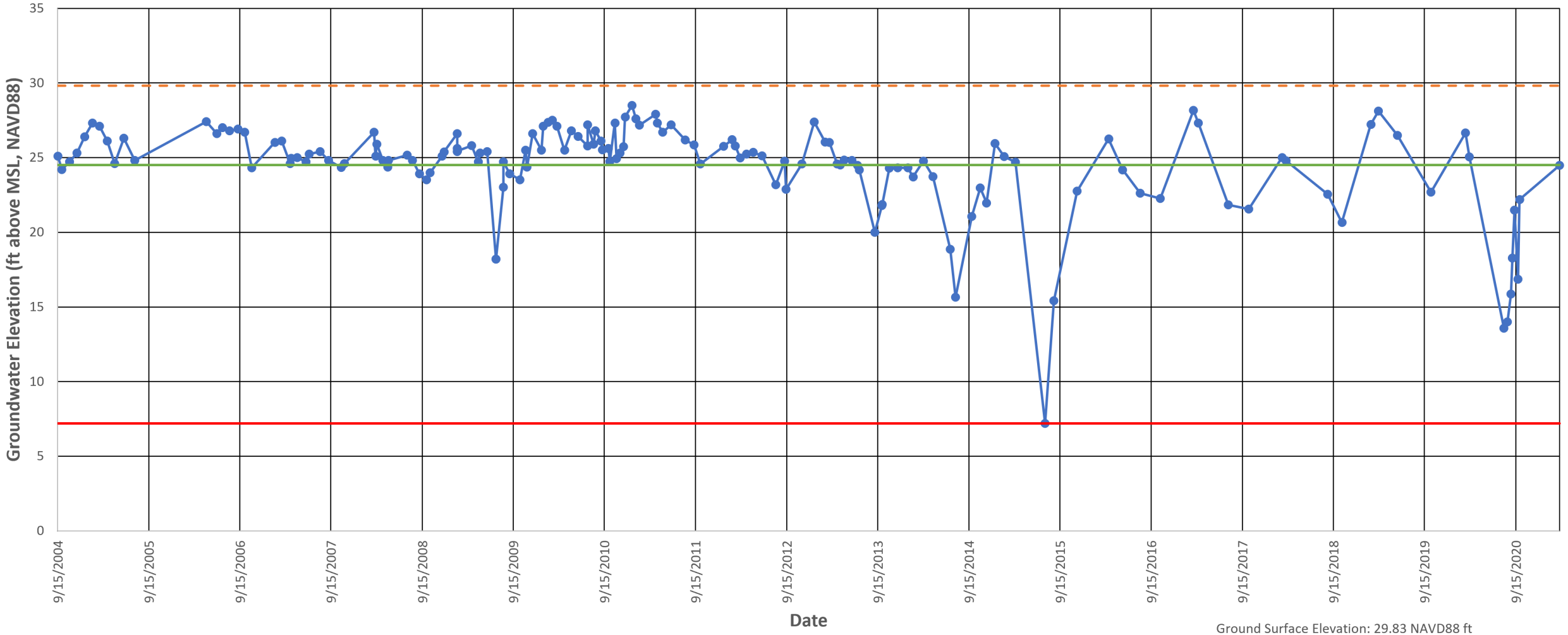
Depth: 320 ft bgs

Screen Interval - 1: 125 - 155 ft bgs

Screen Interval - 2: 280 - 310 ft bgs

Aquifer Zone: AZ-1

Flood MW-1A (deep)



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 17.3 ft

MT Method Selected: Historic Low

Site Code: 389605N1218102W001

SWN: 13N01E24G002M

Local ID: Flood MW-1A (deep)

Other ID: N/A

Ground Surface Elevation: 29.83 NAVD88 ft

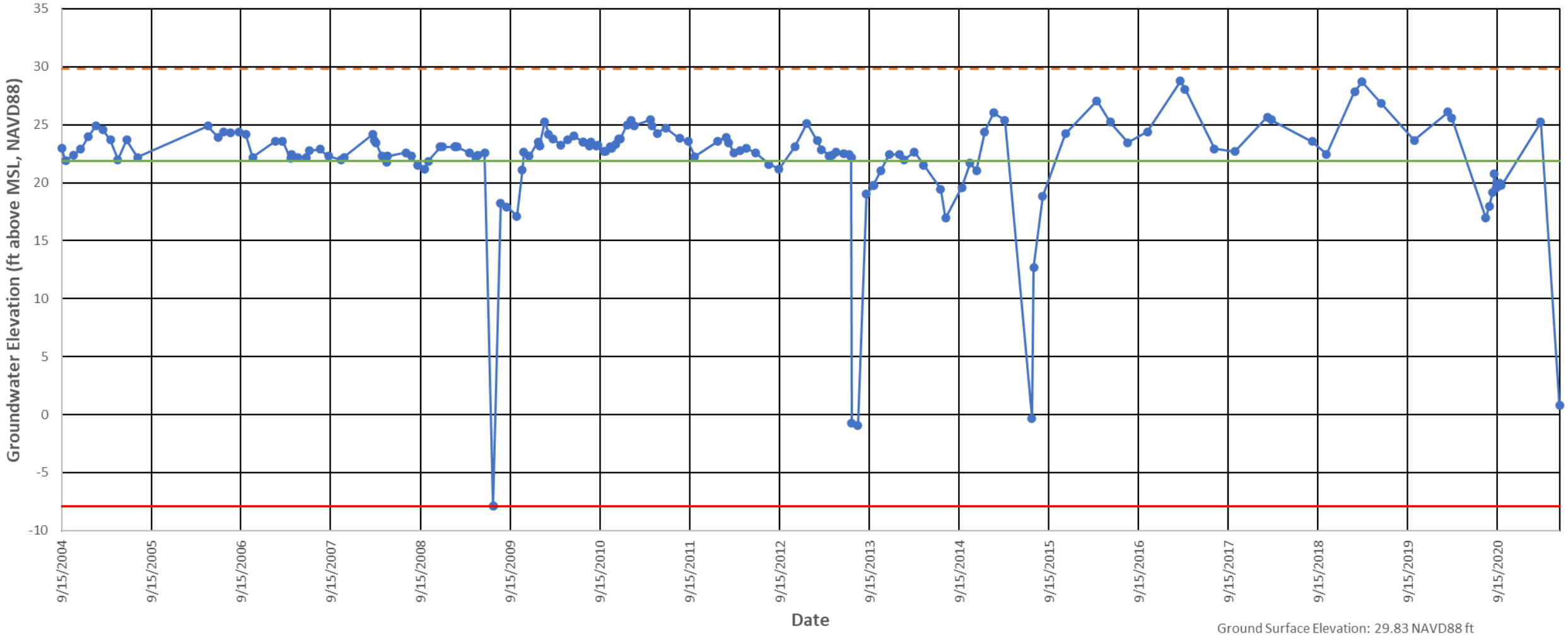
Depth: 310 ft bgs

Screen Interval - 1: 240 - 300 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

Flood MW-1B (int)



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 29.79 ft

MT Method Selected: Historic Low

Site Code: 389605N1218102W002

SWN: 13N01E24G003M

Local ID: Flood MW-1B (int)

Other ID: N/A

Ground Surface Elevation: 29.83 NAVD88 ft

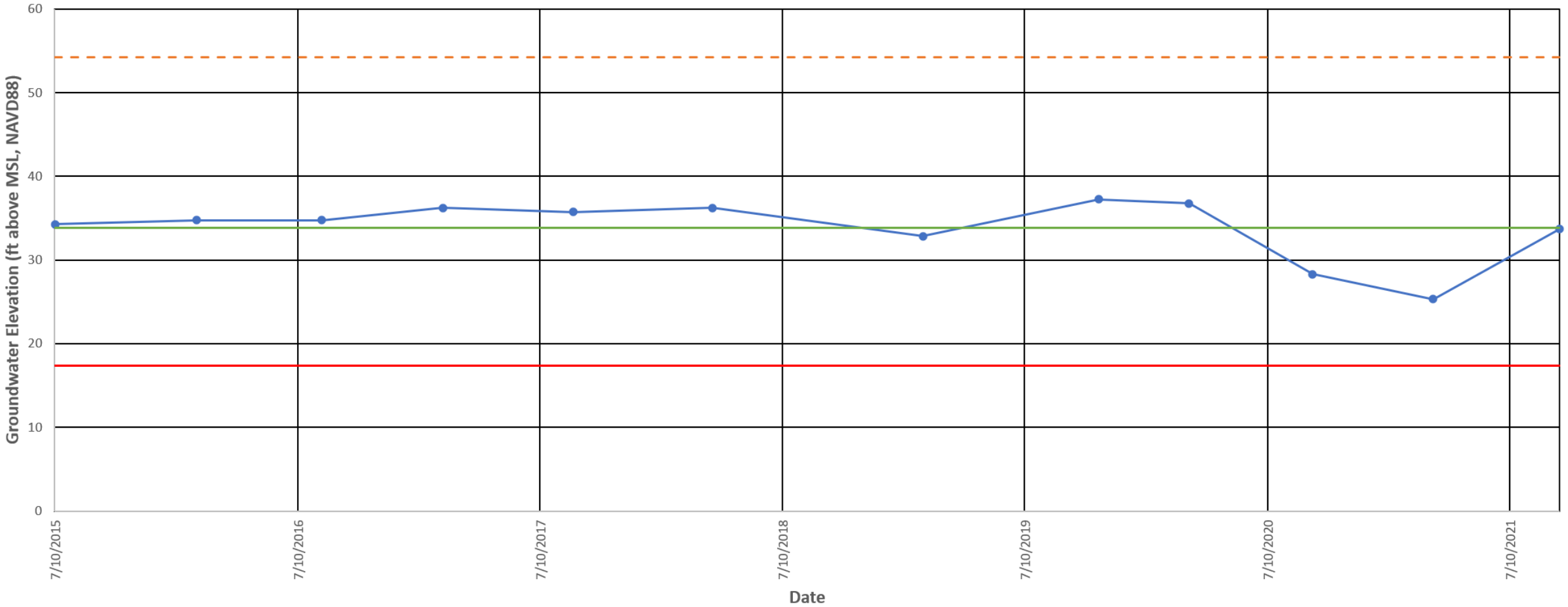
Depth: 160 ft bgs

Screen Interval - 1: 130 - 160 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

La Grande



Groundwater Level
Ground Surface Elevation
Measurable Objective
Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: N/A

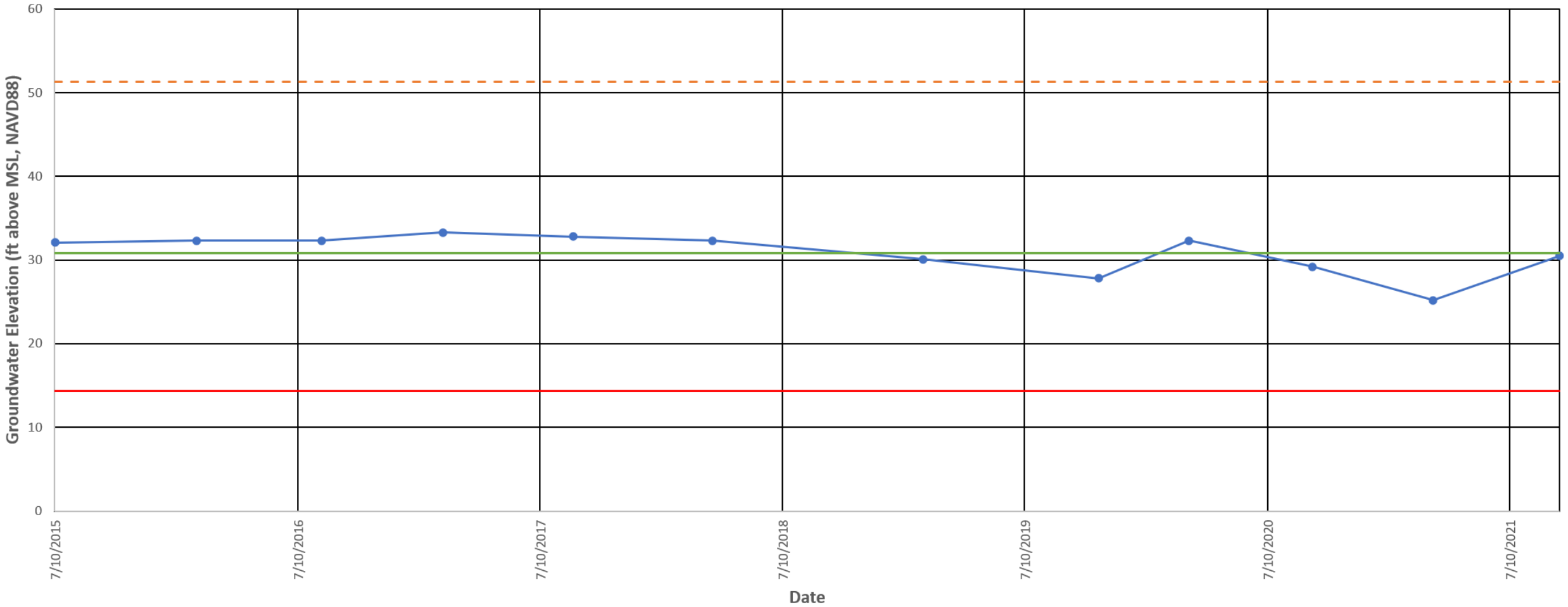
SWN: N/A

Local ID: Hillcrest Well #8

Other ID: N/A

Ground Surface Elevation: 54.247 NAVD88 ft
Depth: 254 ft bgs
Screen Interval - 1: N/A - N/A ft bgs
Screen Interval - 2: N/A - N/A ft bgs
Screen Interval - 3: N/A - N/A ft bgs
Aquifer Zone: AZ-2

Edwin



Groundwater Level
Ground Surface Elevation
Measurable Objective
Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: N/A

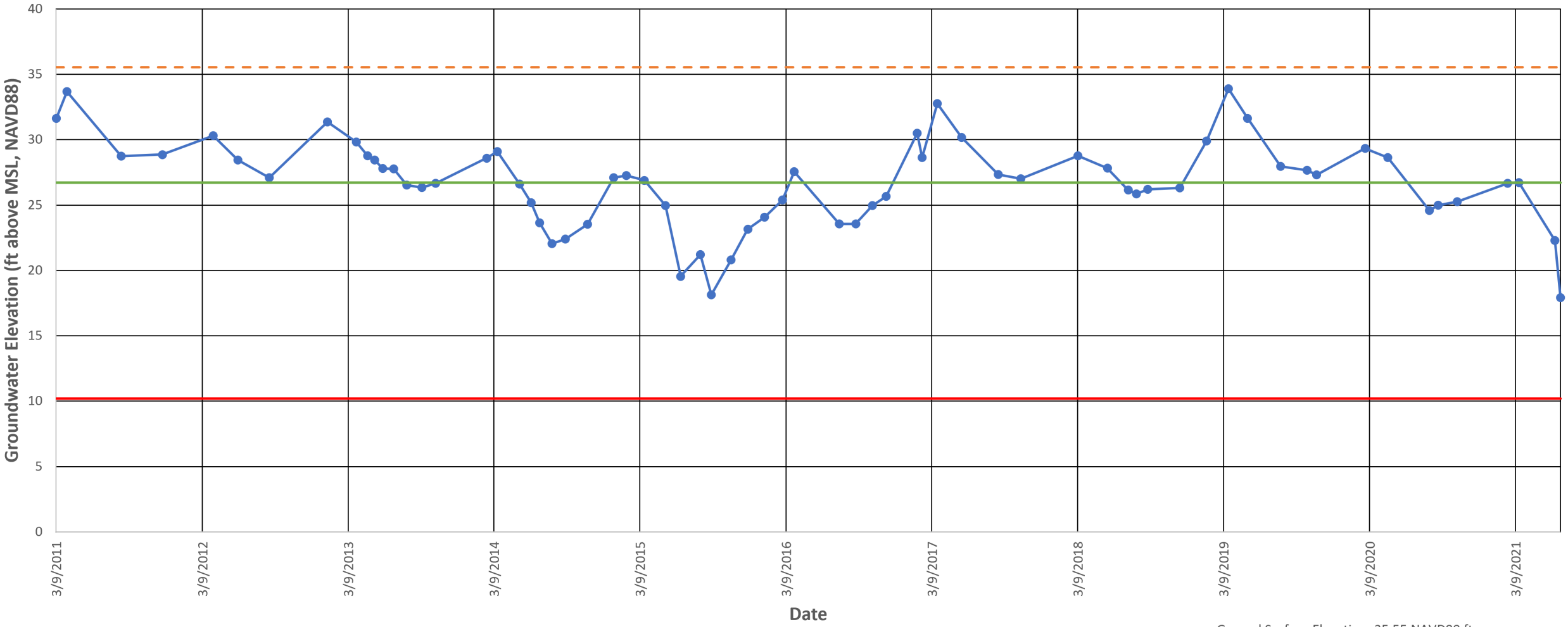
SWN: N/A

Local ID: Hillcrest Well #9

Other ID: N/A

Ground Surface Elevation: 51.301 NAVD88 ft
Depth: 190 ft bgs
Screen Interval - 1: N/A - N/A ft bgs
Screen Interval - 2: N/A - N/A ft bgs
Screen Interval - 3: N/A - N/A ft bgs
Aquifer Zone: AZ-2

Sutter County MW-6B



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 390087N1216722W002

SWN: 13N03E06A002M

Local ID: Sutter County MW-6B

Other ID: N/A

Ground Surface Elevation: 35.55 NAVD88 ft

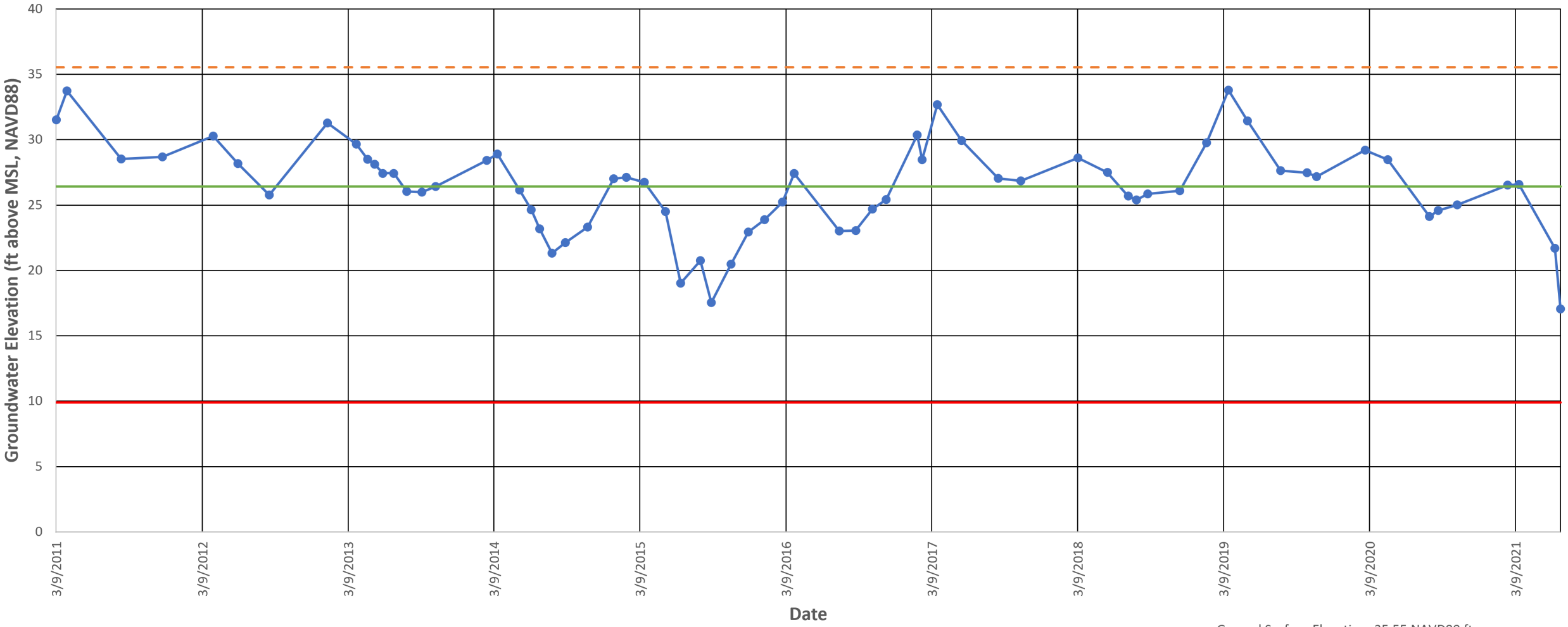
Depth: 175 ft bgs

Screen Interval - 1: 155 - 165 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

Sutter County MW-6C



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 390087N1216722W003

SWN: 13N03E06A003M

Local ID: Sutter County MW-6C

Other ID: N/A

Ground Surface Elevation: 35.55 NAVD88 ft

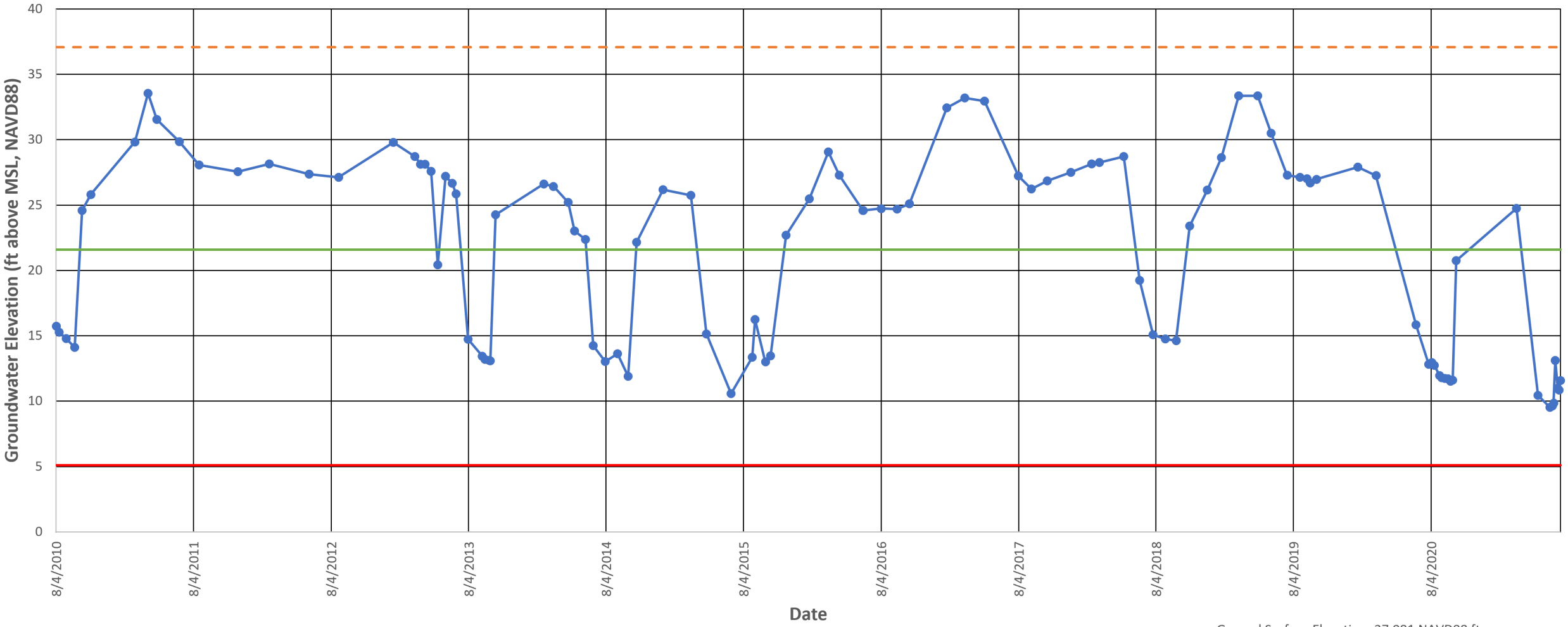
Depth: 265 ft bgs

Screen Interval - 1: 245 - 255 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

Sutter County MW-4A



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 389452N1215992W001

SWN: 13N03E26J002M

Local ID: Sutter County MW-4A

Other ID: N/A

Ground Surface Elevation: 37.081 NAVD88 ft

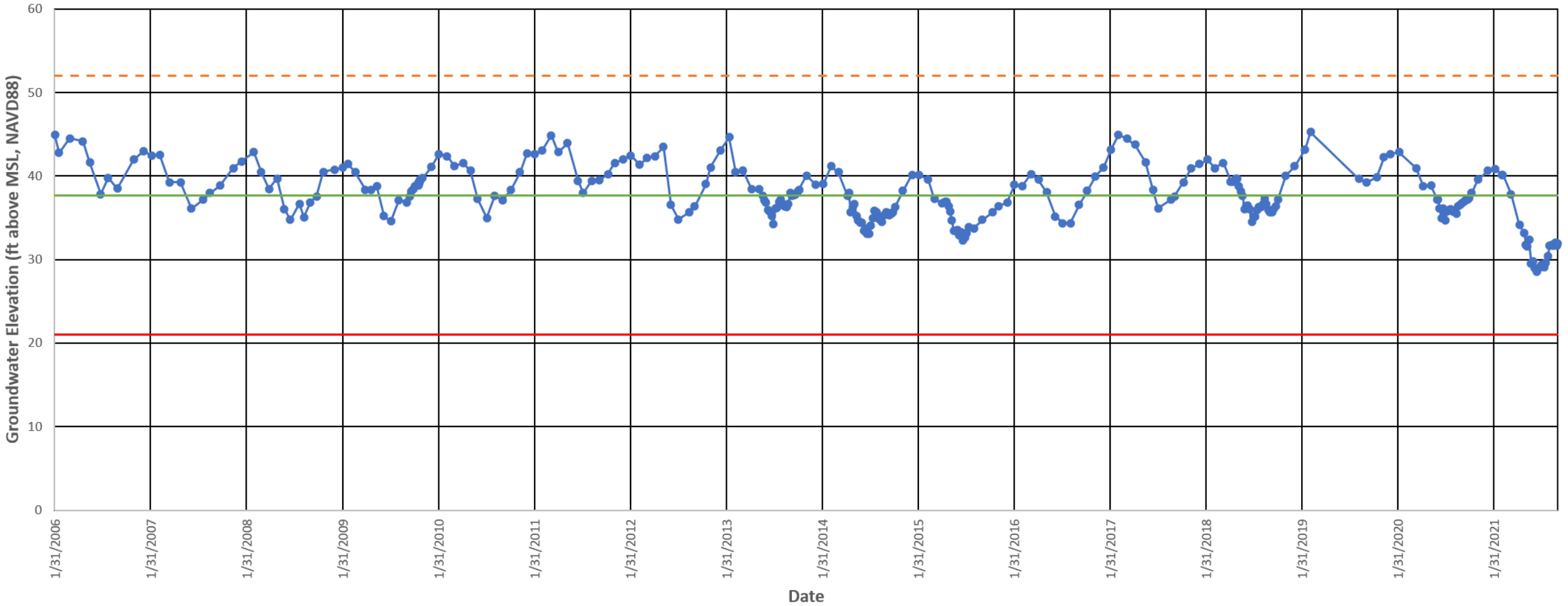
Depth: 175 ft bgs

Screen Interval - 1: 145 - 165 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

SEWD MW-3B



Groundwater Level
Ground Surface Elevation
Measurable Objective
Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 390682N1216901W002

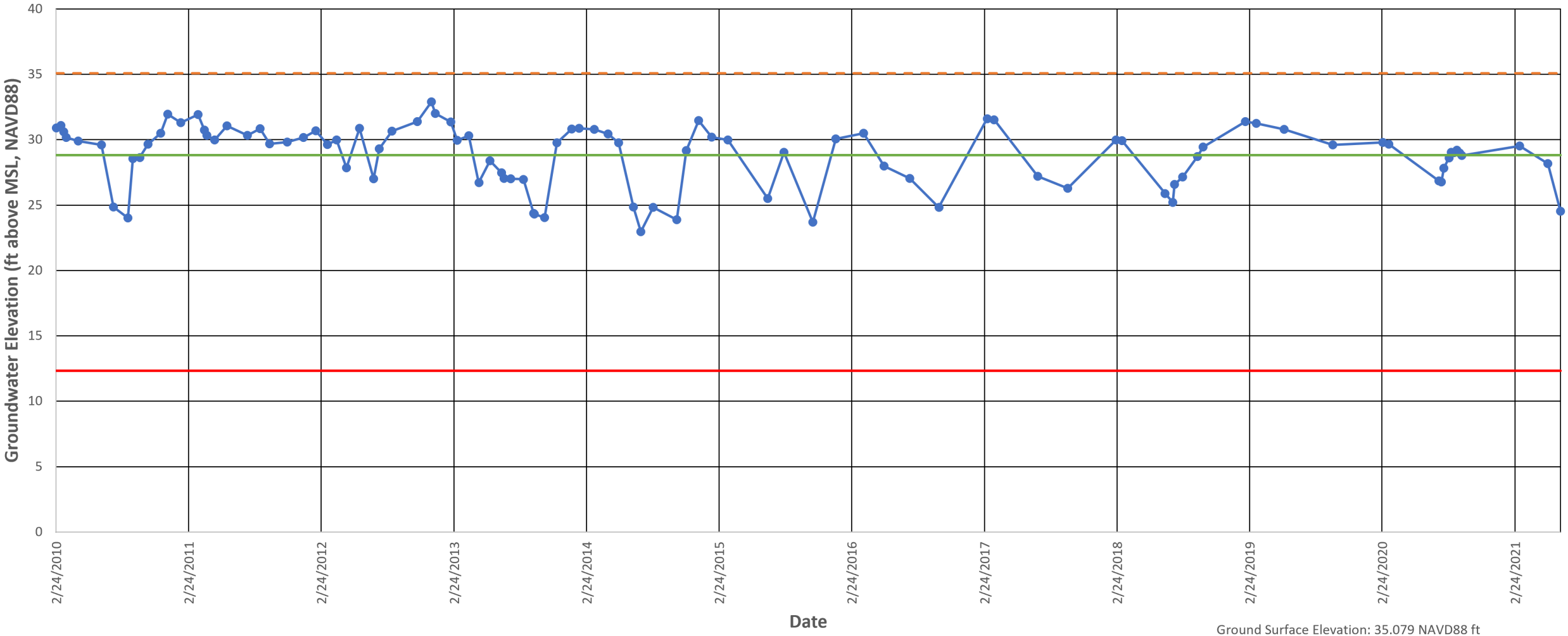
SWN: 14N02E13A004M

Local ID: SEWD MW-3B

Other ID: N/A

Ground Surface Elevation: 52 NAVD88 ft
Depth: 245 ft bgs
Screen Interval - 1: 210 - 240 ft bgs
Screen Interval - 2: N/A - N/A ft bgs
Screen Interval - 3: N/A - N/A ft bgs
Aquifer Zone: AZ-2

Sutter County MW-1B



Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 390696N1217778W002

SWN: 14N02E17C002M

Local ID: Sutter County MW-1B

Other ID: N/A

Ground Surface Elevation: 35.079 NAVD88 ft

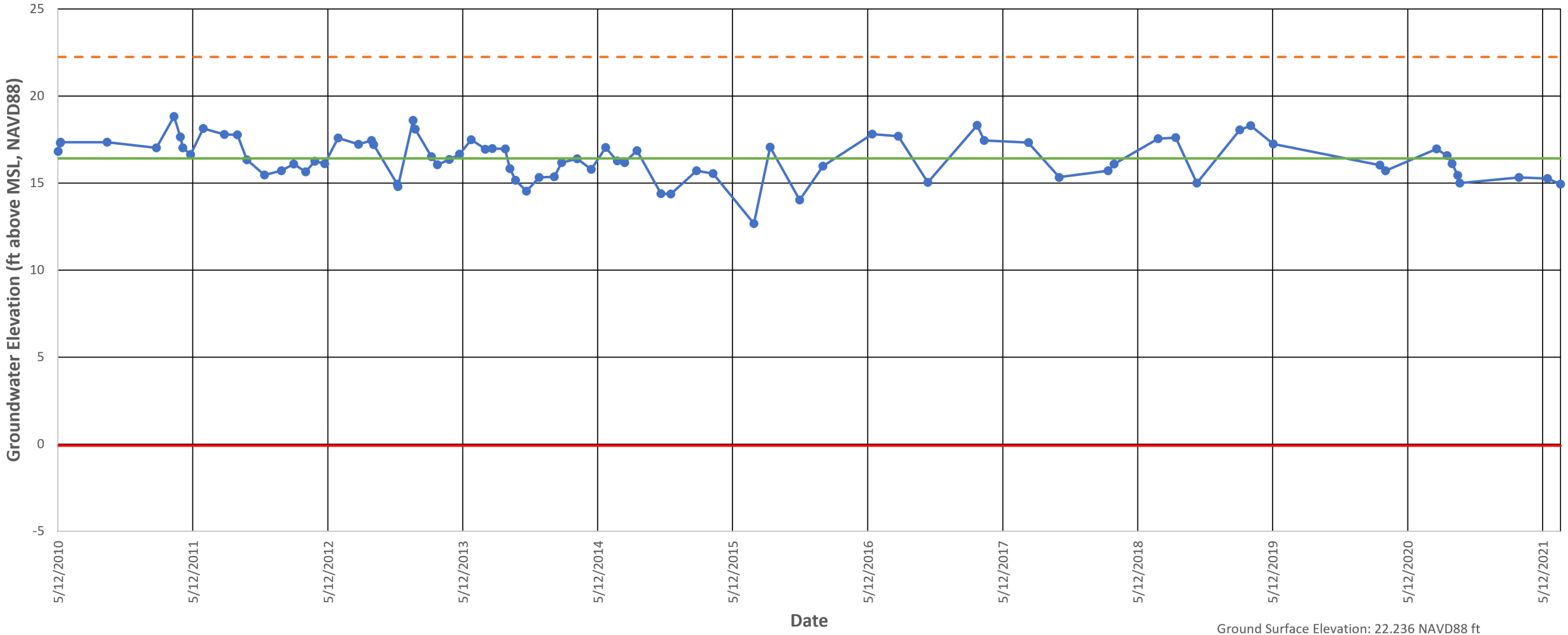
Depth: 245 ft bgs

Screen Interval - 1: 205 - 215 ft bgs

Screen Interval - 2: 225 - 235 ft bgs

Aquifer Zone: AZ-2

Sutter County MW-2B



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 388761N1217094W002

SWN: 11N03E20H003M

Local ID: Sutter County MW-2B

Other ID: N/A

Ground Surface Elevation: 22.236 NAVD88 ft

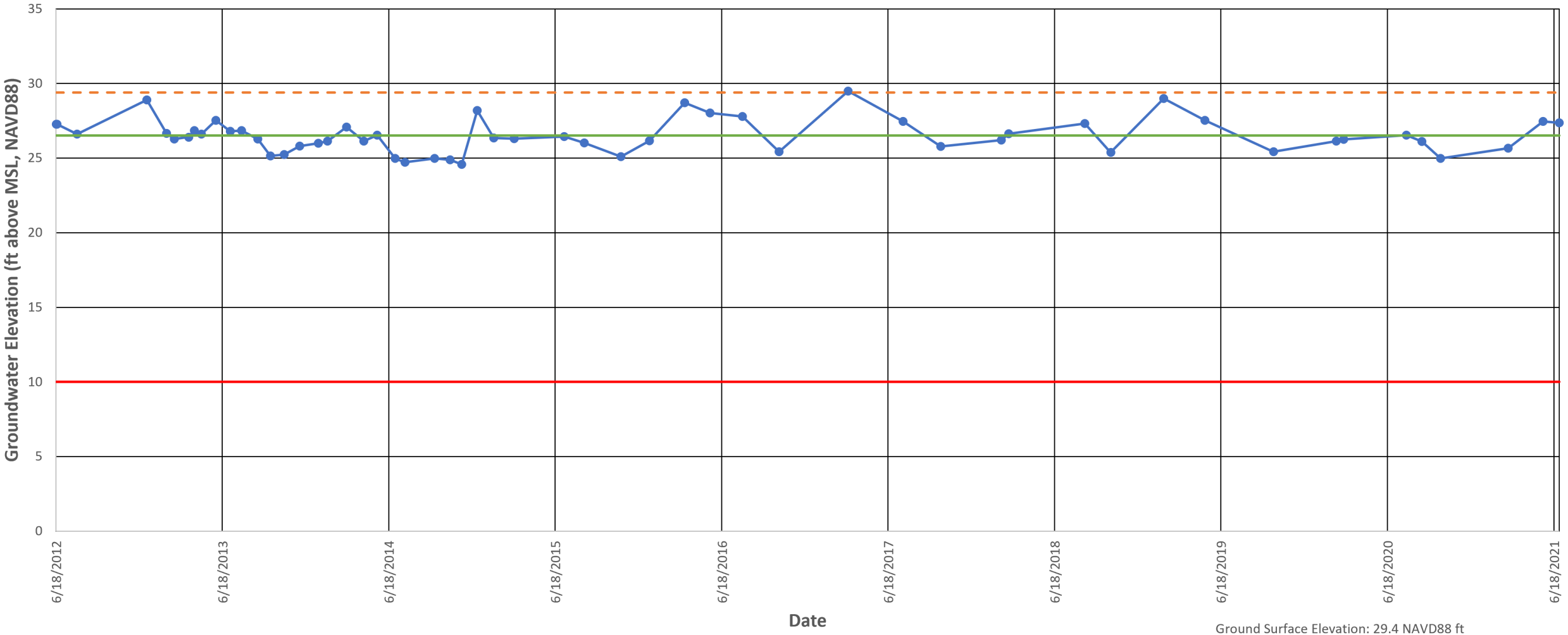
Depth: 300 ft bgs

Screen Interval - 1: 210 - 220 ft bgs

Screen Interval - 2: 260 - 280 ft bgs

Aquifer Zone: AZ-2

SMWC MW-1B



Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 390244N1217813W002

SWN: 14N02E32D002M

Local ID: SMWC MW-1B

Other ID: N/A

Ground Surface Elevation: 29.4 NAVD88 ft

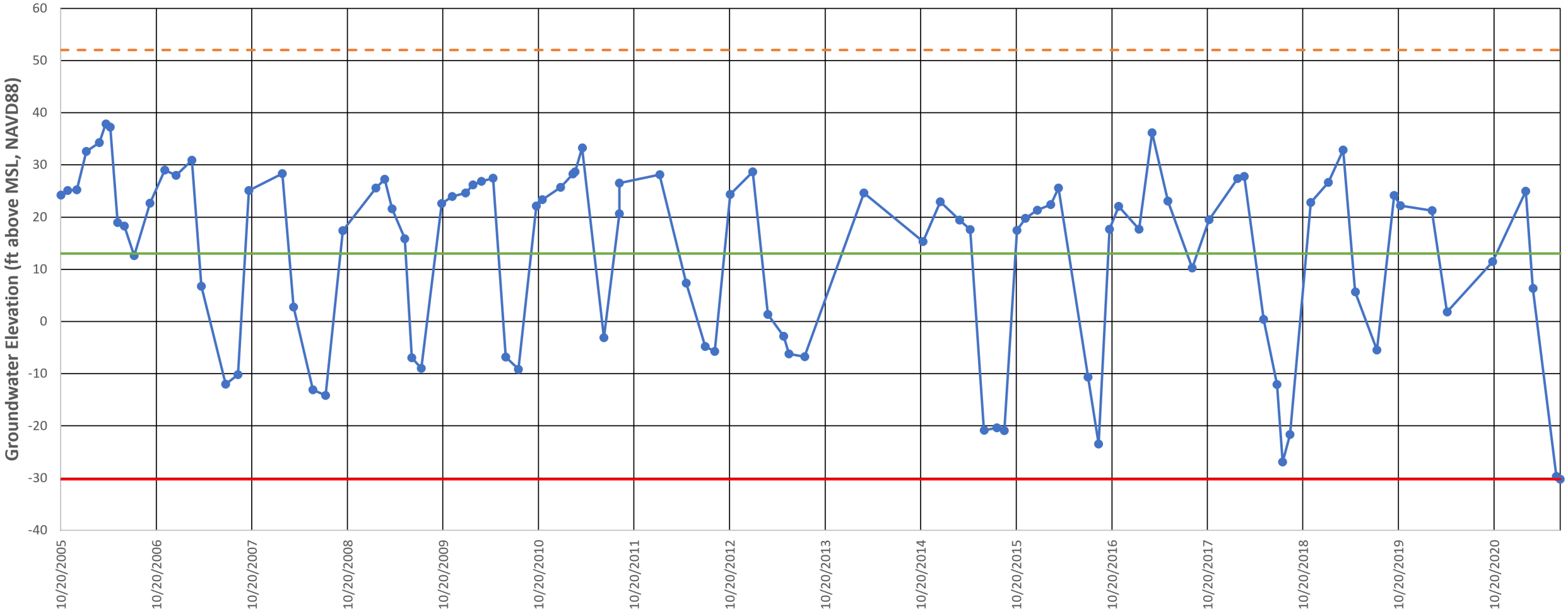
Depth: 210 ft bgs

Screen Interval - 1: 170 - 200 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

Feather River MW-1B



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 43.19 ft

MT Method Selected: Historic Low

Site Code: 390458N1216114W002

SWN: 14N03E23D004M

Local ID: Feather River MW-1B

Other ID: N/A

Ground Surface Elevation: 52.05 NAVD88 ft

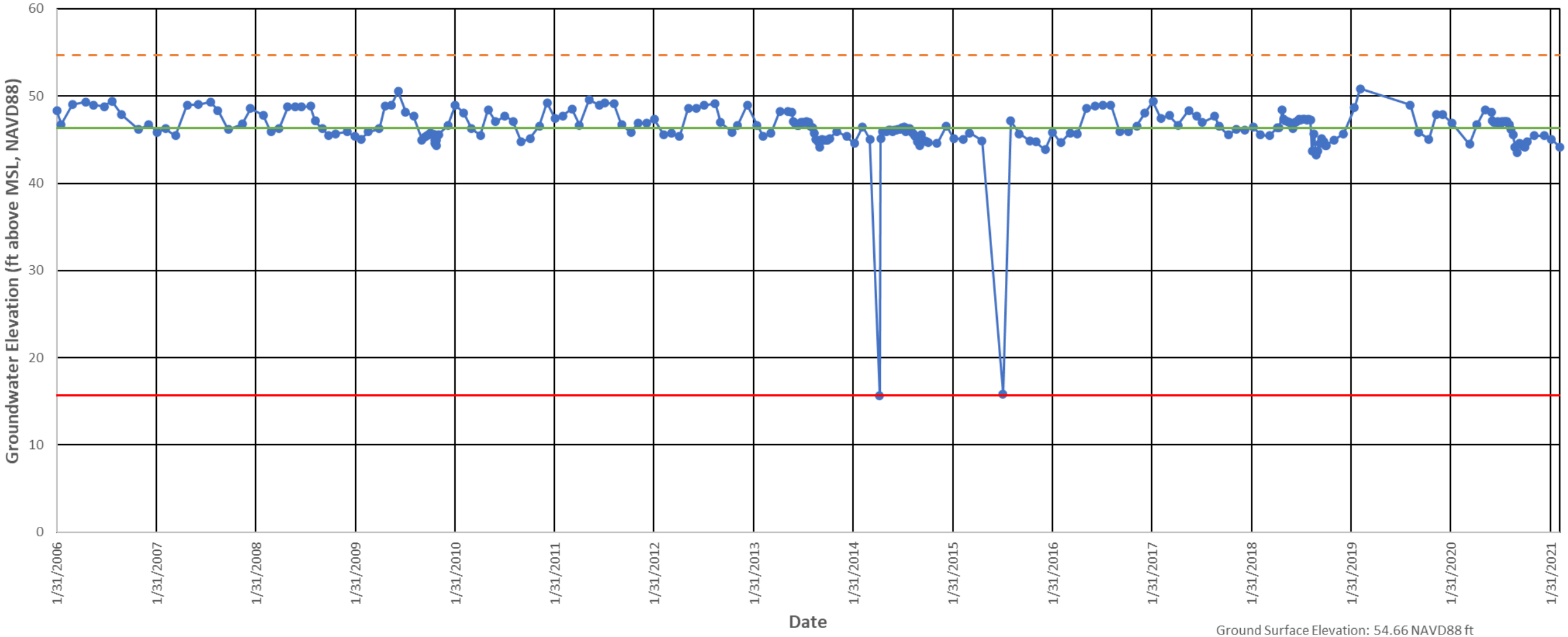
Depth: 260 ft bgs

Screen Interval - 1: 235 - 255 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

SEWD MW-1A



Operational Range: 30.62 ft

MT Method Selected: Historic Low

Site Code: 391658N1217070W001

SWN: 15N02E12E001M

Local ID: SEWD MW-1A

Other ID: N/A

Ground Surface Elevation: 54.66 NAVD88 ft

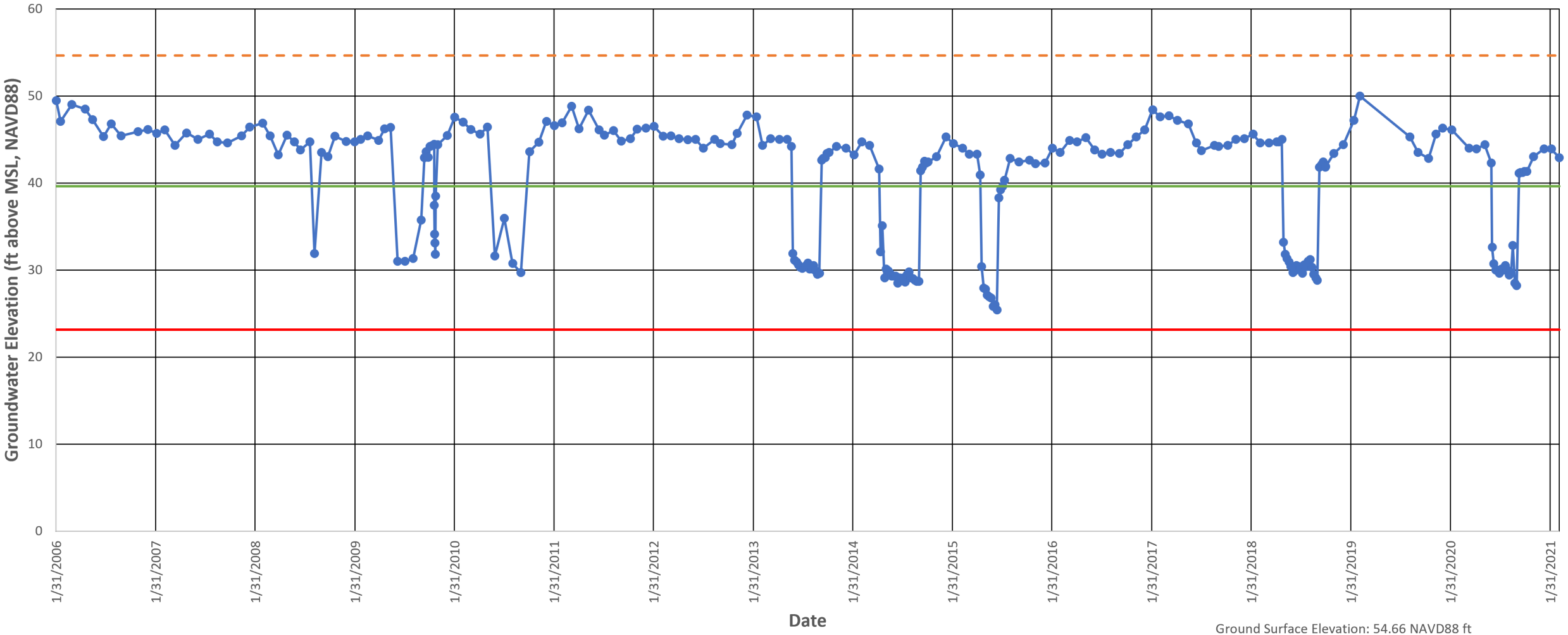
Depth: 173 ft bgs

Screen Interval - 1: 148 - 168 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

SEWD MW-1B



Groundwater Level
Ground Surface Elevation
Measurable Objective
Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 391658N1217070W002

SWN: 15N02E12E002M

Local ID: SEWD MW-1B

Other ID: N/A

Ground Surface Elevation: 54.66 NAVD88 ft

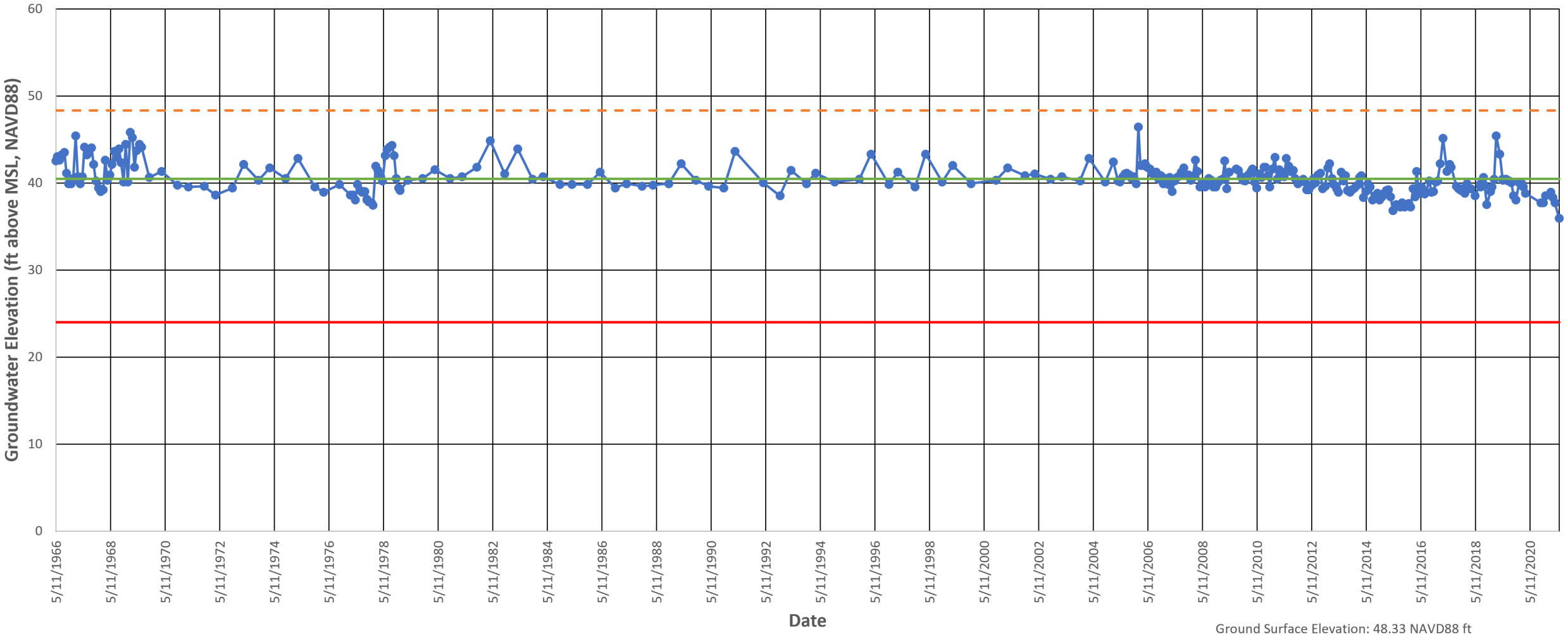
Depth: 266 ft bgs

Screen Interval - 1: 240 - 260 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

15N02E22D001M



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 391414N1217442W001

SWN: 15N02E22D001M

Local ID: N/A

Other ID: N/A

Ground Surface Elevation: 48.33 NAVD88 ft

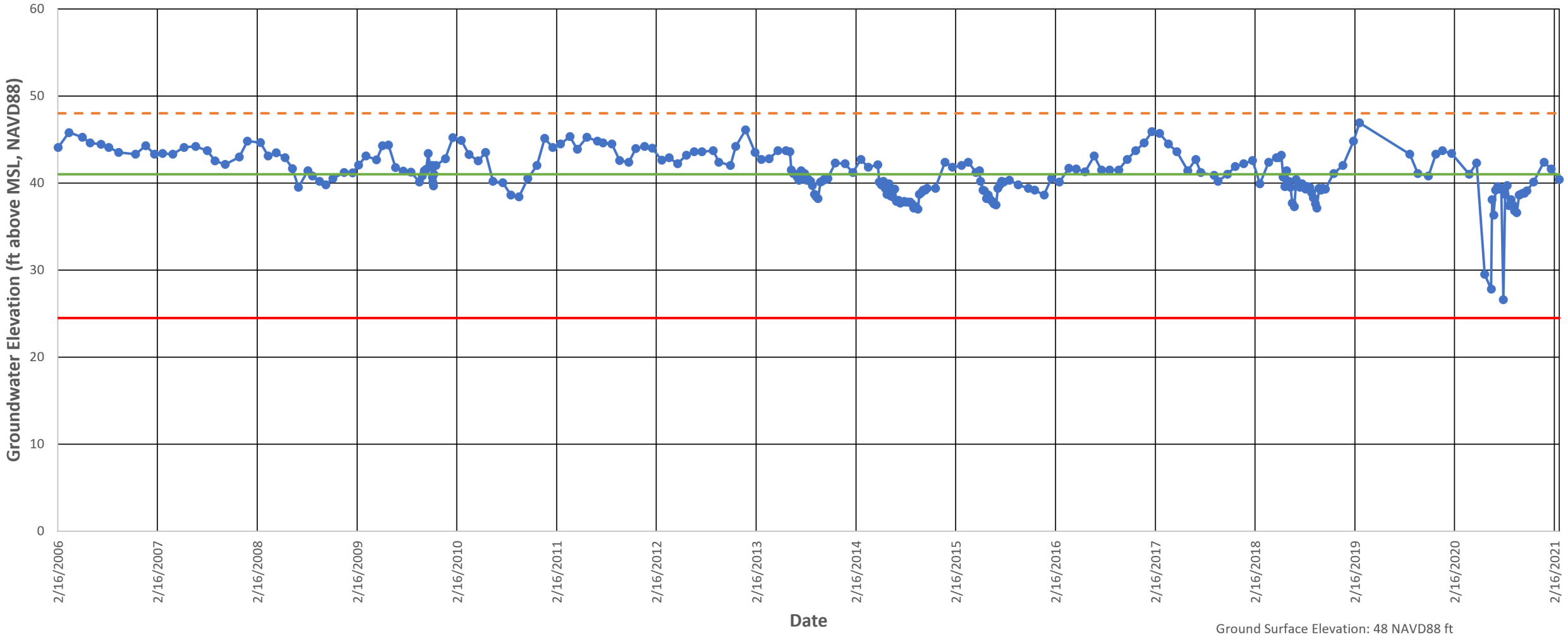
Depth: 302 ft bgs

Screen Interval - 1: N/A - N/A ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

SEWD MW-2A



Groundwater Level
Ground Surface Elevation
Measurable Objective
Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 391279N1216989W001

SWN: 15N02E24P001M

Local ID: SEWD MW-2A

Other ID: N/A

Ground Surface Elevation: 48 NAVD88 ft

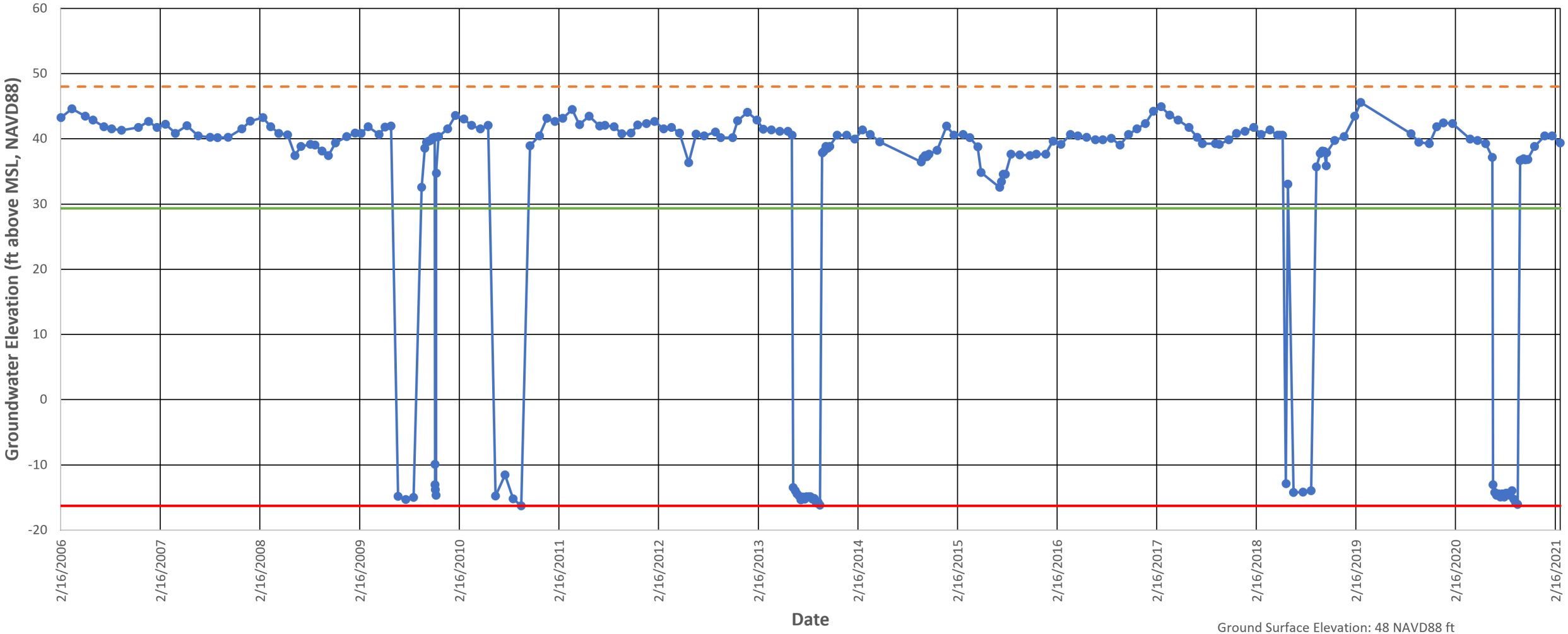
Depth: 254 ft bgs

Screen Interval - 1: 204 - 244 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

SEWD MW-2B



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 45.61 ft

MT Method Selected: Historic Low

Site Code: 391279N1216989W002

SWN: 15N02E24P002M

Local ID: SEWD MW-2B

Other ID: N/A

Ground Surface Elevation: 48 NAVD88 ft

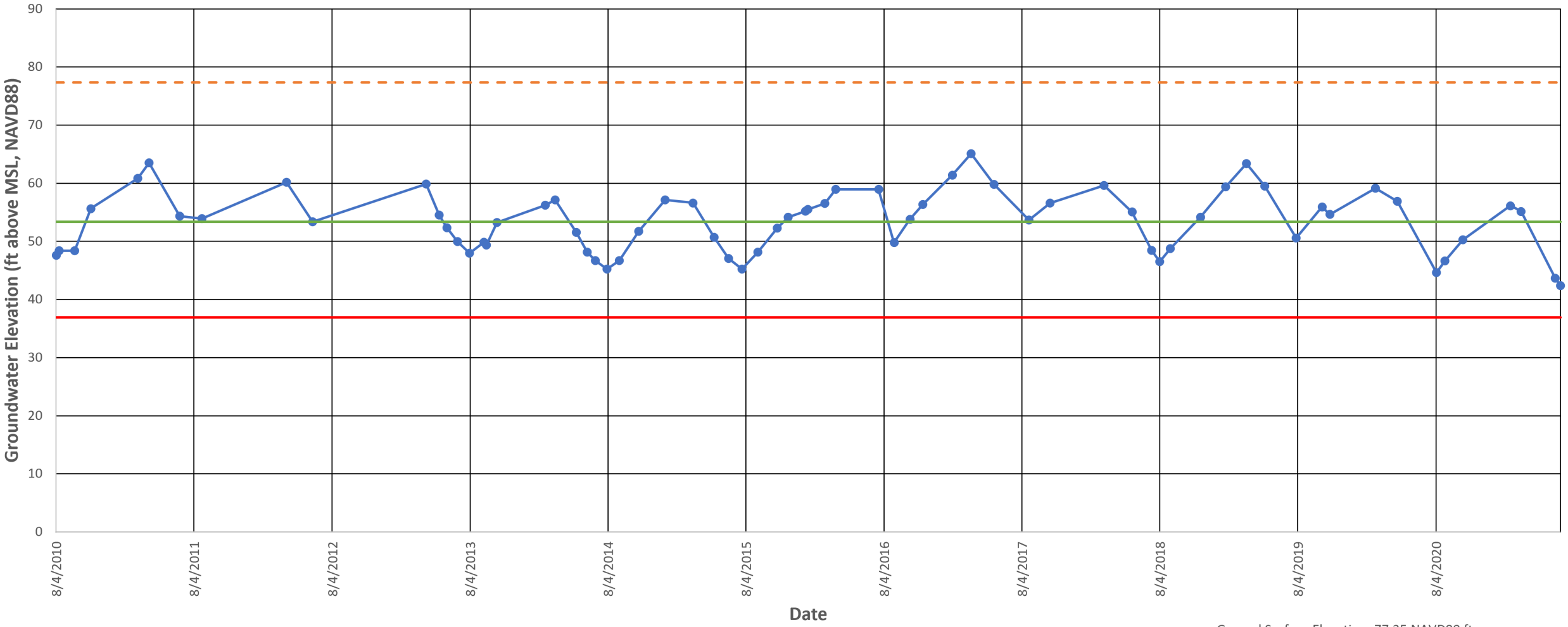
Depth: 379 ft bgs

Screen Interval - 1: 354 - 374 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

Sutter County MW-3B



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 392394N1216509W002

SWN: 16N03E17J002M

Local ID: Sutter County MW-3B

Other ID: N/A

Ground Surface Elevation: 77.35 NAVD88 ft

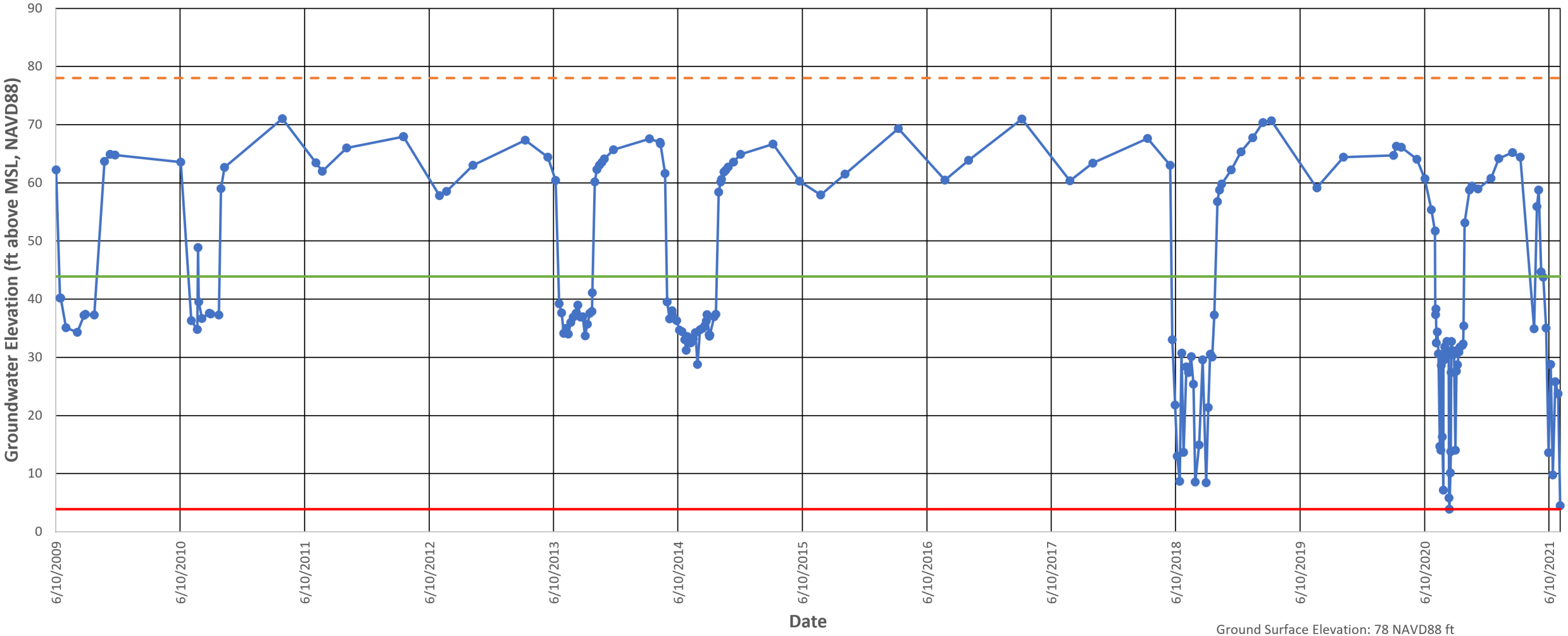
Depth: 315 ft bgs

Screen Interval - 1: 285 - 305 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

BWD MW-1B



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 39.99 ft

MT Method Selected: Historic Low

Site Code: 392970N1216907W002

SWN: 17N02E25J002M

Local ID: BWD MW-1B

Other ID: N/A

Ground Surface Elevation: 78 NAVD88 ft

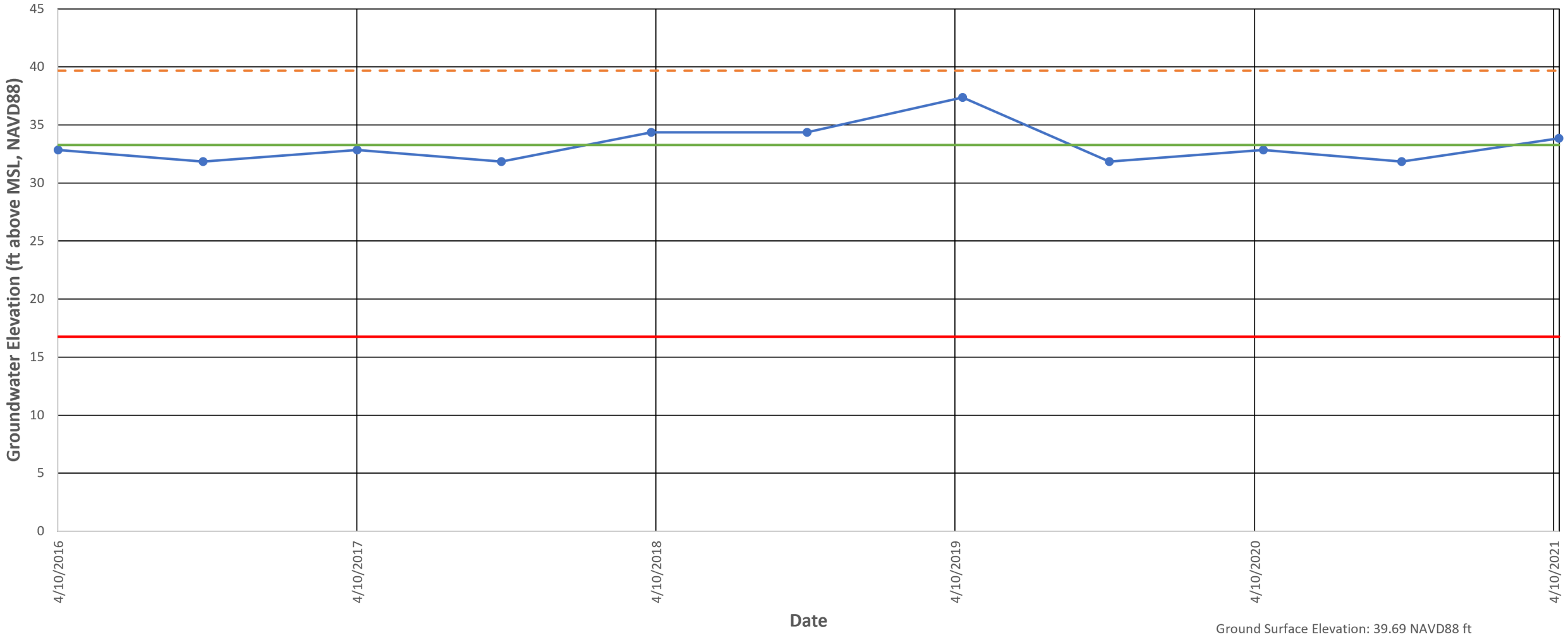
Depth: 370 ft bgs

Screen Interval - 1: 320 - 360 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

BS2-Franklin



Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 391283N1218286W001

SWN: N/A

Local ID: BS2-Franklin

Other ID: N/A

Ground Surface Elevation: 39.69 NAVD88 ft

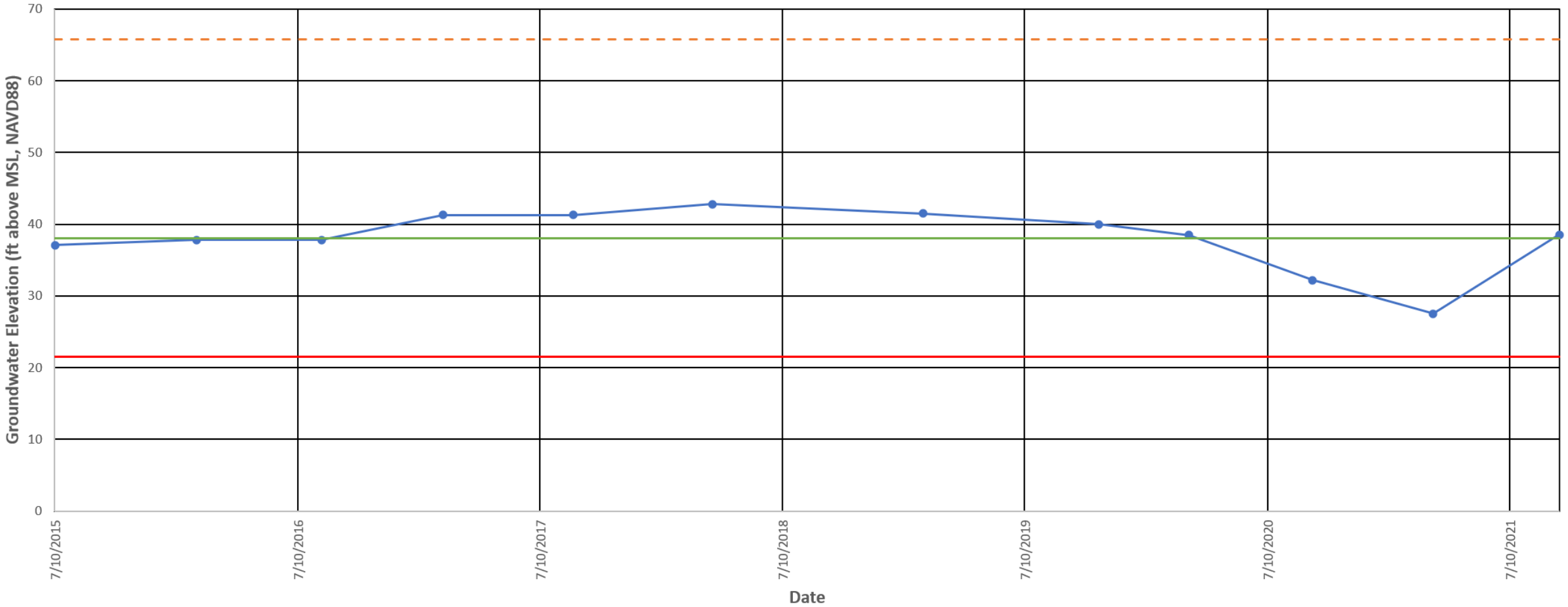
Depth: 300 ft bgs

Screen Interval - 1: N/A - N/A ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-2

WTP well



Groundwater Level
Ground Surface Elevation
Measurable Objective
Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: N/A

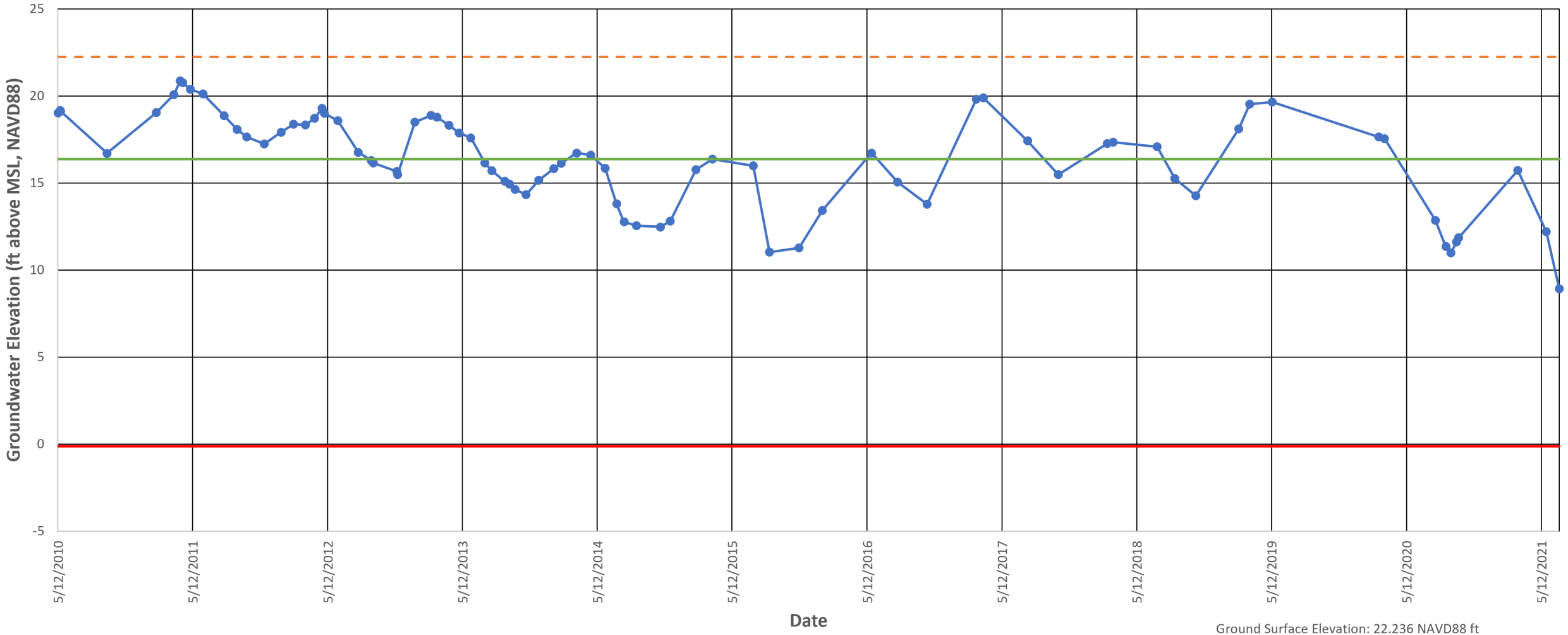
SWN: N/A

Local ID: WTP well

Other ID: N/A

Ground Surface Elevation: 65.785 NAVD88 ft
Depth: 0 ft bgs
Screen Interval - 1: 370 - 390 ft bgs
Screen Interval - 2: 453 - 473 ft bgs
Screen Interval - 3: N/A - N/A ft bgs
Aquifer Zone: AZ-2 and AZ-3

Sutter County MW-2C



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 388761N1217094W003

SWN: 12N02E23H003M

Local ID: Sutter County MW-2C

Other ID: N/A

Ground Surface Elevation: 22.236 NAVD88 ft

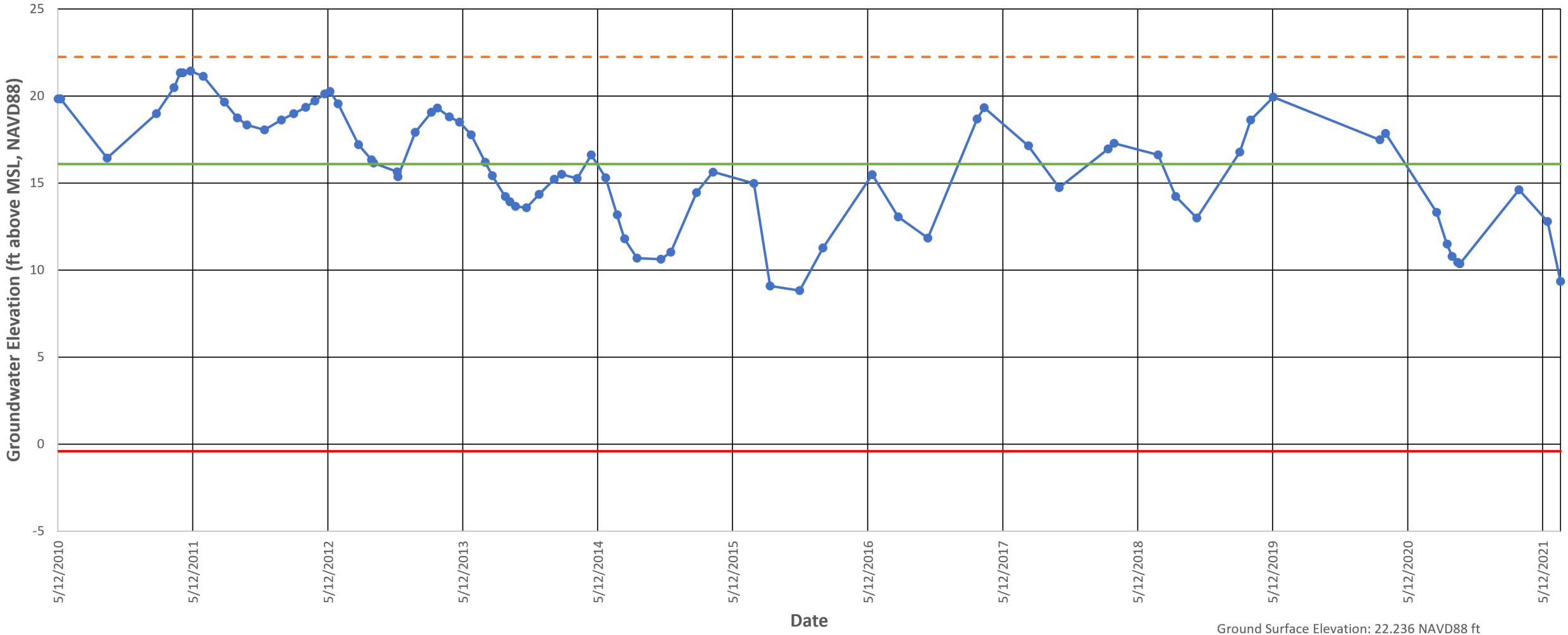
Depth: 600 ft bgs

Screen Interval - 1: 570 - 590 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

Sutter County MW-2D



Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 388761N1217094W004

SWN: 12N02E23H004M

Local ID: Sutter County MW-2D

Other ID: N/A

Ground Surface Elevation: 22.236 NAVD88 ft

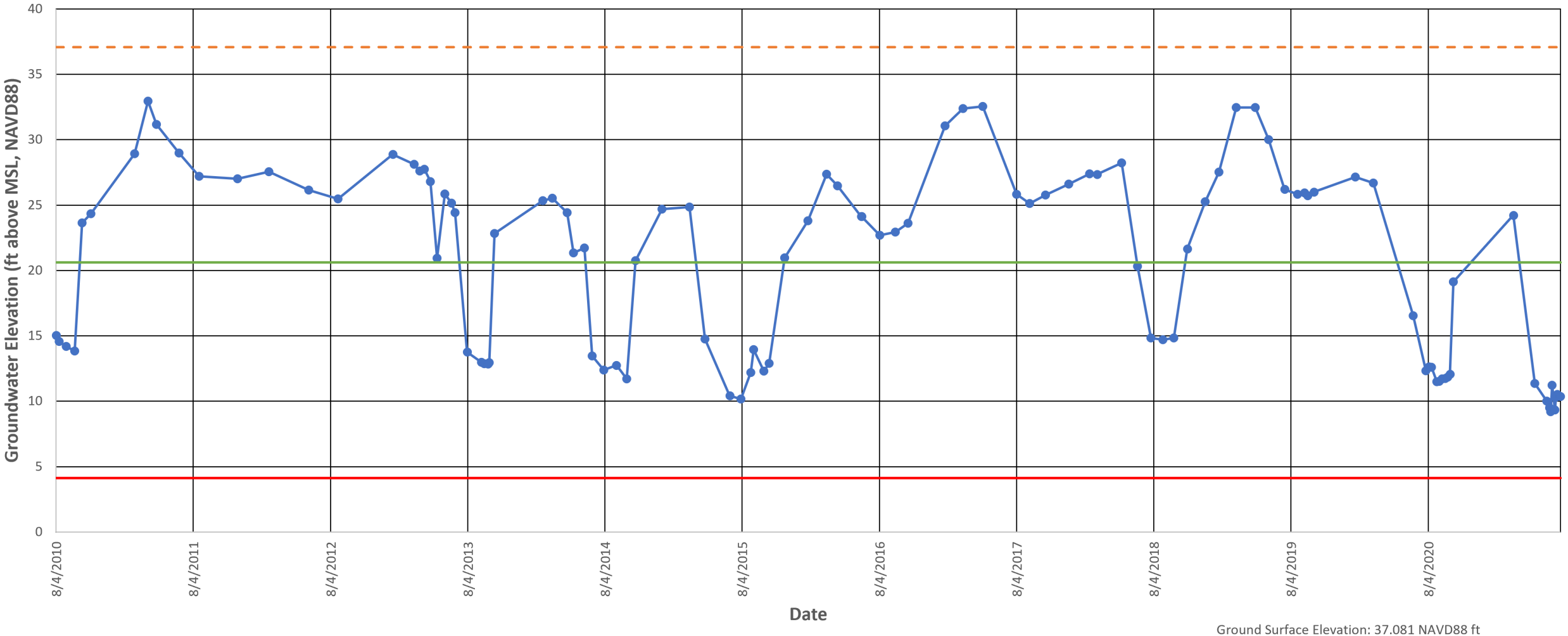
Depth: 705 ft bgs

Screen Interval - 1: 655 - 665 ft bgs

Screen Interval - 2: 685 - 695 ft bgs

Aquifer Zone: AZ-3

Sutter County MW-4B



Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 389452N1215992W002

SWN: 13N03E26J003M

Local ID: Sutter County MW-4B

Other ID: N/A

Ground Surface Elevation: 37.081 NAVD88 ft

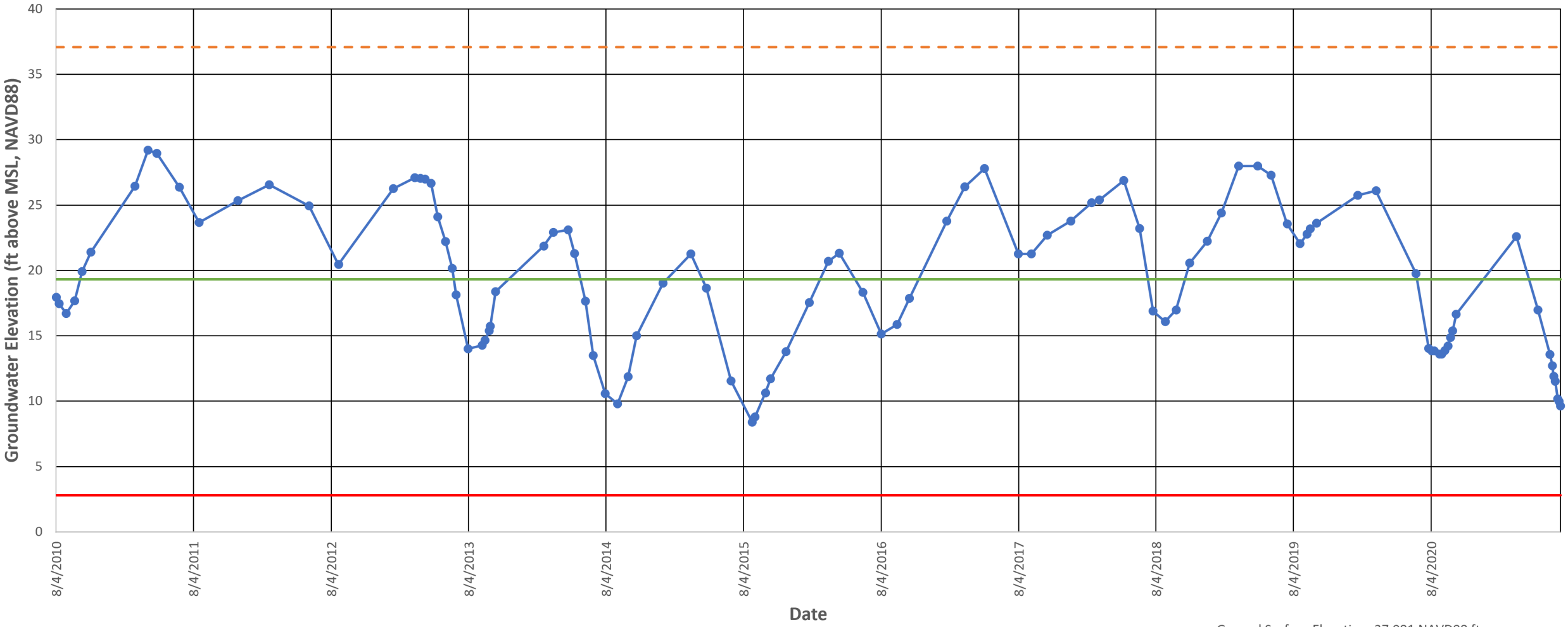
Depth: 445 ft bgs

Screen Interval - 1: 425 - 435 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

Sutter County MW-4C



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 389452N1215992W003

SWN: 13N03E26J004M

Local ID: Sutter County MW-4C

Other ID: N/A

Ground Surface Elevation: 37.081 NAVD88 ft

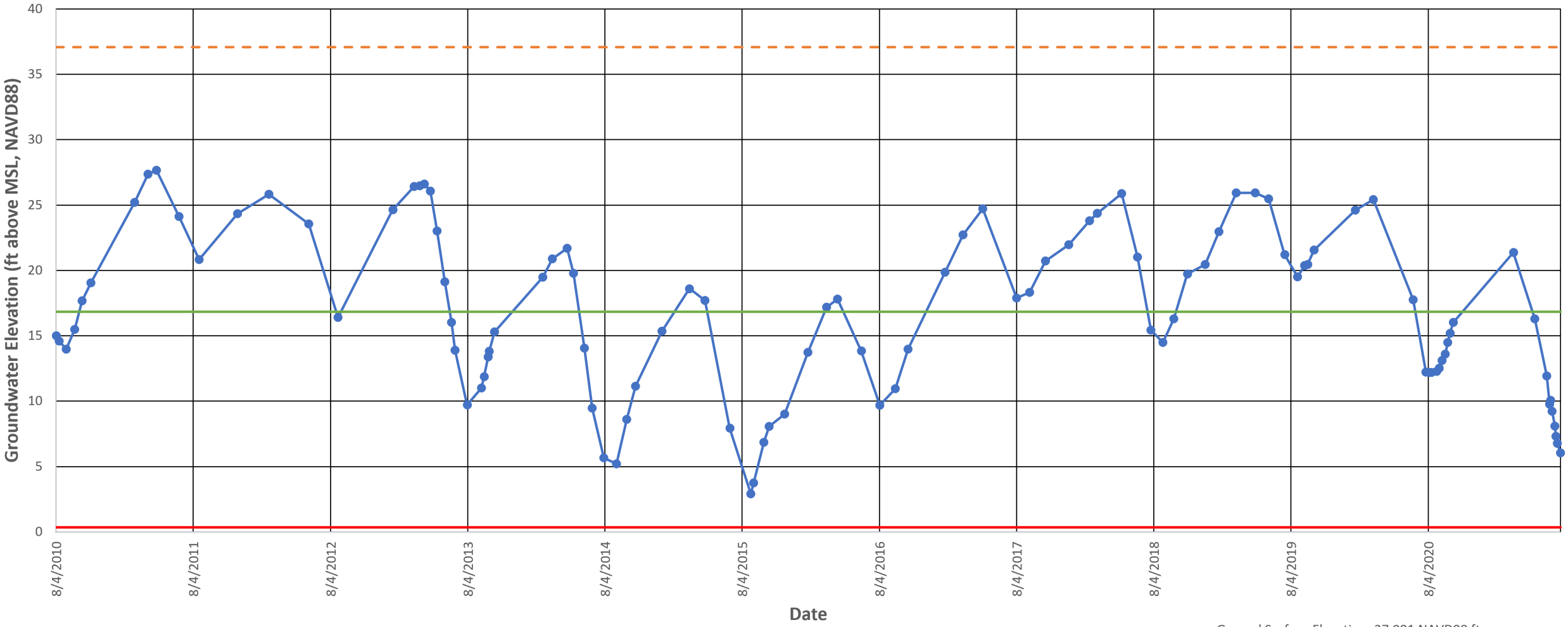
Depth: 610 ft bgs

Screen Interval - 1: 590 - 600 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

Sutter County MW-4D



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 389452N1215992W004

SWN: 13N03E26J005M

Local ID: Sutter County MW-4D

Other ID: N/A

Ground Surface Elevation: 37.081 NAVD88 ft

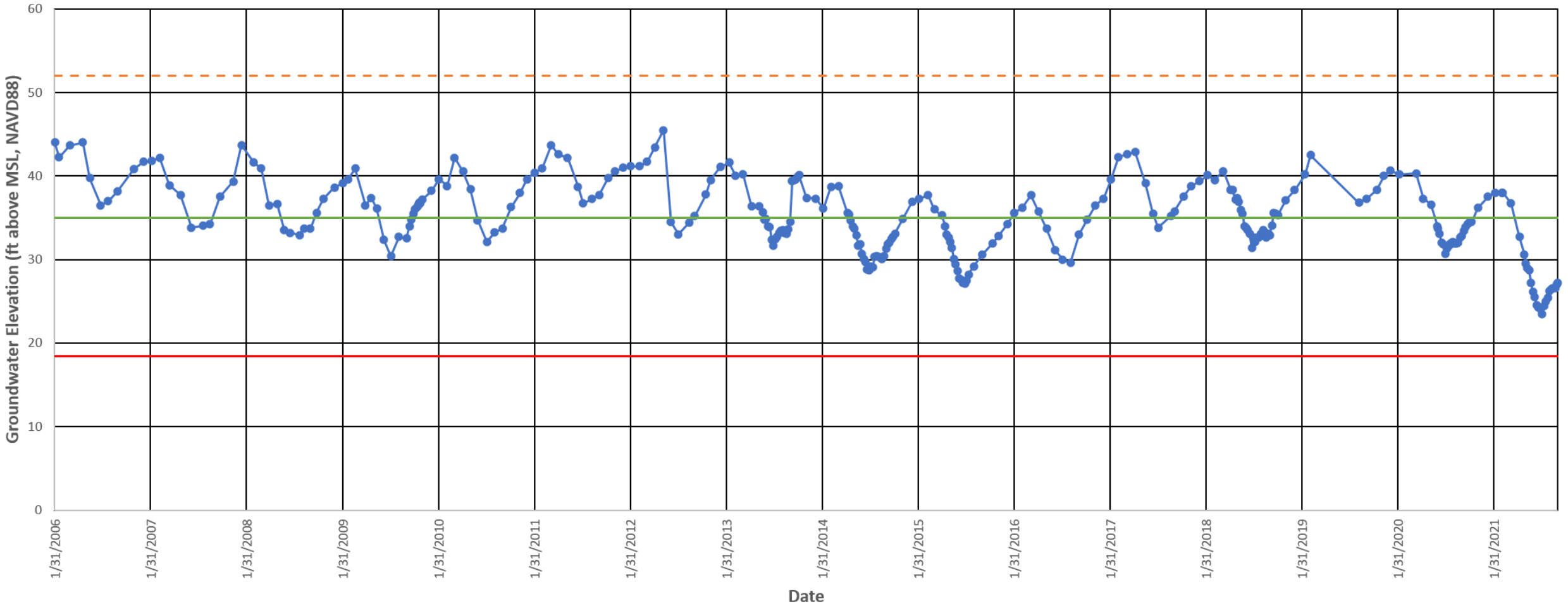
Depth: 1005 ft bgs

Screen Interval - 1: 985 - 995 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

SEWD MW-3C



Groundwater Level
Ground Surface Elevation
Measurable Objective
Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 390682N1216901W003

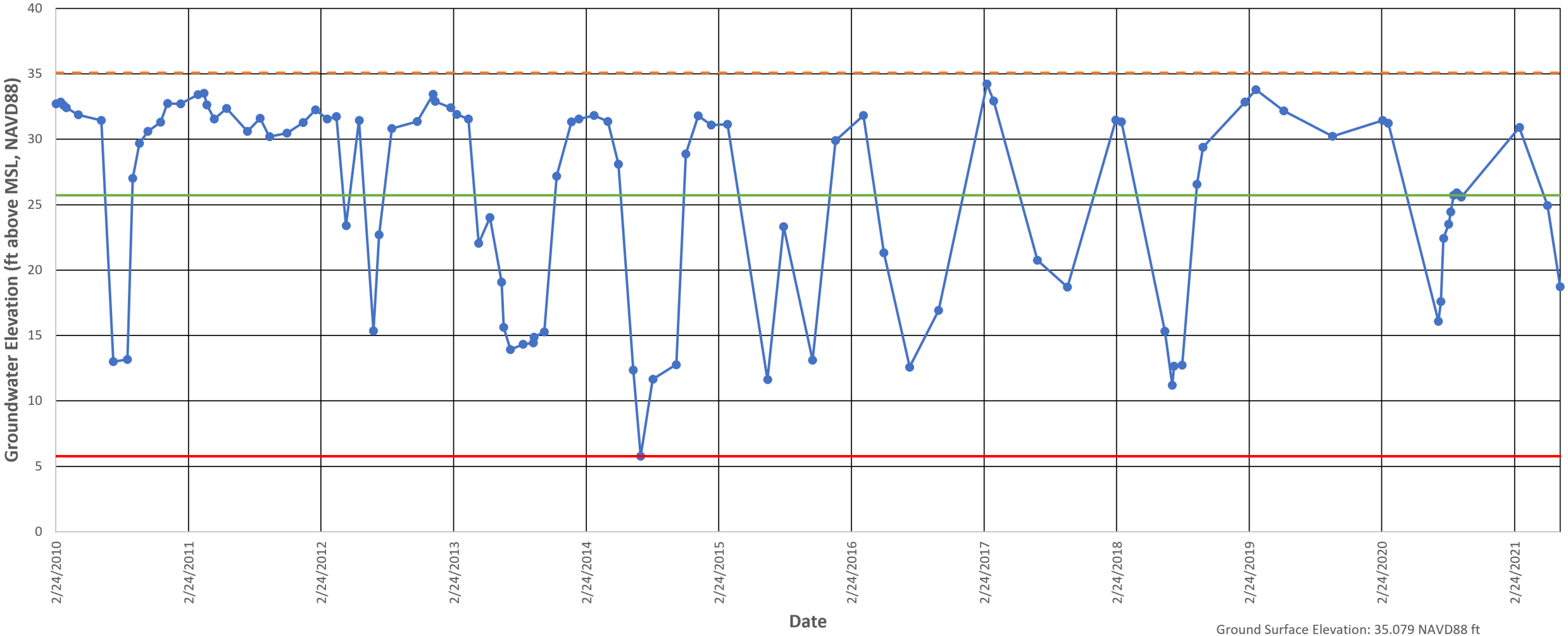
SWN: 14N02E13A005M

Local ID: SEWD MW-3C

Other ID: N/A

Ground Surface Elevation: 52 NAVD88 ft
Depth: 585 ft bgs
Screen Interval - 1: 550 - 580 ft bgs
Screen Interval - 2: N/A - N/A ft bgs
Screen Interval - 3: N/A - N/A ft bgs
Aquifer Zone: AZ-3

Sutter County MW-1C



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 19.95 ft

MT Method Selected: Historic Low

Site Code: 390696N1217778W003

SWN: 14N02E17C003M

Local ID: Sutter County MW-1C

Other ID: N/A

Ground Surface Elevation: 35.079 NAVD88 ft

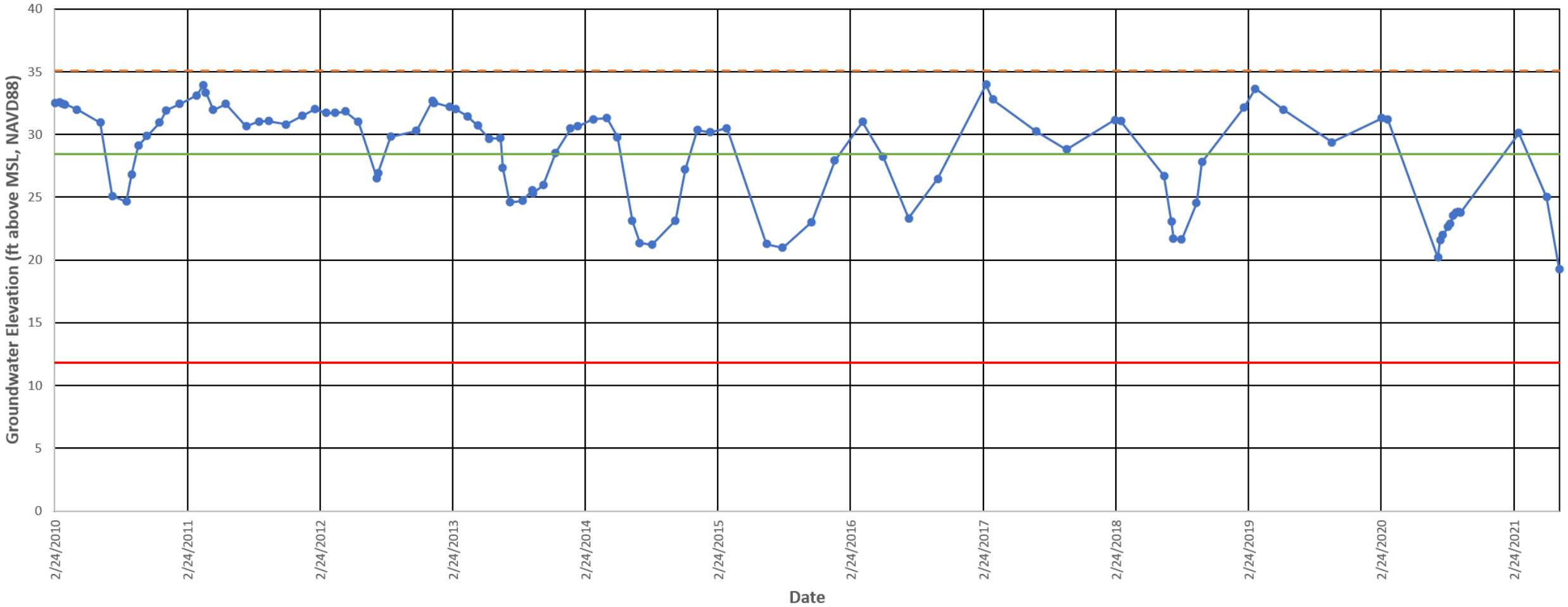
Depth: 425 ft bgs

Screen Interval - 1: 395 - 415 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

Sutter County MW-1D



Groundwater Level
Ground Surface Elevation
Measurable Objective
Minimum Threshold

Operational Range: 16.61 ft

MT Method Selected: Minimum Operating Range

Site Code: 390696N1217778W004

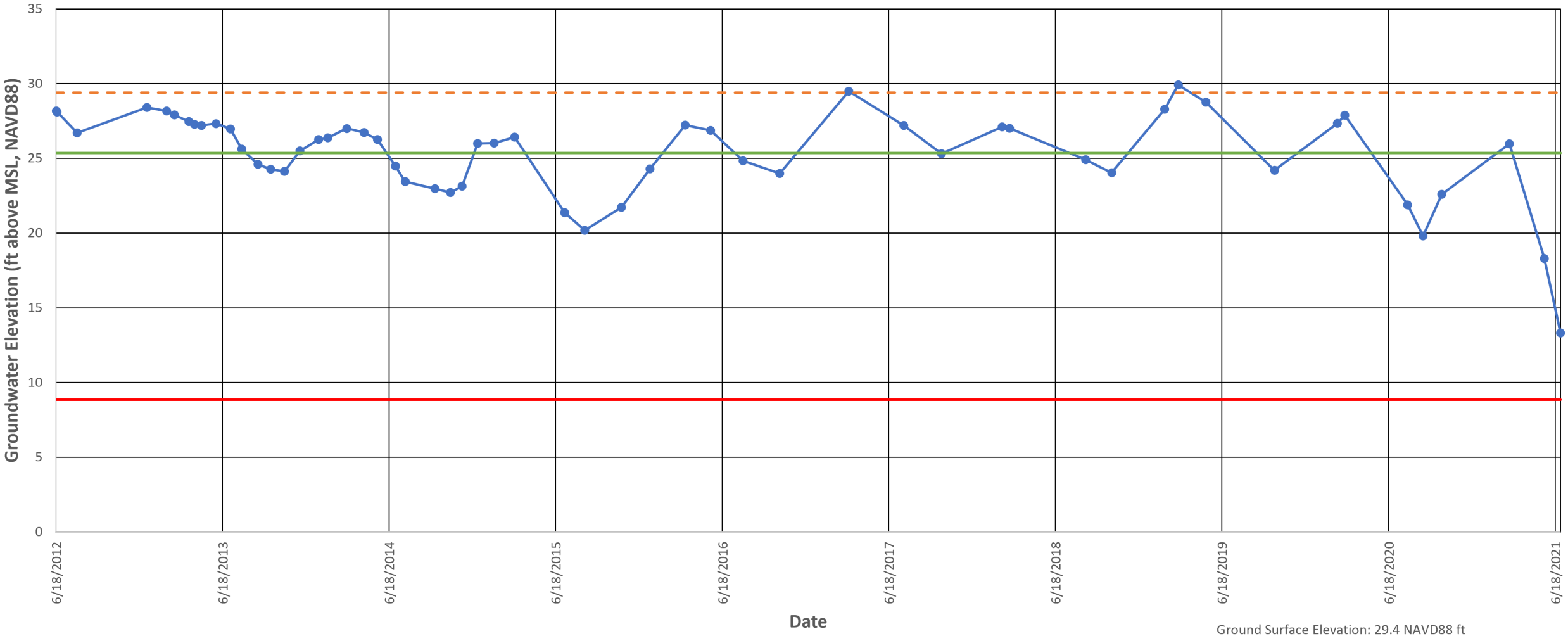
SWN: 14N02E17C004M

Local ID: Sutter County MW-1D

Other ID: N/A

Ground Surface Elevation: 35.079 NAVD88 ft
Depth: 755 ft bgs
Screen Interval - 1: 725 - 745 ft bgs
Screen Interval - 2: N/A - N/A ft bgs
Screen Interval - 3: N/A - N/A ft bgs
Aquifer Zone: AZ-3

SMWC MW-1C



Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 390244N1217813W003

SWN: 14N02E32D003M

Local ID: SMWC MW-1C

Other ID: N/A

Ground Surface Elevation: 29.4 NAVD88 ft

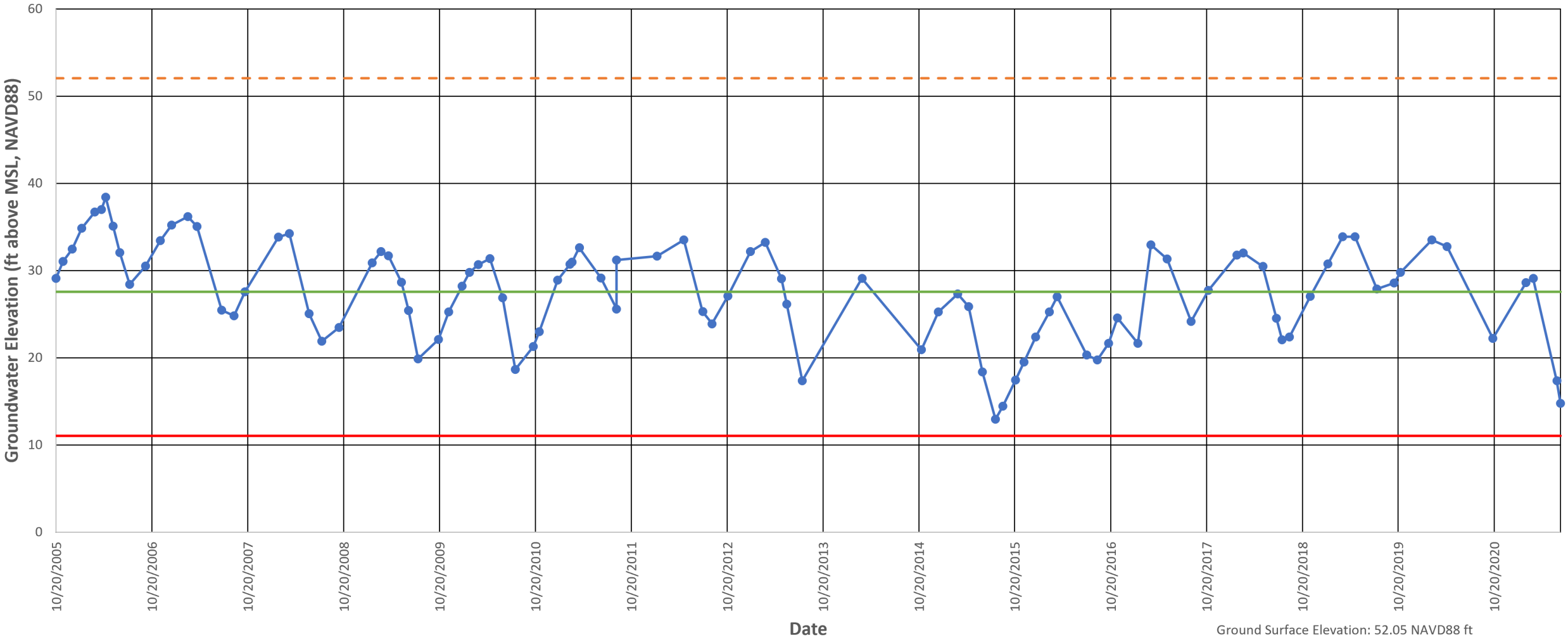
Depth: 500 ft bgs

Screen Interval - 1: 460 - 490 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

Feather River MW-1C



Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 390458N1216114W003

SWN: 14N03E23D005M

Local ID: Feather River MW-1C

Other ID: N/A

Ground Surface Elevation: 52.05 NAVD88 ft

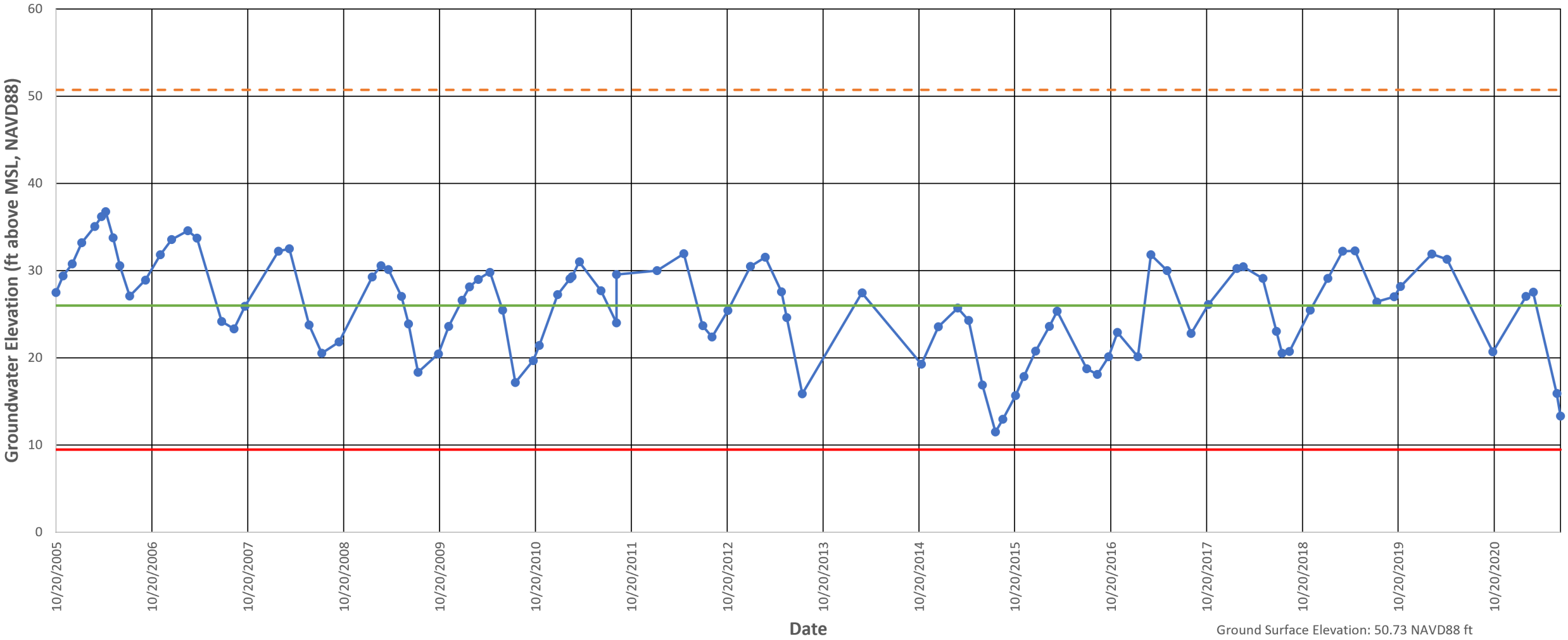
Depth: 689 ft bgs

Screen Interval - 1: 664 - 684 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

Feather River MW-1D



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 390458N1216114W004

SWN: 14N03E23D006M

Local ID: Feather River MW-1D

Other ID: N/A

Ground Surface Elevation: 50.73 NAVD88 ft

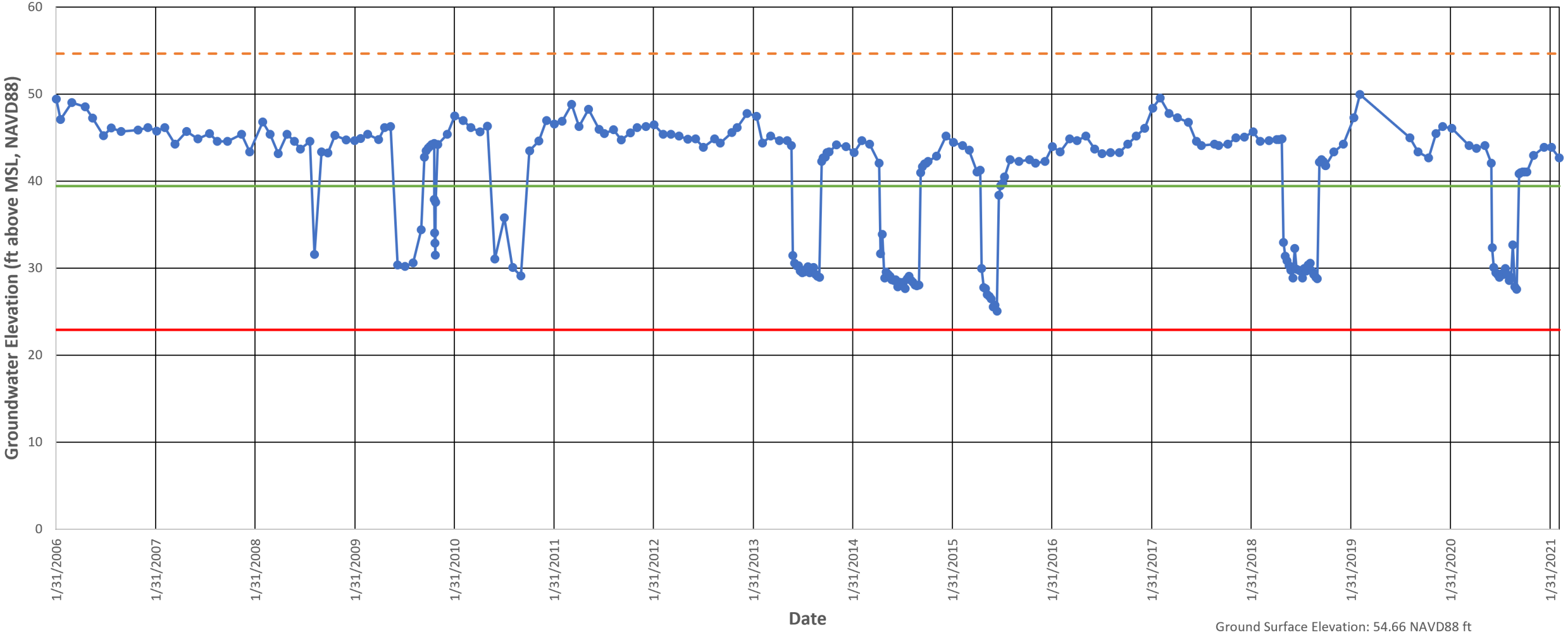
Depth: 1021 ft bgs

Screen Interval - 1: 996 - 1016 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

SEWD MW-1C



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 391658N1217070W003

SWN: 15N02E12E003M

Local ID: SEWD MW-1C

Other ID: N/A

Ground Surface Elevation: 54.66 NAVD88 ft

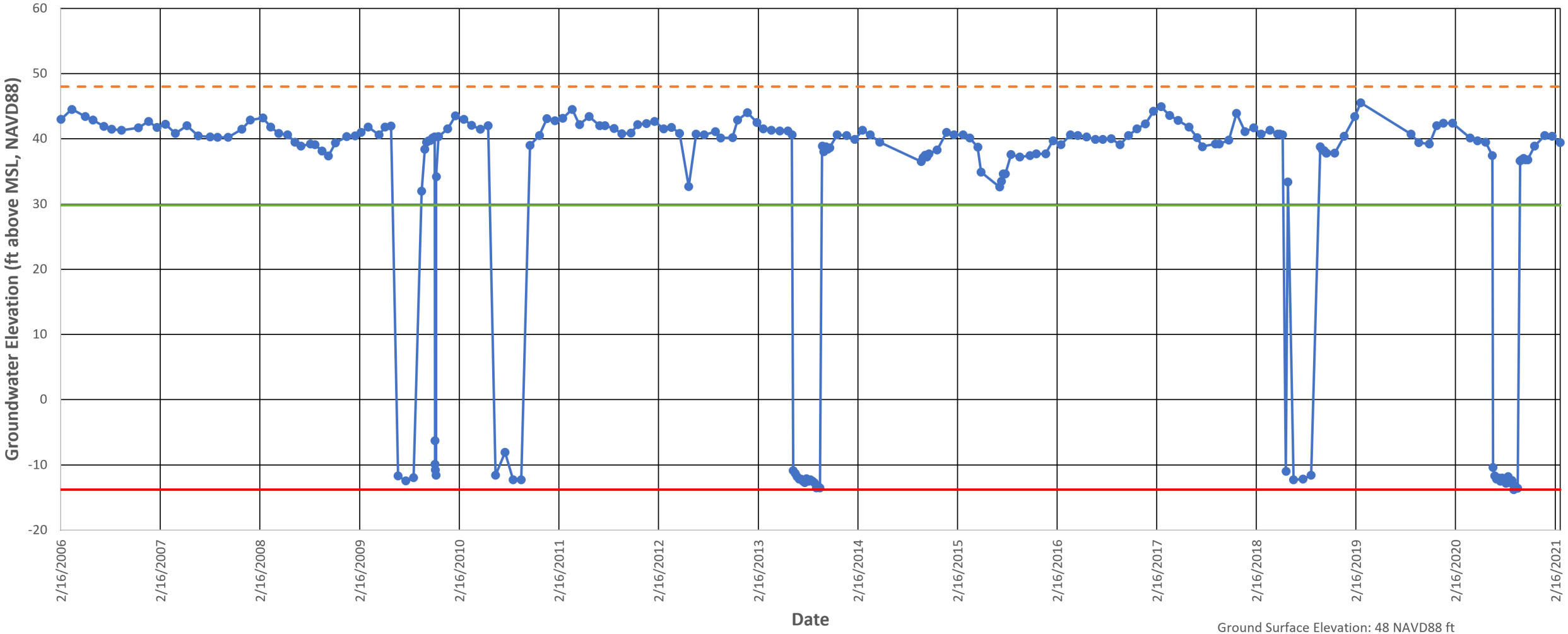
Depth: 559 ft bgs

Screen Interval - 1: 524 - 554 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

SEWD MW-2C



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 43.6 ft

MT Method Selected: Historic Low

Site Code: 391279N1216989W003

SWN: 15N02E24P003M

Local ID: SEWD MW-2C

Other ID: N/A

Ground Surface Elevation: 48 NAVD88 ft

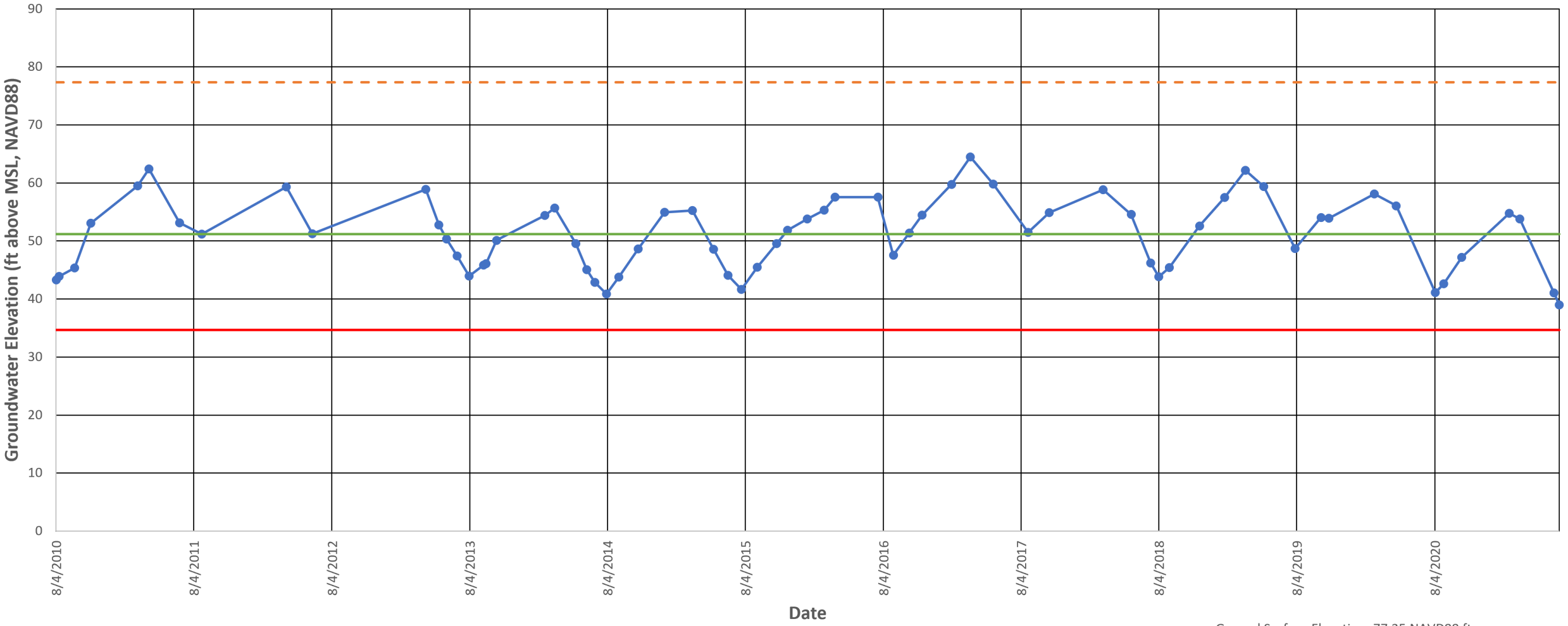
Depth: 488 ft bgs

Screen Interval - 1: 438 - 478 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

Sutter County MW-3C



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 392394N1216509W003

SWN: 16N03E17J003M

Local ID: Sutter County MW-3C

Other ID: N/A

Ground Surface Elevation: 77.35 NAVD88 ft

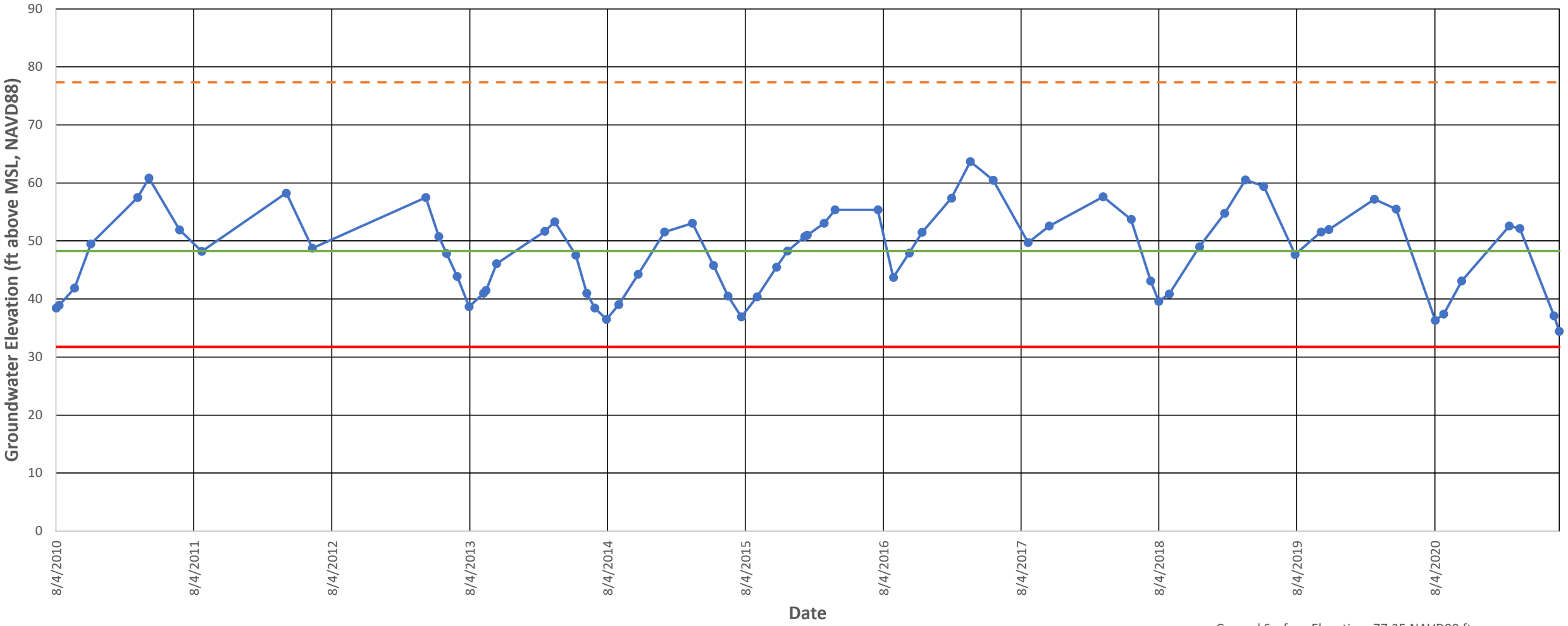
Depth: 430 ft bgs

Screen Interval - 1: 400 - 420 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

Sutter County MW-3D



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 392394N1216509W004

SWN: 16N03E17J004M

Local ID: Sutter County MW-3D

Other ID: N/A

Ground Surface Elevation: 77.35 NAVD88 ft

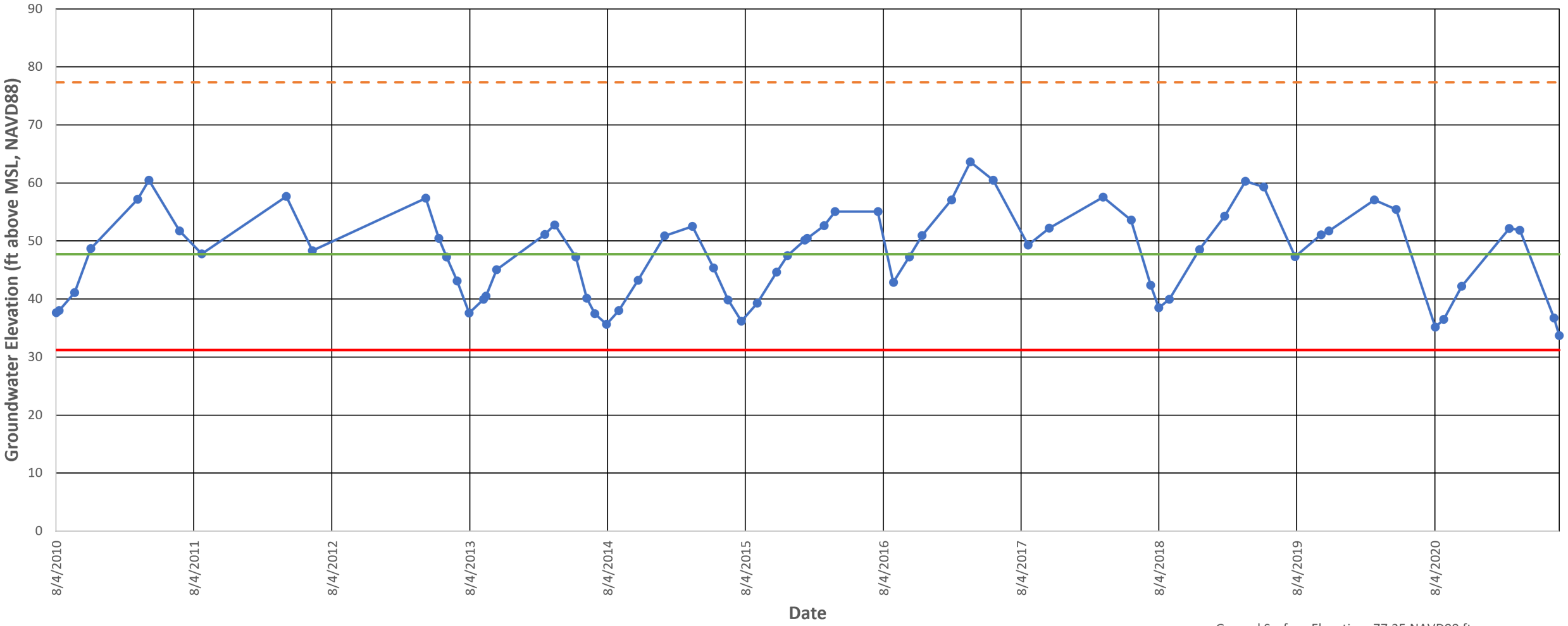
Depth: 615 ft bgs

Screen Interval - 1: 595 - 605 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

Sutter County MW-3E



Groundwater Level

Ground Surface Elevation

Measurable Objective

Minimum Threshold

Operational Range: 16.5 ft

MT Method Selected: Minimum Operating Range

Site Code: 392394N1216509W005

SWN: 16N03E17J005M

Local ID: Sutter County MW-3E

Other ID: N/A

Ground Surface Elevation: 77.35 NAVD88 ft

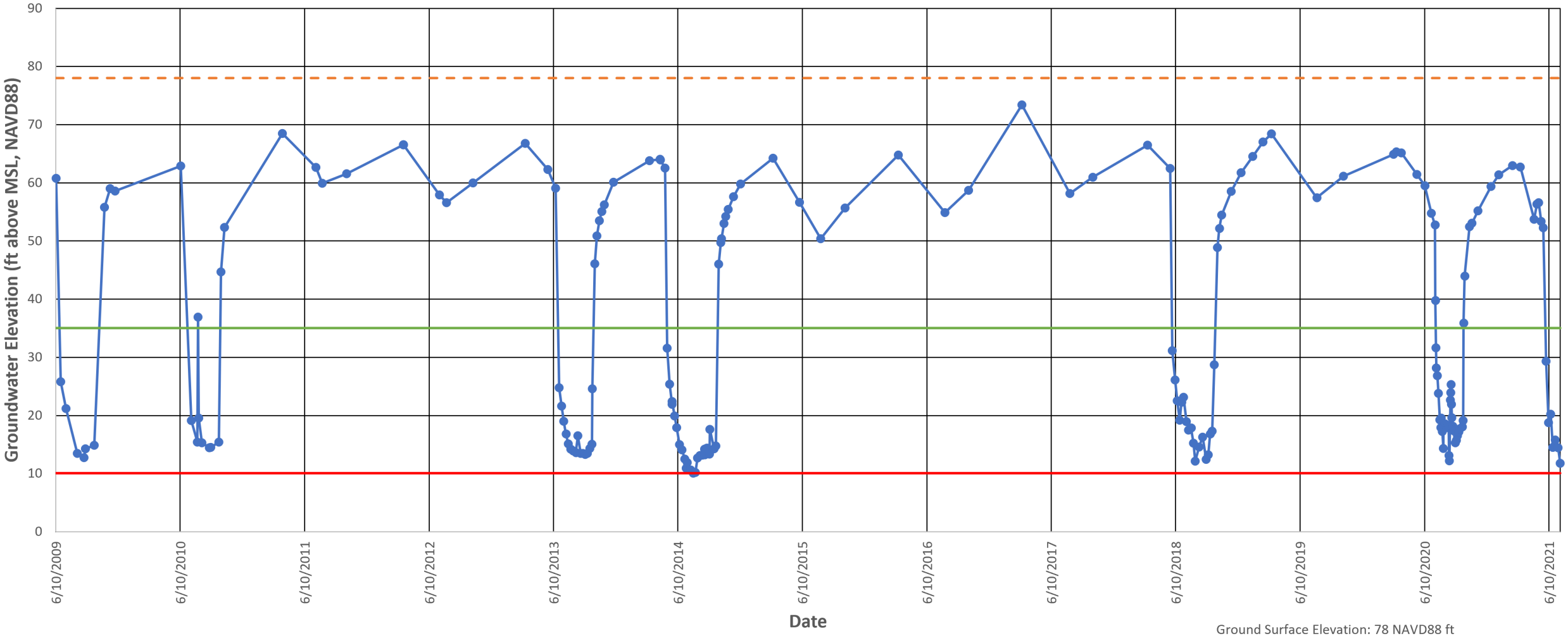
Depth: 785 ft bgs

Screen Interval - 1: 765 - 785 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

BWD MW-1A



Groundwater Level
Ground Surface Elevation
Measurable Objective
Minimum Threshold

Operational Range: 24.91 ft

MT Method Selected: Historic Low

Site Code: 392970N1216907W001

SWN: 17N02E25J001M

Local ID: BWD MW-1A

Other ID: N/A

Ground Surface Elevation: 78 NAVD88 ft

Depth: 591 ft bgs

Screen Interval - 1: 486 - 586 ft bgs

Screen Interval - 2: N/A - N/A ft bgs

Aquifer Zone: AZ-3

Appendix 6-B
Sustainable Management Criteria for Chronic Lowering of Groundwater Levels Methodology Technical Memorandum

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TECHNICAL MEMORANDUM

PREPARED BY: Leslie Dumas

DATE: August 16, 2021 (modified October 2026)

RE: Sustainable Management Criteria for Chronic Lowering of Groundwater Levels

As required pursuant to the Groundwater Sustainability Plan (GSP) Emergency Regulations Article 5 *Plan Contents*, Subarticle 3 *Sustainable Management Criteria* (§ 354.22 through 354.30), Sustainable Management Criteria (SMC) are to be established for applicable sustainability indicators in a given groundwater basin. This memorandum was prepared to document the methods considered for identifying when undesirable results are occurring and for establishing the minimum thresholds (MTs) and measurable objectives (MO) for the chronic lowering of groundwater levels sustainability indicator for the Sutter Subbasin.

1. IDENTIFICATION OF UNDESIRABLE RESULTS

The Sustainable Groundwater Management Act (SGMA) defines sustainable groundwater management as "the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results" (California Water Code Section 10721). Undesirable results statements describe the conditions at which, for each applicable sustainability indicator, significant and unreasonable negative impacts to beneficial uses and users are observed in the Subbasin. For the Sutter Subbasin, undesirable results for the chronic lowering of groundwater levels occur when MTs are exceeded in 25% or more of representative monitoring locations concurrently over two consecutive seasonal low water level measurements.

The identification of undesirable results for the chronic lowering of groundwater levels was developed through discussion and consensus among the Sutter Subbasin Groundwater Management Coordination Committee (SSGMCC) and subbasin stakeholders attending the SSGMCC meetings on July 8, 2021; July 22, 2021; and August 5, 2021 and subsequent SSGMCC meetings throughout the GSP amendment process in 2026. Input during the 2022 GSP development process was also received from stakeholders during a public workshop held on August 11, 2021. The frequency portion of the undesirable results statement (groundwater levels below MTs for two consecutive seasonal low groundwater elevations) was selected for several reasons:

1. Statistically, one data point does not delineate a trend. Groundwater elevations naturally rise and fall in the Sutter Subbasin based on hydrologic year conditions, the timing of applied surface water and/or groundwater pumping, releases from upstream reservoirs, and the time of year relative to irrigation. Using the criterion of '…two consecutive seasonal low water level measurements" ensures the conditions are establishing a trend, and that the undesirable results are occurring at the beginning of a trend, thereby resulting in early corrective actions.

2. The use of seasonal low groundwater elevations was selected to ensure potential impacts to beneficial uses and users are considered (per DWR's Recommended Corrective Action 3a). Historically, groundwater levels in the Subbasin rebound after annual lows (typically occurring at the end of the year when irrigation use has ended the next year's rainfall events have not yet begun).

3. Subbasins in the Sacramento Valley are typically delineated by the rivers and other surface water courses. Subbasins adjoining the Sutter Subbasin are using a similar frequency (24 months) in identifying if undesirable results are occurring. Use of a similar frequency in the Sutter Subbasin facilitates data sharing,

comparison of conditions across the subbasin boundaries, and promotes the regional management of the larger Sacramento Valley Groundwater Basin.

The percentage of exceedance (25%) in representative monitoring wells was also selected as a result of the consensus among the SSGMCC members and subbasin stakeholders attending the SSGMCC meetings on July 8; July 22, 2021; and August 5, 2021. This percentage was selected in a fashion similar to that for the frequency. Specifically, selecting a higher percentage of MT exceedances (e.g., 50%) was thought to result in more extensive Subbasin impacts and therefore be harder to correct. Considering the percentage used by the adjoining subbasins was, again, thought to provide benefits in consistent data collecting and sharing and for facilitating the larger regional management of the Sacramento Valley Groundwater Basin. Finally, it was believed that 25% recognizes overlying land use and the ability to adapt to changes in water supply reliability as part of an adaptive management strategy to maintain Subbasin sustainability.

2. MEASURABLE OBJECTIVE

Measurable objectives are defined as specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included a GSP to achieve the sustainability goal for the basin or subbasin. Based on the projected water budgets (including climate change) detailed in **Section 5.3** of the *Basin Setting* chapter of the Sutter Subbasin GSP, the Sutter Subbasin has been shown to be currently in a sustainable state and is projected to remain in a sustainable state. As such, measurable objectives have been formulated around the maintenance of current conditions and to be reflective of both past, current and future conditions.

Four potential methods were evaluated for establishing numerical measurable objectives at each representative monitoring location in the groundwater level monitoring network. These methods were:

- Average of measurements from water year (WY) 2015 to 2020
- Average of historic record
- Average of seasonal highs over historic record
- 10 feet below ground surface elevation

The average of measurements between WY 2015 and WY 2020 was considered as it represents both the last five years of records (containing both dry, wet and average hydrologic conditions) and is the methodology utilized by several of the adjoining groundwater subbasins to the Sutter Subbasin. The average groundwater level calculated over the historic record for each representative monitoring site was considered as it reflected a longer, more varied, hydrologic record and therefore can be considered to be more statistically representative of the Subbasin. The average of groundwater elevations over the period of seasonal high levels was considered as, similar to the average groundwater level, it reflects a longer, more varied hydrologic record, but it also reflects the Subbasin in its 'recovered' state. And finally, 10 feet below the ground surface elevation was considered as established in the Sutter Subbasin Alternative Plan.

The average of historic record was selected as the measurable objective methodology for the following reasons:

- The 10 feet below ground surface methodology appeared somewhat arbitrary and did not consider the modeled water budget results.

- The average of seasonal high groundwater levels over the historic record set a higher MO than the other two methodologies. While maintaining elevated groundwater levels is important, it is not necessarily reflective of the long-term variations in groundwater record and could result in an artificial need to maintain higher groundwater elevations long-term, limiting the beneficial use of groundwater in the Subbasin.

- The MO values produced by considering the average groundwater elevations versus just those recorded during the WY2015-2020 period of record were, for the most part, very similar.

As such, it was determined that using the entire historic record was a more statistically sound approach, and therefore, this was the method selected for establishing the MOs.

3. MINIMUM THRESHOLDS

Minimum thresholds are defined in the GSP Emergency Regulations as a numeric value for each sustainability indicator used to define undesirable results. For the Sutter Subbasin, several methods were evaluated for establishing the Subbasin MTs for declining groundwater levels. These methods were selected based the methods used by the adjoining subbasins and by those utilized in establishing MTs for several of the critically-overdrafted subbasins. Methods considered included:

- Thiessen polygons with consideration of the number of impacted domestic wells in each polygon
- Minimum saturated thickness required to maintain domestic and/or agricultural groundwater pumping
- Historic low at each representative well, based on available record
- Operating range using proxy wells
- Minimum operating range by zone (Shallow/Aquifer Zone (AZ)-1 and AZ-2/AZ-3)

The results of the evaluation of each of these methods is described below.

3.1 Thiessen Polygons

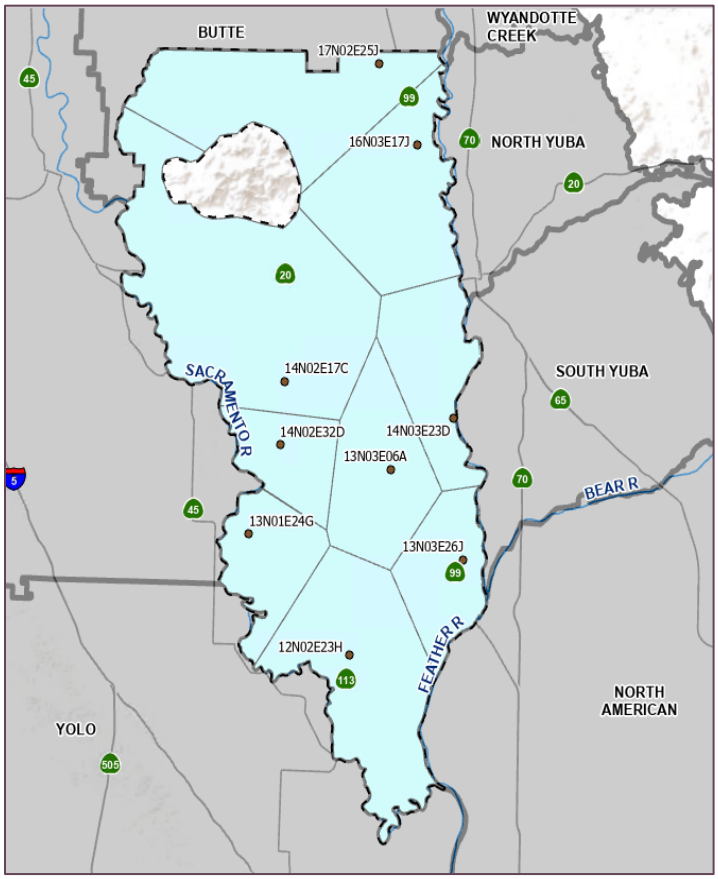
Thiessen polygons are polygons generated around a set of points in a given space by assigning all locations in that space to the closest member of the point set. Any location in a Thiessen polygon is closer to the corresponding point inside it than to any other member of the point set. For this analysis, the Sutter Subbasin was subdivided into Thiessen polygons based on a selection of sample wells representing the point set (Figure 1). Domestic wells with available construction (including well depth and/or screen interval) and location information in the California Department of Water Resources[1] (DWR's) Well Completion Report Map Application were evaluated in each Thiessen polygon to determine the percentile of minimum domestic well depths within each polygon.

In each polygon, the 10th percentile of minimum domestic well depths (a reasonable reflection of the shallowest of the domestic wells) within the polygon was estimated. The resulting depths ranged between 36 and 129 feet deep throughout the Subbasin. These depths were then compared against the overall historical fluctuations in groundwater levels at the wells identified in Figure 1 – ranging between 30 and 140 feet.

This analysis indicates that historic groundwater elevation fluctuations are on the same order as the 10th percentile of minimum domestic well depths, indicating that the likelihood of the shallowest of domestic wells going dry due to Subbasin management is equivalent to the likelihood of those wells going dry due to natural hydrologic variations.

[1] DWR's Well Completion Report Map Application is available at https://www.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37.

Figure 1: Sutter Subbasin Thiessen Polygons Example



3.2 Minimum Saturated Thickness

As noted in the Santa Cruz Mid-County Groundwater Basin GSP (November 2019)[1], in determining minimum thresholds for chronic lowering of groundwater levels it is assumed that groundwater levels cannot go below a level which prevents overlying groundwater users from meeting their typical water demand. Overlying water demand is determined from land use and by the well use in the vicinity of the representative monitoring network wells. The saturated thickness of an aquifer is an important factor that can limit well yields, as when groundwater levels decline, the saturated thickness of the aquifer also decreases. In using this methodology to establish minimum thresholds, one evaluates the minimum saturated thickness that would need to be maintained such that the aquifer can produce sufficient water to the well to meet the minimum rate of pumping needed to meet typical demands.

Pump rates and aquifer properties control how much saturated aquifer thickness (distance between the bottom of the well and the groundwater level) is needed to meet water demands. Water demands by municipal wells are known as municipal agencies have detailed records of each well's pump capacity and volumes pumped. Private domestic and agricultural well users generally do not have this information, and therefore assumptions are made to estimate their water usage. For evaluating the use of minimum saturated thickness as a method for establishing minimum thresholds

[1] Available at: https://sgma.water.ca.gov/portal/gsp/preview/11.

in the Sutter Subbasin, the methodology utilized by the Santa Cruz Mid-County Groundwater Basin GSP was conducted and the results evaluated against typical domestic and agricultural well construction in the Sutter Subbasin.

Similar to the Santa Cruz Mid-County Groundwater Basin GSP analysis, average pumping rates of 15 gallons per minute (gpm) were assumed for domestic well users. For agricultural wells, the estimated required pumping capacity was assumed to be 250 gpm. These values were used, along with assumed aquifer properties, in a spreadsheet tool developed by the Kansas Geological Survey (Brookfield, 2016)[1] to estimate a theoretical minimum saturated thickness (MST) at representative locations around the Sutter Subbasin required to meet the overlying water demand. The tool considers well efficiency, nearby pumping wells, and drawdown in the well due to pumping at a given rate.

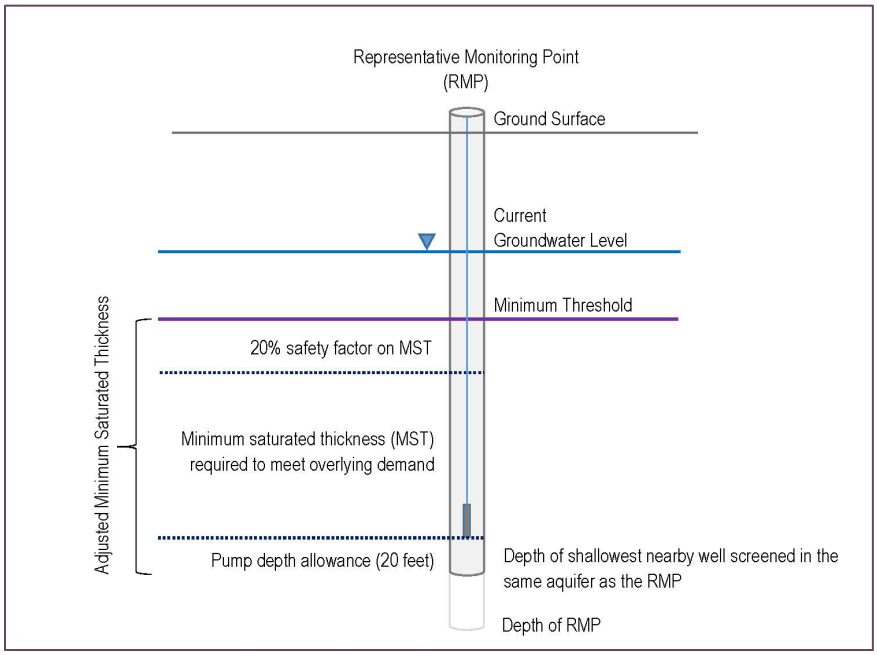
To consider uncertainties in the MST estimation, a 20% safety factor was added to the MST obtained from the spreadsheet tool, similar to the method used in the Santa Cruz Mid-County Groundwater Basin GSP. It is also assumed that a well pump can be placed no deeper than 20 feet from the bottom of the well to prevent the pump from being damaged by settled sediment in the bottom of the well. This is the typical depth well pumps are set in domestic wells. To account for this, a further 20 feet was added to the estimated MST, as shown in Figure 2. The resultant adjusted MST was then considered to be the minimum thickness of the saturated aquifer that is needed for overlying groundwater users to meet their typical demand. In many areas of the Sutter Subbasin, there are two overlying uses, such as agricultural and domestic, or municipal and domestic. For these cases, the adjusted MST of the use type that results in the shallowest groundwater level is used. Further, as a conservative measure, the approach assumed that the representative monitoring location has a depth equal to the shallowest nearby well screened. This results in a shallower groundwater elevation than if the actual depth of the representative monitoring location is used (if it is deeper than nearby wells).

Using the method described above resulted in an adjusted MST of 30 feet. Adding the 20-foot pump depth allowance results in a conservative adjusted MST of 50 feet. Based on construction information for identified wells in the shallow and upper (AZ1) aquifer zones in the Subbasin, domestic and shallow production wells in the upper portions of the principal aquifer range in depth from 30 to 150 feet.

While this methodology was appropriate for use in the Santa Cruz Mid-County Groundwater Basin GSP area (due to supply wells typically being of much greater depth than in the Sutter Subbasin), application of this methodology to the shallowest of wells in the Subbasin is not reasonable due to the shallow groundwater levels, and therefore shallow domestic wells, in the Sutter Subbasin and would result in minimum thresholds at or near the total depth of the well in many locations.

[1] Brookfield, Andrea. 2016. *Minimum Saturated Thickness Calculator*. Kansas Geological Survey Open-File Report 2016-3. February as viewed at http://www.kgs.ku.edu/Hydro/Publications/2016/OFR16_03/index.html on June 28, 2021.

Figure 2: Schematic of Minimum Saturated Thickness Approach



3.3 Historic Low

In the Sutter Subbasin, groundwater levels have been sustainable over the available historic record where the aquifer has been shown to rebound during all water year types following the irrigation season, returning to pre-pumping levels on a seasonal basis (as discussed in further detail in **Section 5.2** of the *Basin Setting* chapter of the Sutter Subbasin GSP). Therefore, setting the MT as the historic low of the available record at each representative monitoring location was determined to be a viable methodology to avoid undesirable results.

3.4 Operating Range Using Proxy Wells

Minimum thresholds and measurable objectives were plotted on hydrographs at representative monitoring locations following completion of the assessment of the methodologies for establishing MTs described in this TM. The resulting operating range (the difference between the MO and MT at any given location) varied considerable from around 3 feet to more than 100 feet. Concern was expressed for those hydrographs with the smaller (less than 5 feet) operating range, especially as many of these locations had minimal data. Specifically, there was concern that the historical record of groundwater levels at those locations did not include the lowest groundwater level that may have occurred, and as a result, the operating range at those locations was not reflective of the 'available' operating range when the prior methodologies were applied. These small operating ranges may prevent the full beneficial use of groundwater by all users in the Sutter Subbasin before undesirable results are observed.

To address this concern, the Subbasin was subdivided into polygons in a manner similar to that used for domestic well depth (**Section 3.1** of this TM), and the operating ranges of representative monitoring wells in those polygons considered in establishing the use of proxy ranges for wells with smaller ranges. This analysis did not, however, yield useful results due to the lack of hydrographs available, and this method was therefore not considered going forward.

3.5 Minimum Operating Range by Zone

Similar to the prior method of using 'proxy' operating ranges for those representative monitoring locations with smaller data sets, the use of a minimum average operating range by aquifer zone was considered. Calculated operating ranges using historic lows for the Shallow AZ and AZ-1 were averaged, as were those for AZ-2 and AZ-3. These zones were combined as such to increase the data set over which the mean was estimated, while recognizing that the Shallow AZ and AZ-1 are reflective of shallow domestic wells, groundwater dependent ecosystems and interconnected surface waters, while AZ-2 and AZ-3 are reflective of larger and deeper municipal and agricultural production wells.

Based on this analysis, the minimum operating range for representative monitoring wells screened in the Shallow AZ and AZ-1 would be 8.0 feet, while that for wells screened in AZ-2 and AZ-3 is 16.5 feet. Application of this methodology as one of the alternatives in setting MTs at representative monitoring locations was considered valid as it reduced impacts of limited data sets in calculating the operating ranges at representative monitoring locations while still providing a technical basis for those estimations (as other methodologies were applied in the calculation of operating ranges used to estimate the average by zone).

4. SUMMARY

The following definitions and methodologies were selected for establishing numeric minimum thresholds and measurable objectives for representative monitoring wells in the groundwater level monitoring network based on the analyses documented above, discussions by the SSGMCC members and attending subbasin stakeholders at public meetings, and public feedback received during presentation of the sustainable management criteria at the August 11, 2021 public workshop.

Definition of Undesirable Results: Groundwater elevations dropping below the minimum threshold criteria at 25% of representative monitoring locations concurrently over two consecutive seasonal low water level measurements resulting in shallow domestic wells going dry in the same general areas as the representative monitoring points in violation, higher pumping costs, and/or the need to modify wells in those areas to obtain groundwater.

Identification of the Occurrence of Undesirable Results: 25% or more of representative monitoring locations exceeding minimum thresholds concurrently over two consecutive seasonal low water level measurements.

Measurable Objectives: Average groundwater level over each wells' historic record.

Minimum Thresholds: Deeper value of the maximum (deepest) historic groundwater level measurement or the average operating range by aquifer zone (8.0 feet for representative monitoring wells screened in the Shallow AZ and AZ-1; 16.5 feet for representative monitoring wells screened in AZ-2 or AZ-3).

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Appendix 6-C
Beneficial Uses and Users Analysis for Chronic Lowering of Groundwater Levels Technical Memorandum

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TECHNICAL MEMORANDUM

TO:	Guadalupe Rivera, on behalf of the Sutter Subbasin
CC:	Sutter Subbasin Groundwater Sustainability Agencies
PREPARED BY:	Emily Honn and Leah Makler, Woodard & Curran
REVIEWED BY:	Leslie Dumas, Woodard & Curran
DATE:	October 16, 2026
RE:	Beneficial Uses and Users Analysis For Chronic Lowering of Groundwater Levels – Response to DWR Recommended Corrective Action No. 3c

The California Department of Water Resources' (DWR's) Recommended Corrective Action (RCA) No. 3 includes several recommendations regarding the basis for Sutter Subbasin's sustainable management criteria (SMC) for the chronic lowering of groundwater levels sustainability indicator. Specifically, RCA No. 3c states:

> *Provide more information about how the proposed minimum thresholds for the chronic lowering of groundwater levels may impact beneficial uses and users. Specifically, consider the impact of the selected minimum threshold levels on supply wells. The consideration should identify the degree/extent of potential impact including the percentage, number, and location of potentially impacted wells at the proposed minimum thresholds for chronic lowering of groundwater levels.*

This technical memorandum (TM) responds specifically to RCA No. 3c. This analysis provides a Subbasin-scale evaluation of the potential impacts of the established groundwater level SMC on beneficial uses and users of groundwater as part of the 2027 GSP Amendment. The beneficial uses and users considered in this analysis are the following:

- Domestic Wells
- Public Water Systems and Community Water Systems
- Groundwater Dependent Ecosystems (GDEs)

The 2022 GSP included a similar assessment of impacts on domestic wells, included in Appendix 6-B of the document. This analysis revises and expands that work to include the additional beneficial users listed above. Additionally, to assess the sensitivity of the results, the updated well and potential GDE impact analyses were also evaluated under a range in the number of wells at their minimum threshold.

Since the publication of the 2022 GSP, minor changes have been made to the chronic lowering of groundwater levels representative monitoring network (RMN) and SMC, as described in the 2027 Periodic Evaluation, broader RCA No. 3 TM, and the 2027 GSP Amendment.

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The undesirable result for the chronic lowering of groundwater levels sustainability criterion is defined in the 2027 GSP Amendment as at least 25% of representative monitoring wells (RMW) reaching their minimum threshold (MT) over two consecutive seasonal low groundwater level measurements.

As defined by the 2027 GSP Amendment, each RMW's MT is determined as the deeper of the following criteria:

1. The historic low for the available record
2. The average operating range (difference between measurable objective [MO] and MT) for all representative monitoring sites using the above criterion for the following aquifer zones (AZs), applied based on available screen interval or well depth information for each RMW:
    a. Shallow AZ and AZ-1 = 8.0 feet
    b. AZ-2 and AZ-3 = 16.5 feet

1. Well Impacts Analysis

a. Methods

An inventory of all wells within the Sutter Subbasin was compiled by their use, type, and depth using the DWR Online System for Well Completion Reports (OSWCR) database (California Department of Water Resources, 2026a). This list was then filtered by the following attributes:

- Active status;
- Known coordinates;[1]
- Known depths; and
- Construction dates during or after 1976 (a production well's usable lifespan is assumed to be approximately 50 years).

The remaining wells were then sorted into each of the following type categories:

- Domestic Wells
- Public Supply Wells
- Public Supply Wells that are within a Community Water System (CWS)

[1] In the OSWCR database, wells lacking precise location data are assigned the centroid coordinates of their associated PLSS section. Including these wells may have resulted in inaccurate impact assessments if assigned to the incorrect Impact Zone.

State small water systems (SSWS) are defined as systems that serve 5 to 14 service connections and do not regularly serve drinking water to more than an average of 25 individuals daily for more than 60 days out of the year (California State Water Resources Control Board, 2021). A public water system is classified as a community water system (CWS) when it serves at least 25 permanent residents or 15 service connections for the majority of a calendar year (United States Environmental Protection Agency, 2026). SSWS have fewer connections and serve fewer permanent residents than CWS. However, since the location and depth of production wells within SSWS are not readily available, this analysis conservatively assesses the impacts to wells within CWS service areas in the Subbasin. It is assumed that impacts on CWS would be correlated with impacts on SSWS.

To capture wells that may be impacted by declines in groundwater levels at RMWs, an "Impact Zone" was delineated by a 3-mile radius around each well. **Figure 1** displays the Subbasin's 52 RMWs from the 2027 GSP Amendment and their Impact Zones. Well IDs for multi-completion wells whose impact zones overlap are highlighted in yellow and indicated by "#" to represent all depth intervals present. **Table 1** summarizes the RMN for groundwater levels and displays each RMW's Impact Zone number and MT.

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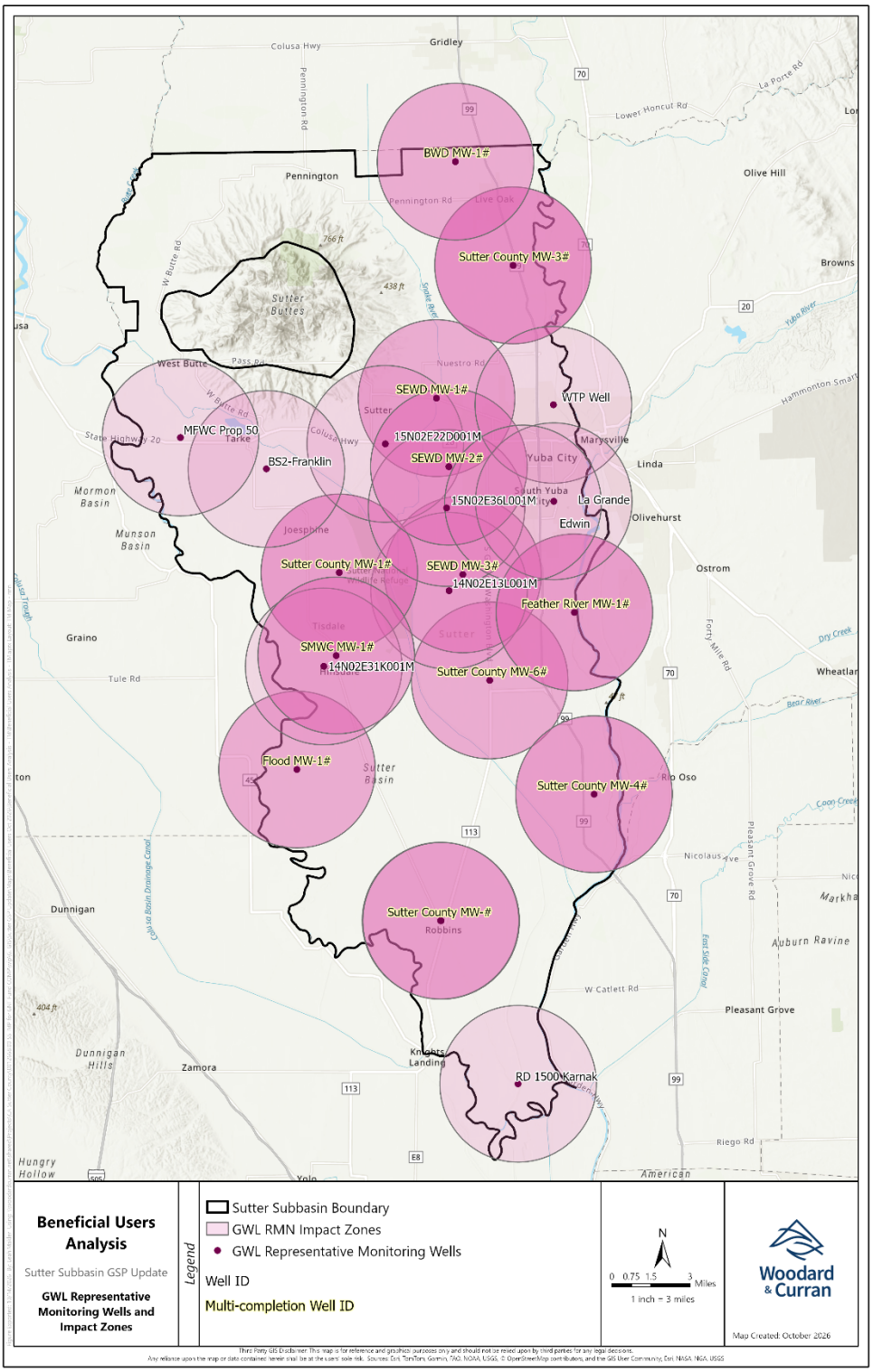

FIGURE 1: SUTTER SUBBASIN GROUNDWATER LEVEL REPRESENTATIVE MONITORING NETWORK AND IMPACT ZONES

TABLE 1: MINIMUM THRESHOLDS AT REPRESENTATIVE MONITORING WELLS

Impact Zone #	State Well Number	Well ID	Minimum Thresholds (feet AMSL, NAVD88)
1	11N03E20H003M	RD 1500 Karnak	10.51
2	12N02E23H001M	Sutter County MW-2A	7.58
3	12N02E23H002M	Sutter County MW-2B	-0.08
4	12N02E23H003M	Sutter County MW-2C	-0.12
5	12N02E23H004M	Sutter County MW-2D	-0.41
6	13N01E24G002M	Flood MW-1A (deep)	7.20
7	13N01E24G003M	Flood MW-1B (int)	-7.90
8	13N01E24G004M	Flood MW-1C	13.00
9	13N03E06A001M	Sutter County MW-6A	21.13
10	13N03E06A002M	Sutter County MW-6B	10.21
11	13N03E06A003M	Sutter County MW-6C	9.91
12	13N03E26J002M	Sutter County MW-4A	5.09
13	13N03E26J003M	Sutter County MW-4B	4.12
14	13N03E26J004M	Sutter County MW-4C	2.82
15	13N03E26J005M	Sutter County MW-4D	0.34
16	14N02E13A003M	SEWD MW-3A	37.37
17	14N02E13A004M	SEWD MW-3B	21.16
18	14N02E13A005M	SEWD MW-3C	18.52
19	14N02E13L001M	-	15.93
20	14N02E17C001M	Sutter County MW-1A	21.50
21	14N02E17C002M	Sutter County MW-1B	12.33
22	14N02E17C003M	Sutter County MW-1C	5.77
23	14N02E17C004M	Sutter County MW-1D	11.91
24	14N02E31K001M	-	19.08
25	14N02E32D001M	SMWC MW-1A	18.34
26	14N02E32D002M	SMWC MW-1B	10.01
27	14N02E32D003M	SMWC MW-1C	8.85
28	14N03E23D003M	Feather River MW-1A	15.78
29	14N03E23D004M	Feather River MW-1B	-30.19
30	14N03E23D005M	Feather River MW-1C	11.05
31	14N03E23D006M	Feather River MW-1D	9.49
32	15N02E12E001M	SEWD MW-1A	15.66
33	15N02E12E002M	SEWD MW-1B	23.14
34	15N02E12E003M	SEWD MW-1C	22.91
35	15N02E22D001M	-	24.00
36	15N02E36L001M	-	33.09
37	16N03E17J001M	Sutter County MW-3A	59.82
38	16N03E17J002M	Sutter County MW-3B	36.89
39	16N03E17J003M	Sutter County MW-3C	34.68

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Impact Zone #	State Well Number	Well ID	Minimum Thresholds (feet AMSL, NAVD88)
40	16N03E17J004M	Sutter County MW-3D	31.78
41	16N03E17J005M	Sutter County MW-3E	31.21
42	17N02E25J001M	BWD MW-1A	10.10
43	17N02E25J002M	BWD MW-1B	3.90
44	17N02E25J003M	BWD MW-1C	60.03
45	-	BS2-Franklin	16.77
46	-	MFWC Prop 50	27.72
47	15N02E24P001M	SEWD MW-2A	24.51
48	15N02E24P002M	SEWD MW-2B	-16.30
49	15N02E24P003M	SEWD MW-2C	-13.80
50	-	WTP Well #1	21.51
51	-	La Grande	17.34
52	-	Edwin	14.35

Table 2 shows the total number of wells, by type, within the RMWs' Impact Zones. The range in well depths, as well as the average well depth, are also shown by well type. The supply wells within the Impact Zones represent 94% and 91% of the domestic and public supply wells within the Subbasin, respectively; thus, this analysis captures potential impacts on a majority of well users within the Subbasin.

Figure 2 and **Figure 3** show the locations of the domestic wells and public supply wells, respectively, within the RMW Impact Zones. **Figure 4** shows the same information but highlights public supply wells located within CWS.

TABLE 2: DETAIL BY WELL TYPE

Well Type	Total Number in Sutter Subbasin[2]	Within 3-mile Radius Impact Zone of RMWs			
		Total Number of Wells	*% of Total Wells Analyzed*	*Well Depth Range (ft bgs)[1]*	*Well Depth Average (ft bgs)*
Domestic Wells	863	809	94%	14 to 457	123
Public Supply Wells	34	31	91%	75 to 720	231
Public Supply Wells – Community Water System	8	8	100%	114 to 535	292

1. ft bgs = feet below the ground surface
2. Excludes wells constructed prior to 1976 and wells lacking depth data.

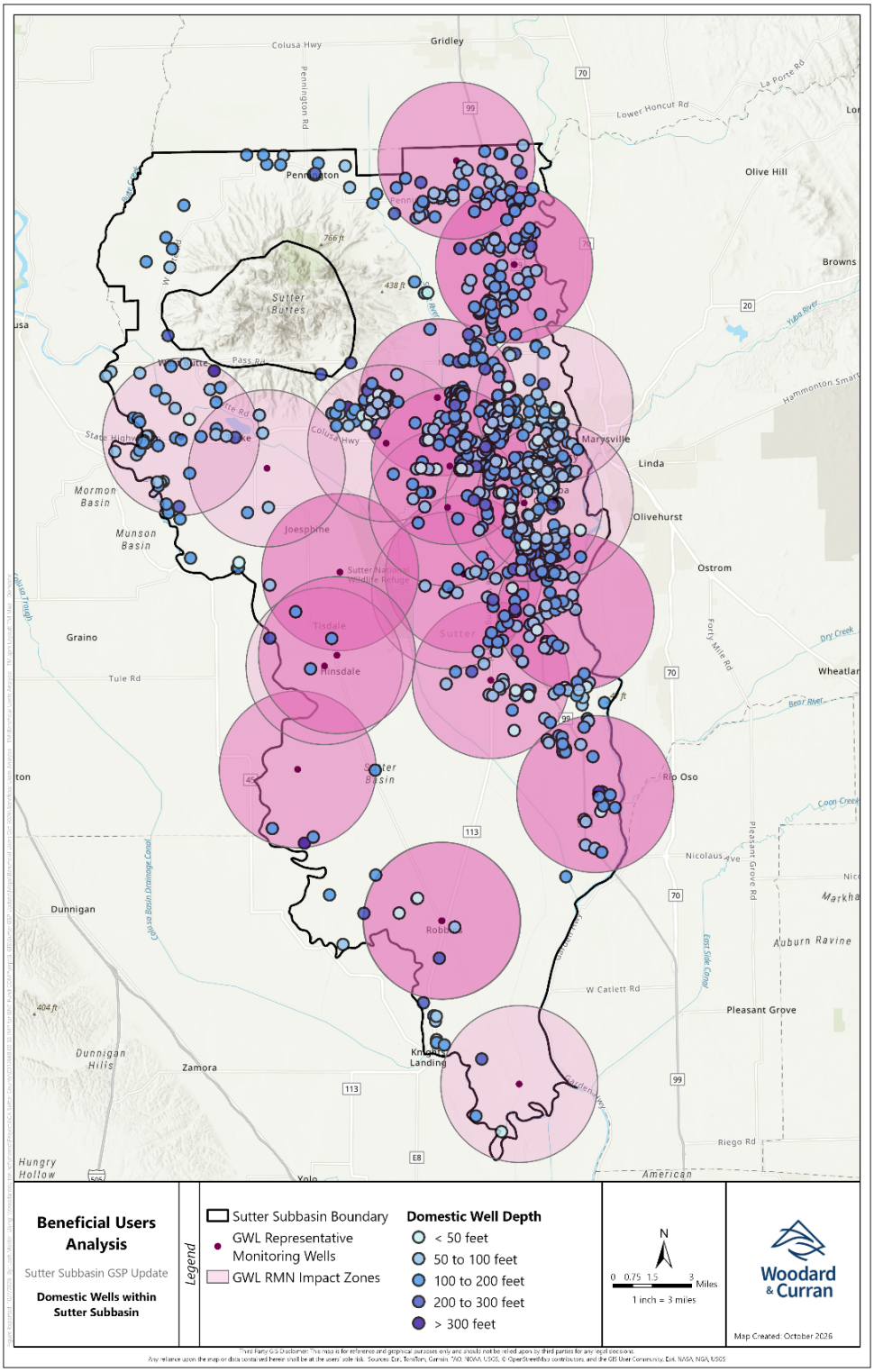

FIGURE 2: INVENTORY OF DOMESTIC WELLS AND GROUNDWATER LEVEL RMN IMPACT ZONES

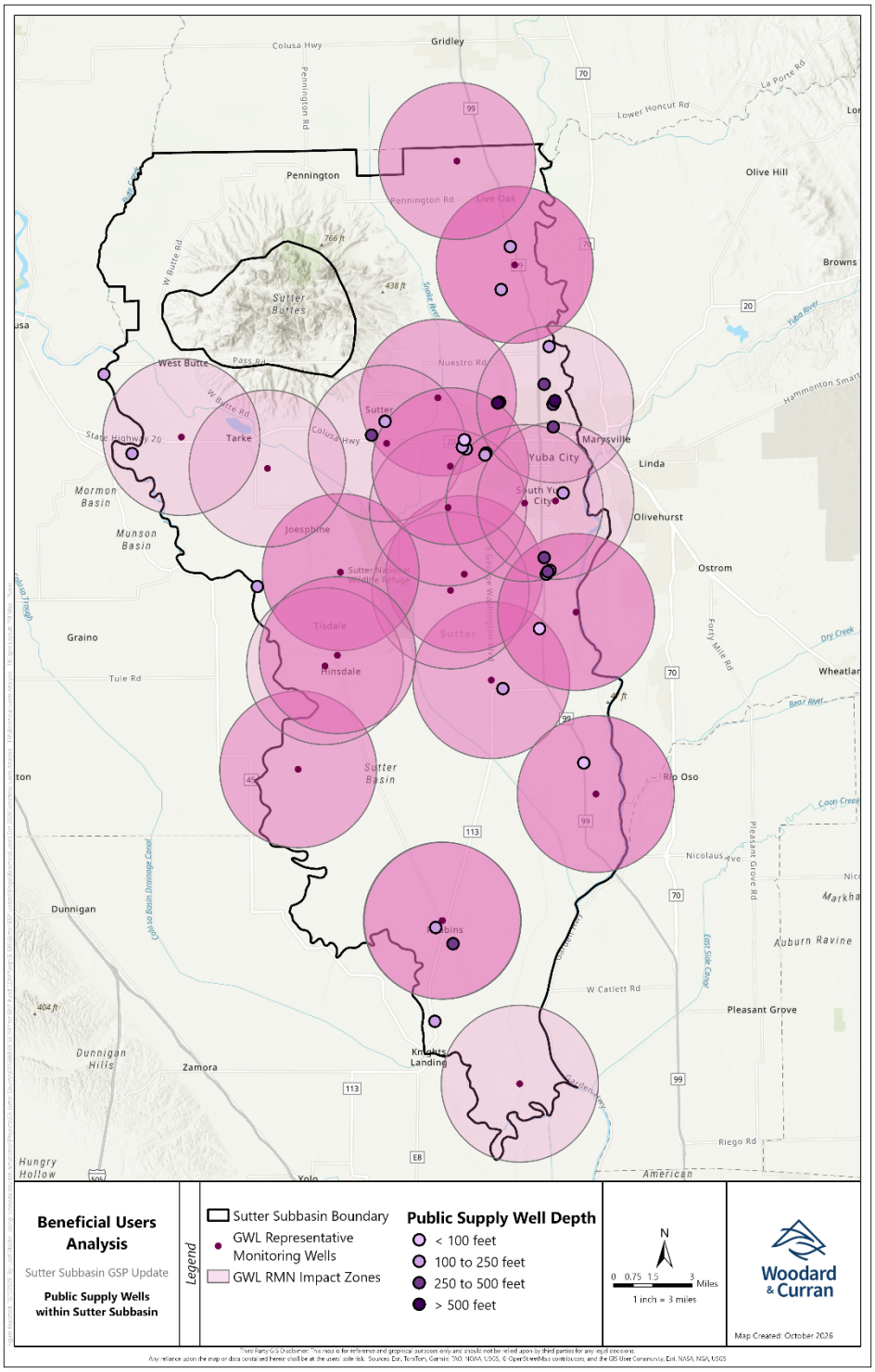

FIGURE 3: INVENTORY OF PUBLIC SUPPLY WELLS AND GROUNDWATER LEVEL RMN IMPACT ZONES

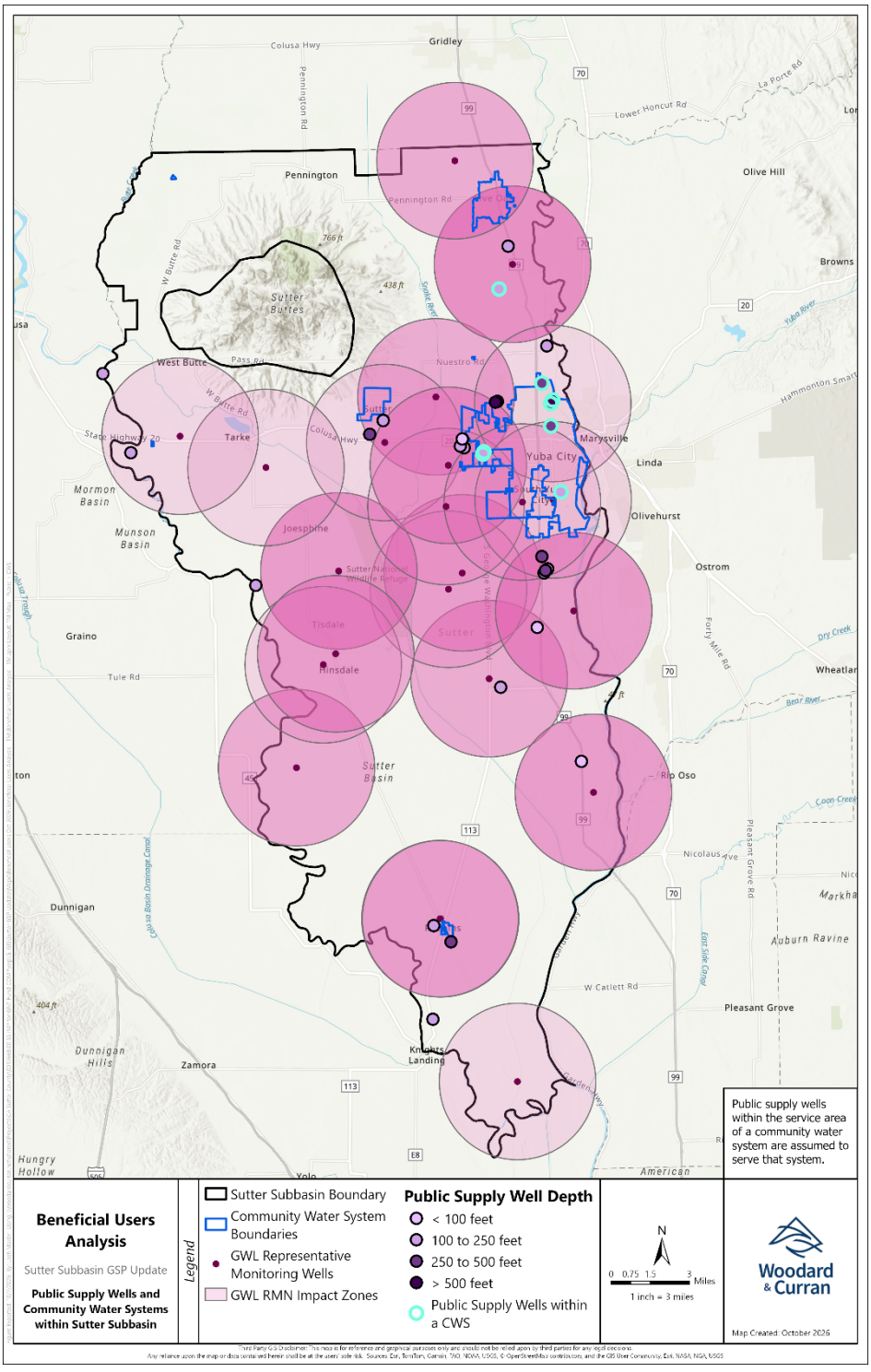

FIGURE 4: INVENTORY OF PUBLIC SUPPLY WELLS WITHIN COMMUNITY WATER SYSTEMS AND GROUNDWATER LEVEL RMN IMPACT ZONES

To identify which RMWs were most vulnerable to reaching their respective MTs during extended dry periods, each RMW's MT was compared to a critical-year low water level, defined as the lowest groundwater elevation observed during WY 2021 or WY 2022 (the most recent drought period). Wells were ranked by this comparison with the assumption that wells closer to their MT during these critical years are more at risk of a MT exceedance.

The undesirable result for the chronic lowering of groundwater levels is defined as when at least 25% of the RMN reaches their respective MT during two consecutive seasonal low groundwater level measurements. With the current RMN, an undesirable result requires at least 13 wells to meet this criterion. To replicate an undesirable result scenario, the 13 RMWs closest to their MT during the WY 2021-2022 critical low years were assumed to have groundwater levels drop to their MT values. For those wells, the MT groundwater level was then compared to the total well depths within the associated Impact Zone to determine whether any supply wells may potentially go dry. For simplicity, it was assumed that groundwater levels, and therefore their impacts on beneficial users, are uniform within the RMW's Impact Zone. For example, in this analysis, a domestic well that is 2 miles away from the RMW location is assumed to be impacted to the same degree as a well that is 0.5 miles from the RMW location.

The same analysis was repeated using differing numbers of RMWs with groundwater levels at their minimum thresholds to serve as a sensitivity analysis. The impacts were calculated when 8%, 15%, 40%, and 100% RMWs reached their respective MT groundwater levels.

b. Results

Of the 809 domestic wells analyzed, approximately three wells could be potentially impacted if the Subbasin experiences an undesirable result for the chronic lowering of groundwater levels as defined in the 2027 GSP Amendment. This represents less than 1% of the total number of domestic wells across the Subbasin, as shown in **Table 3**. The three potentially impacted domestic wells are highlighted in **Figure 5**. Additionally, this analysis shows that public supply wells are likely sufficiently deep to not experience impacts under an undesirable result scenario, as shown in **Table 4**.

TABLE 3: SUMMARY OF POTENTIAL DOMESTIC WELL IMPACTS

Undesirable Result Definition	Number of RMWs at MT	Total Number of Domestic Wells Analyzed	Number of Potentially Impacted Domestic Wells	Percentage of Total Domestic Wells
25%	13	809	3	0.4%

TABLE 4: SUMMARY OF POTENTIAL PUBLIC SUPPLY WELL IMPACTS

Undesirable Result Definition	Number of RMWs at MT	Total Number of Public Supply Wells Analyzed	Number of Potentially Impacted Public Supply Wells	Percentage of Total Public Supply Wells
25%	13	31	0	0%

The sensitivity analysis indicated that the number of wells potentially impacted is not sensitive to the number of representative monitoring wells at their minimum threshold groundwater levels. The 8%, 15%, and 40% scenarios still showed less than 1% of domestic wells may potentially be impacted. In the most extreme case, in which all RMWs reach their MT for groundwater levels, less than 2% of domestic wells were shown to potentially be impacted. These results are summarized in **Table 5**.

There were no impacts to public supply wells under all scenarios, including the extreme case in which all RMWs drop to their MT groundwater levels, as shown in **Table 6**.

TABLE 5: SENSITIVITY ANALYSIS OF UNDESIRABLE RESULT SCENARIOS – DOMESTIC WELLS

Percent RMWs at MT for Groundwater Levels	Number of RMWs dropped to MT	Total Number of Domestic Wells Analyzed	Number of Potentially Impacted Domestic Wells	Percentage of Total Domestic Wells Analyzed
8%	4	809	2	0.2%
15%	8	809	3	0.4%
40%	21	809	3	0.4%
100%	52	809	15	1.9%

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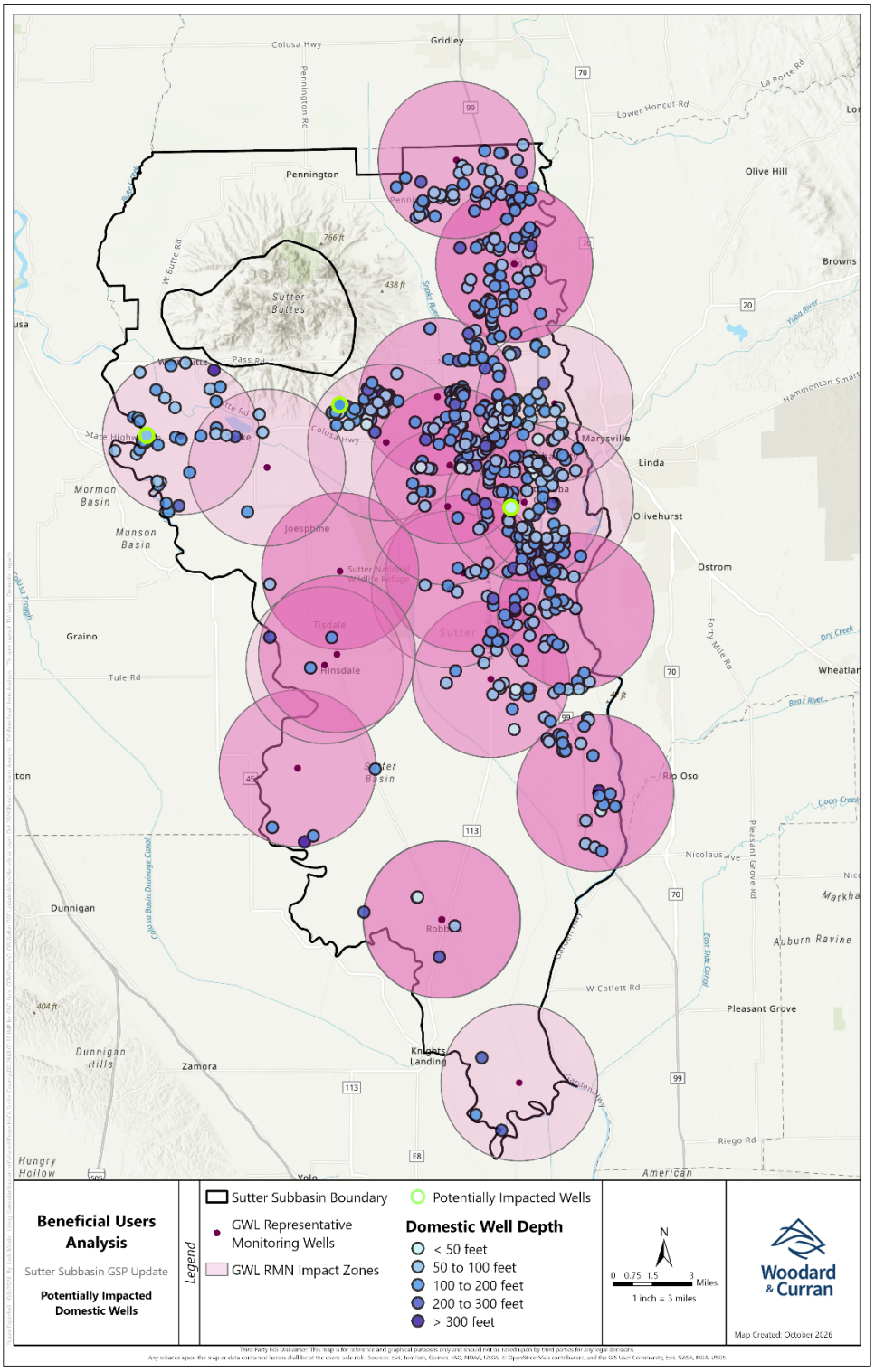

FIGURE 5: DOMESTIC WELLS AT RISK OF IMPACT UNDER GROUNDWATER LEVEL UNDESIRABLE RESULTS

TABLE 6: SENSITIVITY ANALYSIS OF UNDESIRABLE RESULT SCENARIOS – PUBLIC SUPPLY WELLS

Percent RMWs at MT for Groundwater Levels	Number of RMWs dropped to MT	Total Number of Public Supply Wells Analyzed	Number of Potentially Impacted Public Supply Wells	Percentage of Total Public Supply Wells Analyzed
8%	4	31	0	0%
15%	8	31	0	0%
40%	21	31	0	0%
100%	52	31	0	0%

DWR has developed a tool and mapping portal to identify areas which may be at risk of groundwater supply shortages (California Department of Water Resources, 2026b). The tool scores Public Land Survey System (PLSS) sections by percentiles of Dry Well Susceptibility. Within the Sutter Subbasin, PLSS sections range in scores from the 10th to 30th percentile, as shown in **Figure 6**. Only a small number of PLSS sections have been scored by the tool within Sutter Subbasin. The three potentially impacted domestic wells are not in or adjacent to PLSS sections with percentile scores, and thus, the results cannot be directly compared to the results of the analysis contained in this TM. However, the majority of PLSS sections are within the 10th percentile across the Subbasin. This is more generally comparable to the results of the analysis contained herein – potential domestic well impacts are expected to be limited to less than 10% of the Subbasin's domestic, small system and public supply wells.

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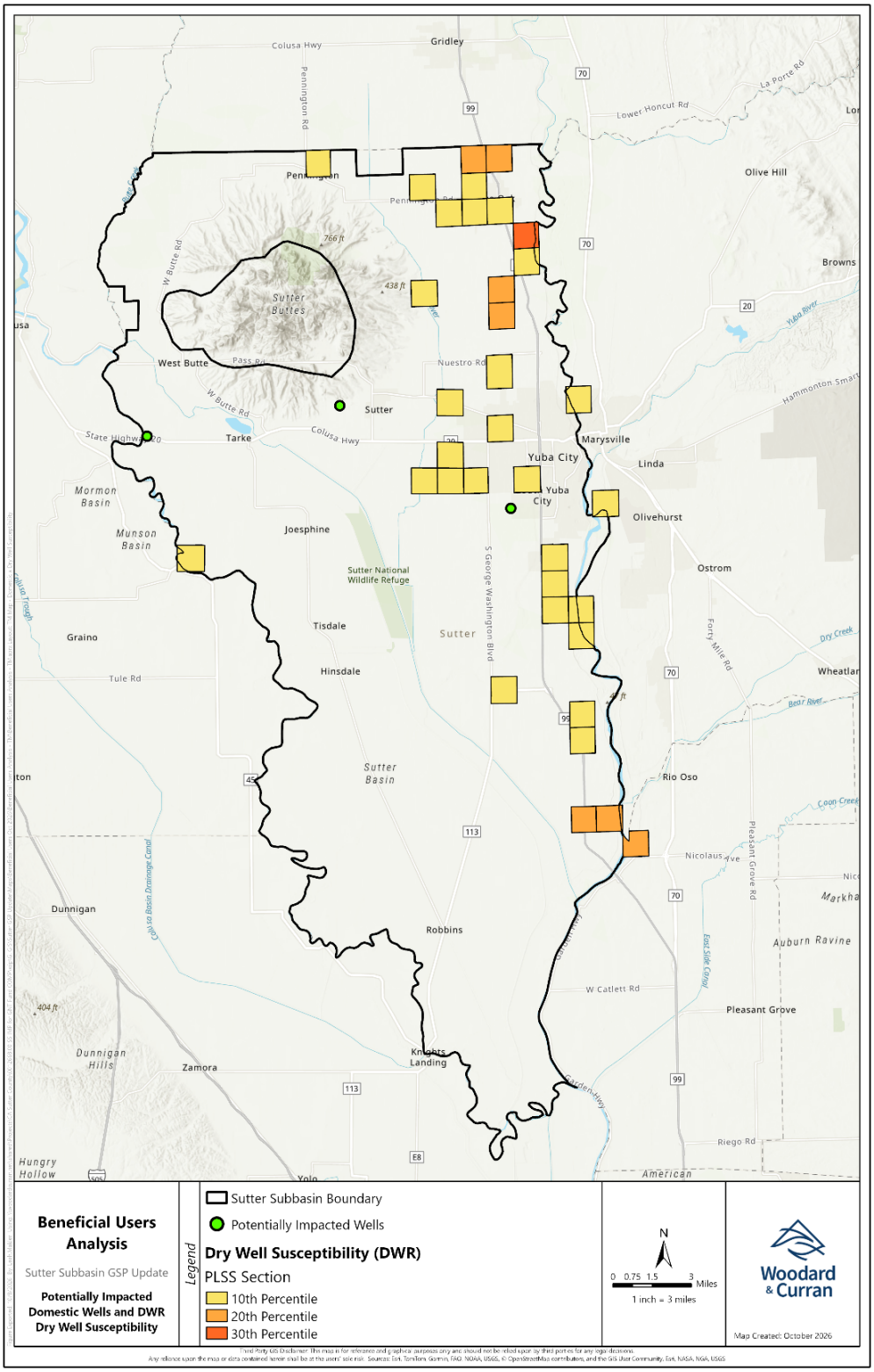

FIGURE 6: POTENTIALLY IMPACTED WELLS COMPARED TO DWR WELL SUSCEPTIBILITY METRICS

c. Limitations of Analysis

The following limitations should be considered in the interpretation of the presented results presented herein:

- The relationship between shallow aquifers and deeper aquifers is still poorly understood and varies considerably across the Subbasin. The majority of data available in the Sutter Subbasin is from its deeper aquifer zones (AZ-1 and deeper) where groundwater is being actively produced for domestic or public supplies. This analysis assumes that the groundwater levels measured in the deeper aquifers at the RMN wells are representative of conditions in all areas of the Impact Zones (including the Shallow Aquifer Zone). That said, the analysis does cover the large majority (more than 90%) of supply wells in the Subbasin and is therefore considered a representative assessment.

- The scenarios analyzed only represent one possible combination of monitoring wells dropping to their MT groundwater levels. The scenarios presented in this analysis utilize lists of RMWs as ranked by the relationship between their observed critical year groundwater levels and their established minimum thresholds. Groundwater levels other than critical-year water levels could be used to rank the vulnerability of the RMWs, such as most recent or model-simulated groundwater levels. The analysis is intended to assess the robustness of the current monitoring network's minimum thresholds and potential impacts. It is not intended to predict the actual circumstances under which an undesirable result may occur.

- The analysis relies on the assumption that groundwater levels within an Impact Zone would drop uniformly to the MT of the representative monitoring well. In reality, groundwater conditions vary spatially due to a variety of factors and can differ within a 3-mile Impact Zone. The assumption was applied as a baseline to simplify the evaluation of MTs across the Subbasin.

- The analysis assumes that impacts on wells would only occur when groundwater levels drop below the total well depth. Wells may fail at shallower depths and due to other circumstances. As discussed above, this assumption was used in order to prepare a Subbasin-scale analysis and align with the data available at that scale.

2. GDE Impacts Analysis

In the Sutter Subbasin, groundwater dependent ecosystems (GDEs) are an environmental beneficial user of groundwater. GDEs are defined in the GSP Emergency Regulations as the following based on the California Code of Regulations (CCR) Title 23 § 351 (m):

> *"Groundwater dependent ecosystem" refers to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface."*

Sufficiently high groundwater levels are required to maintain connection between the root zones of these ecosystems and the groundwater supply they rely on for survival. The 2022 GSP and 2027 GSP Amendment identified GDEs to assess whether groundwater management could affect these beneficial users of groundwater. The following analysis builds on the desktop GDE identification included in the 2027 GSP Amendment to investigate impacts to GDEs as a beneficial user, if the Subbasin were to experience undesirable results.

a. Methods

For the purposes of this analysis, GDEs were identified and screened using the same methods as described in the 2027 GSP Amendment, starting with DWR's Natural Communities Commonly Associated with Groundwater (NCCAG) dataset, which includes vegetation communities and wetlands commonly associated with groundwater (California Department of Water Resources, 2022). NCCAG areas were screened out as potential areas of GDEs if they: (1) occurred where groundwater depths exceeded vegetation rooting depths (30 feet below the ground surface), (2) were located within 150 feet of losing streams or rivers that provide surface water recharge, or (3) were adjacent to irrigated lands, within 50 feet for most irrigated lands and 150 feet for irrigated rice fields.

In the 2027 GSP Amendment, the presence of GDEs was evaluated across a range of hydrologic conditions using average groundwater depths from normal (2013), dry (2015), and wet (2017) years. This analysis evaluates impacts to potential GDEs identified in 2015, a dry year, in order to assess impacts on the largest identified GDE footprint. Impacts to potential GDEs were assessed in a manner consistent with the analysis completed for well impacts (previously described).

The delineated polygons in the NCCAG dataset represent mapping of vegetation, wetlands, springs, and seeps across California compiled from 48 publicly available State and federal agency datasets. The size of the polygon is determined for each ecological grouping using databases that gather information through aerial imagery, remote sensing, and field inspection. For this analysis, the total number of potential GDE polygons identified in the NCCAG dataset within each Impact Zone radii was counted. Both a count and an area of GDE impact are reported due to concerns about the reliability of the exact acreages of the polygon delineations in the NCCAG dataset.

The rooting depth threshold plays a similar role as the well depth in the well impacts analysis by defining at what groundwater level there is an impact or not. It is assumed that if the groundwater levels fall below the MT in an Impact Zone, all identified potential GDEs within the Impact Zone would be impacted. Like in the well impact analysis, the groundwater levels in the Impact Zone are assumed to be level across the zone, and therefore, the impacts are assumed to be uniform throughout the full Impact Zone. If a potential GDE falls anywhere within an Impact Zone, it is designated as either potentially "impacted" or "not impacted," depending on where the groundwater level falls in relation to the rooting depth threshold (30 feet below ground surface).

It should be noted that the analysis presented herein is based on desktop work only. Field study beyond this analysis will be required to determine the presence, extent, and status of potential GDEs in the Subbasin to further inform future assessment.

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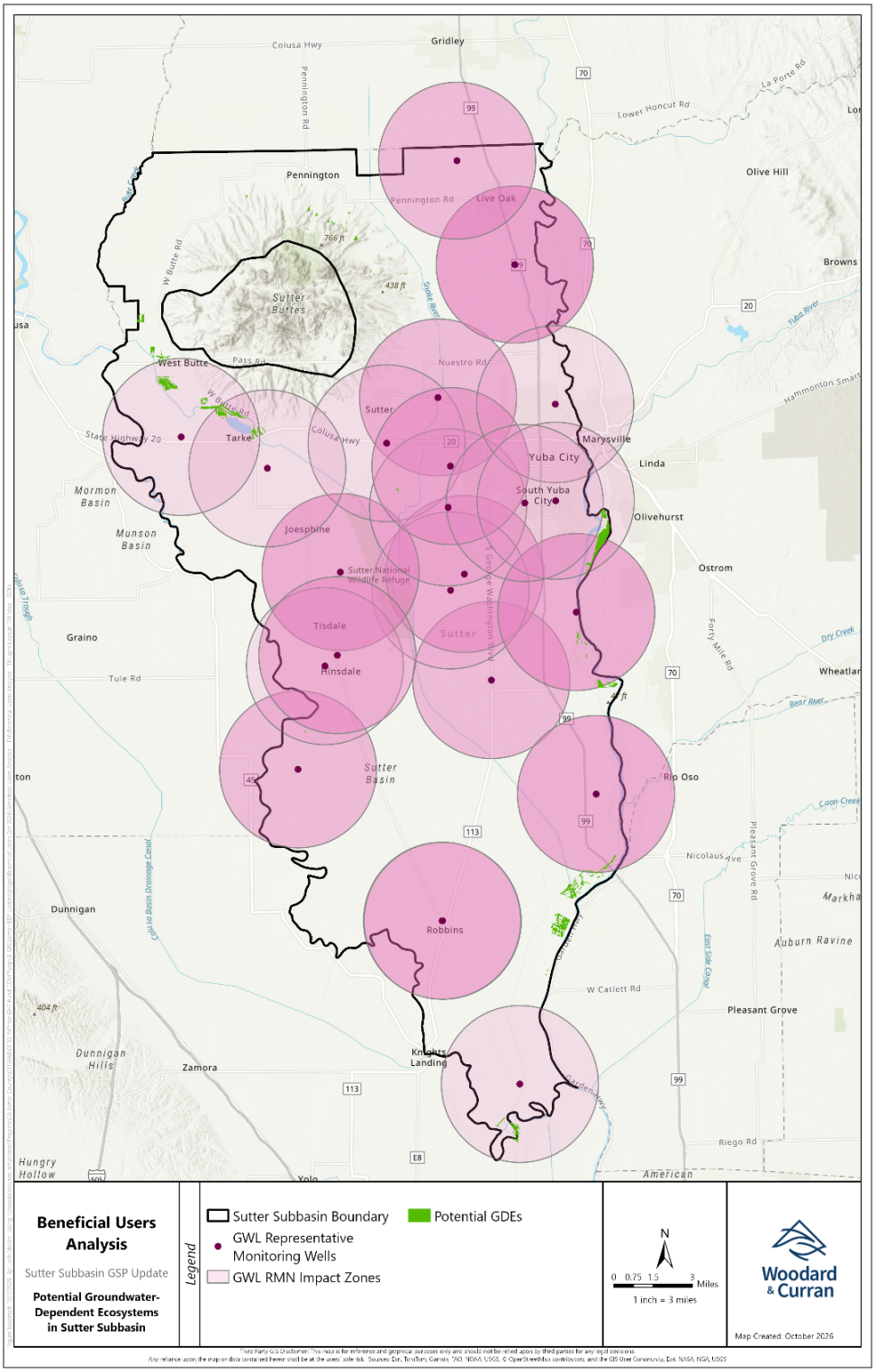

FIGURE 7: INVENTORY OF GDES AND REPRESENTATIVE MONITORING WELL IMPACT ZONES

b. Results

There are 285 potential GDE polygons identified across the Subbasin totaling an area of approximately 2.5 square miles.

Under undesirable results conditions, as defined in the 2027 GSP Amendment, this analysis found no impacts to GDE polygons as shown in **Table 7**. Only under the most extreme scenario, in which 100% of the RMWs reach their MT groundwater levels, are impacts to GDE polygons recorded. These results are shown in **Table 8**. Under this extreme scenario, the impacts to GDEs are substantial. In terms of a count, 22% of the GDE polygons are impacted and in terms of area, 33% of the total GDE area (or approximately 0.83 square miles) is potentially impacted.

TABLE 7: SUMMARY OF POTENTIAL GDE IMPACTS

Undesirable Result Definition for Groundwater Levels	Total Count of GDE Polygons in Sutter Subbasin	Total Area of GDEs in Sutter Subbasin (sq miles)	Number of Potentially Impacted GDE Polygons	Percentage of Total GDE Polygons
25%	285	2.5	0	0%

TABLE 8: SENSITIVITY ANALYSIS OF UNDESIRABLE RESULT SCENARIOS - GDES

Percent RMWs at MT for Groundwater Levels	Total Count of GDE Polygons in Sutter Subbasin	Total Area of GDEs in Sutter Subbasin (sq miles)	Number of Potentially Impacted GDE Polygons	Area of Potentially Impacted GDE polygons (sq miles)	Percentage of Total GDE Polygons	Percentage of Total Area
8%	285	2.5	0	0	0%	0%
15%	285	2.5	0	0	0%	0%
40%	285	2.5	0	0	0%	0%
100%	285	2.5	64	0.8	22%	33%

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c. Limitations of Analysis

The following limitations and outstanding data gaps should be considered in the interpretation of the results presented above. The GDE analysis is subject to most limitations discussed in the well impact analysis, in addition to the following:

- The impact analysis included in this TM is a desktop only analysis. No field survey has been completed to ground-truth the presence or extent of GDEs. Field surveys to verify the locations and extent of GDEs should be completed to verify both the mapping used in this analysis and the findings of this analysis.

- The definition of what an ecosystem is in the NCCAG dataset carries a number of assumptions. The size of the polygons in NCCAG is based on how an ecosystem is defined within the dataset, and this incorporates a variety of assumptions regarding the identification of a potential GDE. For example, two stretches of stream may have similar densities of potential GDEs in the field, but if one reach has more individual species than the other, the two reaches may be classified as more individual GDE polygons despite their similar densities. Therefore, the size of the NCCAG polygons as well as the actual count of GDE polygons should be interpreted cautiously.

Additionally, while the groundwater level RMN does overlap with more than half of potential GDE locations mapped in the Subbasin (60%), there is generally a lack of overlap between groundwater level monitoring well locations and locations of potential GDEs. To assess impacts on a greater number of GDEs, additional monitoring locations would need to be established near the Sutter Buttes, in the northwest portion of the Subbasin, and north of the southern tip of the Subbasin. Monitoring in these areas would increase understanding of groundwater level impacts on GDEs, while also providing information on interconnected surface water dynamics. Since the publication of the 2022 GSP, the groundwater levels RMN described in the 2027 GSP Amendment has replaced an interconnected surface water (ISW)-specific RMN as proxy due to various monitoring limitations in the ISW-specific RMN. The Subbasin GSAs are in the process of filling data gaps to monitor for depletions of ISW conditions and potential GDEs for future reporting.

3. Conclusion

Under undesirable results conditions (as defined in the 2027 GSP Amendment), this analysis finds that less than 1% of the domestic wells analyzed may be potentially impacted by groundwater levels declining to their MT values. No public supply wells, public supply wells within Community Water Systems, or groundwater dependent ecosystems are expected to be impacted at defined undesirable results conditions for groundwater levels. Therefore, this analysis shows that the undesirable result definition and MTs established for the chronic lowering of groundwater levels are protective of beneficial uses and users of groundwater in the Sutter Subbasin.

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