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San Antonio Creek Valley Groundwater Basin Groundwater Sustainability Plan

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Abbreviations and Acronyms

Agency	Groundwater Sustainability Agency
Basin Plan	Water Quality Control Plan for the Central Coastal Basin
Basin	San Antonio Creek Valley Groundwater Basin
BMP	Best Management Practice
CGPS	Continuous Global Positioning System
DDW	Division of Drinking Water
DWR	California Department of Water Resources
EPA	U.S. Environmental Protection Agency
GAMA	Groundwater Ambient Monitoring and Assessment
GDE	groundwater-dependent ecosystem
GSP	Groundwater Sustainability Plan
ILRP	Irrigated Lands Regulatory Program
InSAR	Interferometric Synthetic Aperture Radar
LACSD	Los Alamos Community Service District
MA	management area
MCL	maximum contaminant level (drinking water)
mg/L	milligrams per liter
MO	measurable objective
MT	minimum threshold
NWIS	National Water Information System
RMS	representative monitoring site
RWQCB	Central Coast Regional Water Quality Control Board
SABGSA	San Antonio Basin Groundwater Sustainability Agency
SAC	Stakeholder Advisory Committee
SGMA	Sustainable Groundwater Management Act
SMC	sustainable management criteria
SMCL	secondary maximum contaminant level (drinking water)
TDS	total dissolved solids
UNAVCO	University NAVSTAR Consortium
USGS	U.S. Geological Survey
VAFB	Vandenberg Air Force Base
VOC	volatile organic compound

WQO water quality objective

SECTION 4: Sustainable Management Criteria [Article 5, Subarticle 3]

§354.22 Introduction to Sustainable Management Criteria. This Subarticle describes criteria by which an Agency defines conditions in its Plan that constitute sustainable groundwater management for the basin, including the process by which the Agency shall characterize undesirable results, and establish minimum thresholds and measurable objectives for each applicable sustainability indicator.

This section defines the conditions that constitute sustainable groundwater management and discusses the process by which the San Antonio Basin Groundwater Sustainability Agency (SABGSA) will characterize undesirable results and establish minimum thresholds and measurable objectives for each sustainability indicator in the San Antonio Creek Valley Groundwater Basin (Basin).

Section 4 presents the data and methods used to develop sustainable management criteria (SMCs) and demonstrate how these criteria influence beneficial uses and users. The SMCs presented in this section are based on currently available data and application of the best available science. As noted in this Groundwater Basin Groundwater Sustainability Plan (GSP), data gaps exist in the hydrogeologic conceptual model. Uncertainty caused by these data gaps was considered when developing the SMCs. These SMCs are considered initial criteria and will be reevaluated and potentially modified in the future as new data become available.

The SMCs are grouped by sustainability indicator. The following five sustainability indicators are applicable in the Basin:

- Chronic lowering of groundwater levels
- Reduction of groundwater in storage
- Degraded groundwater quality
- Land subsidence
- Depletion of interconnected surface water

The sixth SMC, seawater intrusion, is not applicable in the Basin.

To retain a consistent and organized approach, this section follows the same format for each sustainability indicator. The description of each SMC includes all the information required by Section 354.22 *et seq.* of the Sustainable Groundwater Management Act (SGMA) regulations and outlined in the SMC Best Management Practice (BMP) guidance (DWR, 2017), including the following:

- How the definition of what might constitute significant and unreasonable conditions was developed
- How minimum thresholds were developed, including the following:
 - The information and methodology used to develop minimum thresholds (Section 354.28 (b)(1))
 - The relationship between minimum thresholds and each sustainability indicator (Section 354.28 (b)(2))
 - The effect of minimum thresholds on neighboring basins (Section 354.28 (b)(3))
 - The effect of minimum thresholds on beneficial uses and users (Section 354.28 (b)(4))
 - How minimum thresholds relate to relevant federal, state, or local standards (Section 354.28 (b)(5))
 - The method for quantitatively measuring minimum thresholds (Section 354.28 (b)(6))

- How measurable objectives were developed, including the following:
 - The methodology for setting measurable objectives (Section 354.30)
 - The methodology for setting interim milestones (Sections 354.30 (a), 354.30 (e), and 354.34 (g)(3))
- How undesirable results were developed, including:
 - The criteria defining when and where the undesirable effects (potential effects on beneficial uses and users of groundwater as described by the sustainability indicators) cause undesirable results (when the effects are significant and unreasonable), based on a quantitative description of the combination of minimum threshold exceedances (Section 354.26 (b)(2))
 - The potential causes of undesirable results (Section 354.26 (b)(1))
 - The effects of these undesirable results on the beneficial users and uses (Section 354.26 (b)(3))

4.1 Definitions

The SGMA legislation and regulations include a number of new terms relevant to the SMCs. These terms below use the definitions in the SGMA regulations (Section 351, Article 2). Where appropriate, additional explanatory text is added in *italics*. This explanatory text is not part of the official definitions of these terms. To the extent possible, plain language, with only a limited use of highly technical terms and acronyms, was used to assist as broad an audience as possible in understanding the development process and implications of the SMCs.

Groundwater-dependent ecosystem (GDE) refers to habitat, plant communities, and aquatic and terrestrial species that rely on surface or near surface water that is supported by groundwater.

Interconnected surface water refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer. Interconnected surface waters are parts of streams, lakes, or wetlands where the groundwater table is close enough to the ground surface to influence water in the lakes, streams, or wetlands or vice versa.

Interim milestone refers to a target value representing measurable groundwater conditions, in increments of 5 years, set by a Groundwater Sustainability Agency (Agency) as part of a Groundwater Sustainability Plan (Plan or GSP). Interim milestones are targets such as groundwater levels that will be achieved every 5 years to demonstrate progress towards sustainability.

Management area (MA) refers to an area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors.

Measurable objectives (MOs) refer to specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin. Measurable objectives are goals that the Plan is designed to achieve.

Minimum thresholds (MTs) refer to numeric values for each sustainability indicator that are used to define undesirable results. Minimum thresholds are established at representative monitoring sites. Minimum thresholds are indicators of where an unreasonable condition might occur. For example, a particular groundwater level might be a minimum threshold if lower groundwater levels would result in a significant and unreasonable reduction of groundwater in storage.

Representative monitoring site (RMS) refers to a monitoring site within a broader network of sites that typifies one or more conditions within the basin or an area of the basin. This term is synonymous with representative well site.

Sustainability indicator refers to the set of six conditions defined by the California Department of Water Resources (DWR) that may be present in a basin that may result in effects, when significant and

unreasonable, that cause undesirable results (defined below), and impact sustainability of the basin as described in California Water Code Section 10721(x).

Uncertainty refers to a lack of understanding of the basin setting that significantly affects the Agency's¹ ability to develop SMCs and appropriate projects and management actions in the Plan,² or to evaluate the efficacy of Plan implementation, and therefore may limit the ability to assess whether a basin is being sustainably managed.

Undesirable result refers to the definition provided in Section 10721 of SGMA, which states that:

“Undesirable result means one or more of the following effects caused by groundwater pumping occurring throughout the basin:

- (1) *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.*
- (2) *Significant and unreasonable reduction of groundwater storage.*
- (3) *Significant and unreasonable seawater intrusion.*
- (4) *Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.*
- (5) *Significant and unreasonable land subsidence that substantially interferes with surface land uses.*
- (6) *Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.”*

Section 354.26 of the SGMA regulations states that “The criteria used to define when and where the effects of the groundwater conditions cause undesirable results shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.”

4.2 Sustainability Goal [§354.24]

§354.24 Sustainability Goal. Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including information from the basin setting used to establish the sustainability goal, a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon.

¹ The San Antonio Basin Groundwater Sustainability Agency (SABGSA) is the Agency referred to in this definition.

² The San Antonio Creek Valley Groundwater Basin Groundwater Sustainability Plan (SAB GSP) is the Plan referred to in this definition.

Per Section 354.24 of the SGMA regulations, the sustainability goal for the Basin has three parts:

- A description of the sustainability goal
- A discussion of the measures that will be implemented to ensure the Basin will be operated within sustainable yield
- An explanation of how the sustainability goal is likely to be achieved

Sustainability Goal: The goal of this GSP is to sustainably manage the groundwater resources of the Basin for current and future beneficial uses of groundwater, including Barka Slough, through an adaptive management approach that builds on best available science and monitoring and considers economic, social, and other objectives of Basin stakeholders.

The GSP includes an existing monitoring program (refer to Section 5) that addresses each of the applicable sustainability indicators. If minimum thresholds are exceeded such that undesirable effects are likely, the GSP will identify management actions and projects that will be implemented to avoid an undesirable result (refer to Section 6).

4.2.1 Qualitative Objectives for Meeting Sustainability Goals

Qualitative objectives are designed to help stakeholders understand the overall purpose for sustainably managing groundwater resources (e.g., Avoid Chronic Lowering of Groundwater Levels) and reflect the local economic, social, and environmental values within the Basin. A qualitative objective is often compared to a mission statement. The qualitative objectives for the Basin are the following:

- **Avoid Chronic Lowering of Groundwater Levels**
 - Maintain groundwater levels that continue to support current and future groundwater uses and sustain the health of Barka Slough in the Basin.
- **Avoid Chronic Reduction of Groundwater in Storage**
 - Maintain sufficient groundwater volumes in storage to sustain current and planned groundwater use in prolonged drought conditions while avoiding impacts to Barka Slough resulting from groundwater pumping.
- **Avoid Degraded Groundwater Quality**
 - Maintain access to drinking water supplies.
 - Maintain access to agricultural water supplies.
 - Maintain quality consistent with current ecosystem uses.
- **Avoid Land Subsidence**
 - Reduce or prevent land subsidence that causes significant and unreasonable effects to groundwater supply, land uses, infrastructure, and property interests.
- **Avoid Depletion of Interconnected Surface Water**
 - Avoid significant and unreasonable effects to beneficial uses, including GDEs, caused by groundwater extraction.
 - Maintain sufficient groundwater levels to maintain areas of interconnected surface water as of January 2015 when SGMA was enacted.
- **Avoid Seawater Intrusion**
 - Not applicable due to the inland location of the Basin.

4.3 Process for Establishing Sustainable Management Criteria [§354.26(a)]

§354.26 Undesirable Results.

(a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

This section presents the process that was used to develop the SMCs for the Basin, including input obtained from Basin stakeholders, the criteria used to define undesirable results, and the information used to establish minimum thresholds and measurable objectives.

4.3.1 Public Input

The public input process was developed in conjunction with the GSA member agency's continued engagement of local stakeholders and interested parties on water issues. This included the formation of the Stakeholder Advisory Committee (SAC), whose members were selected by the GSA Board because they have an interest in maintaining a healthy agricultural and business community, good water quality, and a healthy environment. The SMCs and beneficial uses presented in this section were developed using a combination of information from public input, public meetings, comment forms, hydrogeologic analysis, and meetings with SAC members.

The general process for establishing SMCs included the following:

- Holding a series of SAC meetings and workshops that outlined the GSP development process and introduced stakeholders to SMCs.
- Conducting public meetings to present initial conceptual minimum thresholds and measurable objectives and receive additional public input. Three virtual meetings on SMCs were held.³

4.3.2 Criteria for Defining Undesirable Results [§354.26(b)(2) and (d)]

§354.26 Undesirable Results.

(b) The description of undesirable results shall include the following:

(2) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.

(d) An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.

³ See <https://sanantoniobasinga.org/meeting-agendas/> for details on the meetings and workshops.

Section 4.2.1 discusses the qualitative objectives for meeting sustainability goals. These goals were discussed in terms of avoiding undesirable results for each of the sustainability indicators. The general criteria used to define undesirable results in the Basin are as follows:

- There must be significant and unreasonable effects caused by pumping
- A minimum threshold is exceeded in a specified number of representative wells over a prescribed period
- Impacts to beneficial uses occur, including to GDEs and/or threatened or endangered species

These criteria may be refined during the 20-year GSP implementation period based on monitoring data and analysis.

4.3.3 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives [§354.28(b)(1),(c)(1)(A)(B), and (e)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by the uncertainty in the understanding of the basin setting.

(c) Minimum thresholds for each sustainability indicator shall be defined as follows:

(1) Chronic Lowering of Groundwater Levels. The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:

(A) The rate of groundwater elevation decline based on historical trend, water year type, and projected water use in the basin.

(B) Potential effects on other sustainability indicators.

(e) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.

The following information and data were used to establish minimum thresholds and measurable objectives for each of the sustainability indicators.

4.3.3.1 Avoid Chronic Lowering of Groundwater Levels

The information used for establishing the minimum thresholds and measurable objectives that pertain to chronic lowering of groundwater levels includes the following:

- Information gathered from the public meetings about the public's perspective of significant and unreasonable conditions and preferred current and future groundwater levels

- Historical groundwater level data plotted versus time from wells monitored by the U.S. Geological Survey (USGS), Los Alamos Community Service District (LACSD), Vandenberg Air Force Base (VAFB), and other agencies
- Depths and locations of existing wells
- Maps of current and historical groundwater level data
- Mapping of the location and types of GDEs
- Analysis of the potential for lowered groundwater levels to impact domestic and agricultural wells (see Section 3.2)
- An historical and projected future water budget for the Basin (described in Section 3.3) used to estimate the magnitude of annual storage reduction that has already occurred and may occur in the future, and to estimate the amount of pumping that can be sustained annually.

The monitoring network and protocols that will be used to measure groundwater levels at the representative monitoring sites are presented in Section 5. The data will be used to monitor groundwater levels and assess changes of groundwater in storage as discussed below.

4.3.3.2 Avoid Chronic Reduction of Groundwater in Storage

Groundwater levels can be used as a surrogate for assessing changes in groundwater in storage and evaluating whether basin-wide total groundwater withdrawals could lead to undesirable results. Therefore, the information that is used to establish minimum thresholds and measurable objectives for the chronic groundwater level decline sustainability indicator can also be used to avoid chronic reduction of groundwater in storage.

4.3.3.3 Avoid Degraded Groundwater Quality

The information used for assessing degraded groundwater quality thresholds includes the following:

- Historical groundwater quality data from wells in the Basin
- Municipal drinking water supply wells (LACSD and VAFB wells) via the SWRCB Division of Drinking Water (DDW) compliance monitoring program
- Domestic and irrigation wells via the SWRCB Irrigated Lands Regulatory Program (ILRP) and USGS National Water Information System (NWIS)
- Observation wells via the USGS Groundwater Ambient Monitoring and Assessment (GAMA) Program and SWRCB GeoTracker database
- Federal and state drinking water quality standards (SWRCB, 2019) and Basin water quality objectives (WQOs) presented in the Water Quality Control Plan for the Central Coastal Basin (Basin Plan) (RWQCB, 2019)
- Feedback about significant and unreasonable conditions from the GSA members and the public

The historical groundwater quality data used to establish thresholds are presented in Section 3.2.3.

Thresholds for contaminants (e.g., volatile organic compounds [VOCs]) are not proposed because assessment, source identification, and cleanup of these constituents of concern are regulated under the authority of state agencies, including the Central Coast Regional Water Quality Control Board (RWQCB). The GSA does not have the responsibility nor the authority to manage contaminants. It is, however, the responsibility of the GSA to ensure concentrations, if any, of these constituents present in groundwater prior to the enactment of SGMA in January 2015 are not increased as a result of pumping or actions taken by the GSA. Elevated concentrations of salts and nutrients (e.g., total dissolved solids [TDS], sulfate, chloride, and

nitrate) can impact beneficial uses, including drinking water and agricultural uses. Thus, minimum thresholds and measurable objectives are proposed for these constituents in accordance with the Basin Plan.

4.3.3.4 Avoid Land Subsidence

Minimum thresholds for subsidence were established to protect groundwater supply, land uses, infrastructure, and property interests from substantial subsidence that may lead to undesirable results. Changes in ground surface elevation are presently measured using Interferometric Synthetic Aperture Radar (InSAR) data available from DWR and the University NAVSTAR Consortium (UNAVCO) Continuous Global Positioning System (CGPS) ORES, located in the town of Los Alamos, near Los Alamos Park. The general minimum threshold is the absence of long-term land subsidence arising from groundwater pumping in the Basin. Section 3.2.4 includes a detailed discussion of the InSAR data provided by DWR and the measured land subsidence data collected by the UNAVCO CGPS.

As described in Section 3.1 of the GSP, the Principal Aquifers in the Basin include the Paso Robles Formation and the Careaga Sand. The Paso Robles Formation contains stream-deposited lenticular beds of sand, gravel, silt and clay; however, the fine-grained material that would be subject to subsidence are not laterally continuous, which tends to reduce the likelihood for significant subsidence. Total subsidence recorded by the UNAVCO station located in Los Alamos during the 20-year period of record (2000 to 2020) indicates a land subsidence rate of approximately 0.49 inches per year. There have been no reports from landowners of impacts resulting from subsidence.

To supplement the InSAR and UNAVCO data, an analysis of the potential for land subsidence to be a significant concern in this Basin is underway. The analysis includes an assessment of the soils and geology in this Basin and the degree to which they would be subject to subsidence and an assessment of the potential for significant and unreasonable subsidence to occur as a result of projected changes in future groundwater levels.

4.3.3.5 Avoid Depletion of Interconnected Surface Water

The information used for establishing minimum thresholds and measurable objectives for depletion of interconnected surface water includes the following:

- Available streamgauge data for Harris Canyon Creek and San Antonio Creek (presently there is no streamgauge in San Antonio Creek where it discharges into Barka Slough); this is a data gap
- Groundwater levels measured in shallow wells near Barka Slough, including multi-level completion wells, that indicate changes in vertical gradients that affect groundwater flow into Barka Slough
- Water budget computations used to estimate exchanges between surface water and groundwater at Barka Slough during historical and projected future time frames
- Studies that identify the extent and distribution of GDEs

4.3.4 Relationship between Individual Minimum Thresholds and Other Sustainability Indicators [§354.28(b)(2)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(2) The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

Section 354.28 of the SGMA regulations requires that the description of all minimum thresholds include a discussion about the relationship between the minimum thresholds for each sustainability indicator. In its BMP guidance for SMCs (DWR, 2017), DWR has clarified this requirement. First, the GSP must describe the relationship between each sustainability indicator's minimum threshold; in other words, describe why or how a groundwater level minimum threshold established at a particular RMS is similar to or different from groundwater level thresholds in nearby RMSs. Second, the GSP must describe the relationship between the selected minimum threshold and minimum thresholds for other sustainability indicators. For example, the GSP must describe how a groundwater level minimum threshold for chronic lowering of groundwater levels, if reached, would not trigger an undesirable result for land subsidence (because it had a more conservative threshold).

4.4 Representative Monitoring Sites

Minimum thresholds and measurable objectives are established at RMSs (also referred to as representative wells) that are deemed to be representative of local and basin-wide groundwater conditions in each Principal Aquifer. Representative wells were selected from a subset of the wells that have been monitored over time in the Basin and have the following characteristics:

- They have known well completion information and are screened exclusively within either the Paso Robles Formation or the Careaga Sand.
- They are spatially distributed to provide information across most of the Basin.
- They have a reasonably long record of data (period of record) so that trends can be determined.
- They have signatures (groundwater levels or water quality trends) that are representative of wells in the surrounding area.

See Section 5 for a detailed discussion of the rationale for selecting RMSs. In summary, the RMS network for groundwater level consists of 15 wells (8 wells in the Paso Robles Formation and 7 wells in the Careaga Sand) that will be used to help identify chronic reductions in groundwater levels and storage. The well located adjacent to Barka Slough, an area designated as a GDE, will be used to monitor potential changes in groundwater levels that may indicate a reduction in groundwater flow into the slough resulting in potential impacts to GDEs. One well is a municipal drinking water supply well operated by the LACSD. Five are production wells used for agricultural irrigation. While not ideal for use as a monitoring well, these five production wells are currently included as RMSs because of their location in the Basin, available well construction data, and a long period of record. These five wells have been matched individually with nearby observation wells (non-pumping wells) that provide comparable spatial coverage of the Basin and have known well construction and aquifer completion data, but do not have a long period of record. Therefore, the five sets of paired wells will continue to be monitored until the period of record for the observation wells is

adequate to identify trends in groundwater elevations and confirm the observation wells are representative of the pumping well to be eventually replaced in the monitoring program.

Minimum thresholds and measurable objectives have been established at these RMSs using measured groundwater elevation data and water quality data where available. Barka Slough is a GDE that receives both surface water and groundwater discharging from the underlying Careaga Sand. There is no streamgage at this time where San Antonio Creek discharges into the slough. Until a streamgage is installed, it will be necessary to establish a minimum threshold for surface water depletion on the basis of observed flow entering the slough, measured flow leaving the slough (measured at the Casmalia Streamgage), and groundwater levels measured at Well 16G3, located adjacent to the slough.

Although groundwater levels and groundwater in storage have decreased substantially over the period of record, no significant and unreasonable impacts to beneficial uses of groundwater (by agriculture, recreation, businesses, and municipal and domestic users) have been reported and there is no indication that wells have been going dry. It is likely that groundwater and surface water entering Barka Slough has decreased over time, but it is unclear to what extent this has been caused by pumping versus drying conditions in the region. There is no documented impact to the slough; however, significant and unreasonable impacts to beneficial uses of groundwater including the slough may occur in the future under assumed climate conditions and if current pumping trends continue (e.g., groundwater levels continue to decline).

Minimum thresholds and measurable objectives for chronic groundwater level decline are presented in Section 4.5, and minimum thresholds and measurable objectives for reduction of groundwater in storage are presented in Section 4.6. The potential for impacts to GDEs for the chronic lowering of groundwater levels sustainability indicator are discussed in Section 4.5 and for the interconnected surface water sustainability indicator in Section 4.10. Minimum thresholds and measurable objectives for degraded groundwater quality are discussed in Section 4.8 and for land subsidence in Section 4.9.

4.5 Chronic Lowering of Groundwater Levels Sustainable Management Criterion

4.5.1 Undesirable Results [§354.26(a),(b)(2),(c) and (d)]

§354.26 Undesirable Results.

(a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

(b) The description of undesirable results shall include the following:

(2) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.

(c) The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.

(d) An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.

Conditions that may lead to an undesirable result for groundwater levels in the Basin include the following:

- **Extended drought.** Extensive droughts may lead to excessively low groundwater levels and undesirable results. Short-term impacts due to drought are anticipated in the SGMA regulations with recognition that management actions need sufficient flexibility to accommodate drought periods and ensure short-term impacts can be offset by increases in groundwater levels or storage during normal or wet periods.
- **High rate of pumping in the Paso Robles Formation.** If the amount of pumping in the Paso Robles Formation exceeds the long-term rate of recharge derived from mountain front recharge, stream percolation, percolation of direct precipitation, septic return flow, irrigation return flow, and discharges from the Careaga Formation (in western portion of the Basin), then groundwater levels may decline, which could affect Paso Robles Formation well production, groundwater discharge into Barka Slough, and GDEs.
- **High rate of pumping in the Careaga Sand.** If the amount of pumping in the Careaga Sand exceeds the long-term rate of natural recharge derived from mountain front recharge, stream percolation, percolation of direct precipitation, septic return flow, irrigation return flow, and recharge from the Paso Robles Formation, then groundwater levels may decline, which could affect Careaga Sand well production, reduce groundwater discharge into Barka Slough, and GDEs.

Significant and unreasonable lowering of groundwater levels in the Basin are characterized as follows:

- Groundwater levels in the Paso Robles Formation or Careaga Sand drop below the minimum threshold (see Section 4.5.2) after average and above-average precipitation periods in 20 percent of representative wells for three consecutive quarters. By disqualifying periods of below-average precipitation or periods of drought that result in lowering of groundwater levels, this approach focuses on periods when groundwater levels are expected to increase (due to average or above-average precipitation) to identify groundwater level decline associated with groundwater pumping.
- An acute or chronic, measurable impact to GDEs associated with interconnected surface water (see Section 4.10), specifically Barka Slough, caused by groundwater pumping in the Basin (during periods of average or above-average precipitation).
- Existing agricultural, municipal, and domestic wells are unable to produce historical average quantities of water due to chronic decline in groundwater levels (e.g., groundwater levels approaching or dropping below well top of screen elevations).

As discussed in Section 3.3.1, groundwater levels have reportedly declined over 140 feet in some areas of the Basin during the period of record. Additionally, from 1981 through 2018, an estimated decrease of 336,000 AF of groundwater in storage occurred in the Basin (see Section 3.3). Based on input from water users in the Basin, consultation with the California Department of Fish and Wildlife, and review of available water level data, no significant and unreasonable results associated with groundwater level decline have been observed in the Basin. However, if current rates of pumping continue (see Section 3.3.5), it is likely that undesirable results would occur in the future, particularly if the effects of climate change are observed.

4.5.2 Minimum Thresholds [§354.28(a),(b)(1),(c)(1)(A)(B),(e), and (d)]

§354.28 Minimum Thresholds.

(a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.

(b) The description of minimum thresholds shall include the following:

(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by the uncertainty in the understanding of the basin setting.

(c) Minimum thresholds for each sustainability indicator shall be defined as follows:

(1) Chronic Lowering of Groundwater Levels. The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:

(A) The rate of groundwater elevation decline based on historical trend, water year type, and projected water use in the basin.

(B) Potential effects on other sustainability indicators.

(e) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.

(d) An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.

Section 354.28(c)(1) of the SGMA regulations states that “The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results.” Minimum thresholds in the Basin are set based on historical low groundwater levels in representative wells (see Table 4-1), plus an additional 10 feet. The historical low groundwater level was selected to recognize the Basin has experienced a chronic lowering of groundwater levels without undesirable results to date. Setting the minimum threshold an additional 10 feet below the historical low groundwater level allows time for project and management actions to be implemented, recognizing that no significant and unreasonable effects have been observed during the historical period. Results of the well impact analysis presented in Section 3.2 indicate that the majority of the agricultural and domestic wells can tolerate additional groundwater level decline without experiencing groundwater levels

falling below the top of well screen elevations. These thresholds are established for representative monitoring sites in different parts of the Basin, reflecting conditions in those areas.

Table 4-1 includes the selected water level elevations for the minimum thresholds established for the Paso Robles Formation and Careaga Sand. Appendix D of the GSP presents a well location map and hydrographs showing the minimum thresholds for each representative well that will be used to monitor for chronic lowering of groundwater levels.

Table 4-1. Chronic Lowering of Groundwater Levels Minimum Thresholds and Measurable Objectives for the Paso Robles Formation and the Careaga Sand

RMS ID ¹	Well Type	Minimum Threshold (feet NAVD 88)	Measurable Objective (feet NAVD 88)
Paso Robles Formation			
LACSD 4	Existing Production Well	418	473
30D1	Existing Production Well ² (Awaiting Access Agreement)	354	427
SACC 1	Existing Observation Well	353	420
22K3	Existing Production Well ² (Awaiting Access Agreement)	357	391
SALS	Existing Observation Well	410	436
20Q2	Existing Production Well ² (Awaiting Access Agreement)	312	356
SACR 3	Existing Observation Well	234	285
2M1	Existing Production Well	258	294
Careaga Sand			
25D1	Existing Production Well (Awaiting Access Agreement)	636	672
13C1	Existing Observation Well	576	601
24E1	Existing Production Well ² (Awaiting Access Agreement)	218	272
SACR 1	Existing Observation Well	303	340
34P1	Existing Production Well ²	370	388
SAHC	Existing Observation Well	372	385
16G3	Existing Observation Well	246	258

Notes

¹ Refer to Figure 3-12 in Section 3 and Appendix D for representative well locations.

² Production well proposed to be replaced with subsequent observation well.

LACSD = Los Alamos Community Service District

NAVD 88 = North American Vertical Datum of 1988

RMS = representative monitoring site

4.5.2.1 Minimum Thresholds for the Paso Robles Formation

As discussed previously, the minimum thresholds for the Paso Robles Formation are based on historical low groundwater levels in representative wells, plus an additional 10 feet (see Table 4-1). The historical low groundwater level was selected to recognize the Basin has experienced a chronic lowering of groundwater levels without undesirable results to date. Setting the minimum threshold an additional 10 feet below the historical low groundwater level allows time for project and management actions to be implemented, recognizing that no significant and unreasonable effects have been observed during the historical period.

4.5.2.2 Minimum Thresholds for the Careaga Sand

As discussed previously, the minimum thresholds for the Careaga Sand are based on historical low groundwater levels in representative wells, plus an additional 10 feet of decline (see Table 4-1). The historical low groundwater level was selected to recognize the Basin has experienced a chronic lowering of groundwater levels without undesirable results to date. Setting the minimum threshold an additional 10 feet below the historical low groundwater level allows time for project and management actions to be implemented, recognizing that no significant and unreasonable effects have been observed during the historical period.

4.5.2.3 Relationship between Individual Minimum Thresholds and Relationships to Other Sustainability Indicators [§354.28(b)(2) and (d)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(2) The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

(d) An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.

Groundwater level minimum thresholds can potentially influence other sustainability indicators, such as the following:

- **Avoid Chronic Reduction of Groundwater in Storage.** Changes in groundwater levels reflect changes in the amount of groundwater in storage. Pumping at, or less than, the sustainable yield will maintain average groundwater levels in the Basin. Likewise, the groundwater level minimum thresholds will maintain an adequate amount of groundwater in storage over an extended period when pumping is equal to or less than the sustainable yield. Therefore, the groundwater level minimum thresholds will not result in long-term significant or unreasonable change of groundwater in storage.
- **Avoid Degraded Groundwater Quality.** A significant and unreasonable condition for groundwater quality is the increase in concentration of constituents of concern exceeding Basin WQOs or state or federal maximum contaminant levels (MCLs) or secondary maximum contaminant levels (SMCLs) (regulatory thresholds) for drinking water caused by lowering of groundwater levels induced by groundwater pumping. Maintaining groundwater levels above minimum thresholds helps minimize the potential for

experiencing degraded groundwater quality (since enactment of SGMA in 2015) or exceeding regulatory thresholds for constituents of concern in drinking water and agricultural wells. Groundwater quality could be affected through two processes:

1. Low groundwater levels in an area could cause deeper, poor-quality groundwater to flow into existing supply wells. Groundwater level minimum thresholds are set below current groundwater levels, meaning a flow of deep, poor-quality groundwater could occur in the future at or below minimum threshold levels. Although no point-source groundwater contamination has been identified in the Basin, the Careaga Sand is underlain by marine deposits. Consequently, groundwater within these underlying marine deposits likely contains increased salt concentrations and is of poorer quality than the groundwater within the overlying Careaga Sand. Should groundwater quality degrade due to lower groundwater levels, the groundwater level minimum thresholds will be reviewed.
 2. Changes in groundwater levels arising from management actions implemented by the GSA to achieve sustainability could change groundwater gradients, which could cause poor-quality groundwater to flow towards supply wells that would not have otherwise been impacted. Examples of these actions may include installation of groundwater recharge facilities (e.g., gravity stormwater recharge or aquifer recharge with recharge wells using treated wastewater). Because these kinds of projects are subject to review under the California Environmental Quality Act, concerns about the potential to introduce or mobilize contaminant plumes would be evaluated before such a project could be implemented.
- **Avoid Land Subsidence.** A significant and unreasonable condition for subsidence is permanent pumping-induced subsidence that substantially interferes with surface land use. Subsidence is caused by dewatering and compaction of clay-rich sediments in response to lowering groundwater levels. Very small amounts of ground surface elevation fluctuations have been reported across the Basin and are within the measurement margin of error. The groundwater level minimum thresholds are set just below existing and historical groundwater levels, which could induce a minor amount of additional subsidence. However, the local soils and geological conditions are less susceptible to compaction and subsidence because there are no known thick clay layers that extend across the full area where the Paso Robles Formation is present (although some clay layers are distinctly present in localized areas). Groundwater levels would likely have to be substantially lower than are predicted to occur in the future to produce significantly more subsidence. Should significant and unreasonable subsidence be observed from lowering groundwater levels, the groundwater level minimum thresholds will be raised to avoid this subsidence.
 - **Avoid Depletion of Interconnected Surface Water.** A significant and unreasonable condition for depletion of surface water is a pumping-induced reduction in groundwater discharge to surface water and resulting impacts GDEs. As discussed in Section 4.10, groundwater levels that continue to decline below historical levels may have an impact on GDEs. Although the minimum thresholds for groundwater levels are set 10 feet lower than historically observed, no significant or unreasonable effects have been observed in association with interconnected surface water during periods of historical low groundwater levels. In order to avoid impacts to Barka Slough, a groundwater level minimum threshold has been established at an RMS well (16G3) located adjacent to Barka Slough. At this location, the groundwater level minimum threshold is set at 15 feet (246 feet NAVD 88) below the average surface elevation of the slough (261 feet NAVD 88). This minimum threshold was selected because it represented the lowest rooting depth that plants living in the slough would likely have. Capillary action in the fine-grained wetland sediments will also bring water farther up (as much as several feet) into the vicinity of the plant roots.
 - **Avoid Seawater Intrusion.** This sustainability indicator is not applicable to this Basin.

The minimum thresholds set for chronic groundwater level decline are protective of all beneficial uses and do not result in undesirable effects for the other sustainability indicators.

4.5.2.4 Effects of Minimum Thresholds on Neighboring Basins [§354.28(b)(3)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

According to DWR Bulletin 118, there is no adjacent downstream groundwater basin; therefore, this section of the SGMA regulations is not applicable to the Basin or this GSP. However, pumping in the Basin may result in a lowering of groundwater levels thus reducing groundwater flow into Barka Slough and then reducing flow to surface water that exits the Basin in San Antonio Creek and flows west toward the Pacific Ocean.

4.5.2.5 Effects of Minimum Thresholds on Beneficial Uses and Land Uses [§354.28(b)(4)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

The groundwater level minimum thresholds have been selected to protect beneficial uses in the Basin while providing a reliable and sustainable groundwater supply. They are based on the assumption that continued water level decline will likely result in undesirable results and impacts to beneficial uses, including GDEs in Barka Slough.

As presented in Section 3.2, a comparison of recent groundwater levels (October 2018) and top of screen elevation for domestic and agricultural wells (for wells with reported construction information) located in the Basin indicated no significant or unreasonable result would occur if groundwater levels were to reach the minimum threshold.

4.5.2.6 Relevant Federal, State, or Local Standards [§354.28(b)(5)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.

No federal, state, or local standards exist for chronic lowering of groundwater levels.

4.5.2.7 Methods for Quantitative Measurement of Minimum Thresholds [§354.28(a) and (b)(6)]

§354.28 Minimum Thresholds.

(a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.

(b) The description of minimum thresholds shall include the following:

(6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

Groundwater level minimum thresholds will be directly measured from existing monitoring wells. The groundwater level monitoring program will be conducted in accordance with the monitoring plan outlined in Section 5 and will consist of collecting groundwater level measurements that reflect non-pumping conditions. The groundwater level monitoring program will be designed and conducted to meet the requirements of the technical and reporting standards included in the SGMA regulations. As discussed in Section 4.5.1, the potential exists for undesirable results to occur if minimum thresholds are exceeded in 20 percent of the representative wells for three consecutive quarters.

4.5.3 Measurable Objectives [§354.30(a),(b),(c),(d), and (g)]

§354.30 Measurable Objectives.

- (a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.
- (b) Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.
- (c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.
- (d) An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.
- (g) An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.

The measurable objectives for chronic lowering of groundwater levels provides a target to be reached over the 20-year GSP implementation period to ensure reliable access to groundwater through dry hydrologic periods, such as the dry period from 2012 through 2016. Measurable objectives for chronic lowering of groundwater levels provide operational flexibility above minimum threshold levels to ensure that the Basin can be managed sustainably over a reasonable range of climate and hydrologic variability. Measurable objectives may change after GSP adoption, as new information and hydrologic data become available.

4.5.3.1 Methodology for Setting Measurable Objectives

Measurable objectives were established to meet the sustainability goal and were based on trends in historical groundwater level data, historical precipitation data, and input from the SAC. The measurable objective levels were set so that: (1) declining water level trends caused by pumping do not occur and (2) there is enough groundwater in storage to get through a multi-year drought as was observed in 2012 through 2016 without undesirable results. Table 4-1 includes the estimated elevations for the measurable objectives established for the Paso Robles Formation and the Careaga Sand. Hydrographs showing the measurable objectives are presented in Appendix D.

4.5.3.2 Measurable Objectives for the Paso Robles Formation

The measurable objectives for the Paso Robles Formation are the groundwater levels measured at each RMS prior to the recent drought beginning in 2012. These levels were selected using available groundwater elevation monitoring data and climatic data.

4.5.3.3 Measurable Objectives for the Careaga Sand

The measurable objectives for the Careaga Sand are the groundwater levels measured at each RMS prior to the recent drought beginning in 2012. These levels were selected using available groundwater elevation monitoring data and climatic data.

4.5.4 Interim Milestones [§354.30(e)]

§354.30 Measurable Objective.

(e) Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin with 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.

Interim milestones show how the GSA would move from current conditions to meeting the measurable objectives in the 20-year GSP implementation horizon. For this Basin, interim milestones are proposed every 5 years, beginning after the GSP is submitted in 2022 and continuing through 2042 (see Table 4-2). A period of 2 years following submittal of this GSP has been allotted to allow time for planning and funding of projects and management actions to be initiated. After the 2-year planning period, interim milestones identify target groundwater levels to be achieved every 5 years so that progress toward reaching the measurable objective target can be evaluated. Achievement of these targets will depend on both the effectiveness of any set of projects and management actions but also climate (precipitation) during that time. If new data identify undesirable results in the future, additional or modifications to existing interim milestones may be proposed as part of a GSP update that is planned for every 5 years.

Table 4-2. Chronic Lowering of Groundwater Levels Interim Milestones for the Paso Robles Formation and the Careaga Sand

RMS ID ¹	Interim Milestones (feet NAVD 88)				
	2020	2027	2032	2037	2042 ³
Paso Robles Formation					
LACSD 4	432	441	451	462	473
30D1 ²	374	385	399	413	427
SACC 1	368	379	393	406	420
22K3 ²	372	376	381	386	391
SALS	422	425	429	432	436
20Q2 ²	322	329	338	347	356
SACR 3	250	257	266	276	285
2M1	268	273	280	287	294
Careaga Sand					
25D1	661	663	666	669	672
13C1	590	592	595	598	601
24E1 ²	252	256	261	267	272
SACR 1	313	319	326	333	340
34P1 ²	384	385	386	387	388
SAHC	382	383	383	384	385
16G3	249	251	254	256	258

Notes

¹ Refer to Figure 3-12 in Section 3 and Appendix D for representative well locations.

² Production well proposed to be replaced with subsequent observation well.

³ Value is equal to the measurable objective at the RMS for the respective sustainability indicator.

LACSD = Los Alamos Community Service District

NAVD 88 = North American Vertical Datum of 1988

RMS = representative monitoring site

4.6 Reduction of Groundwater in Storage Sustainable Management Criterion

4.6.1 Undesirable Results [§354.26(a),(b)(2),(c), and (d)]

§354.26 Undesirable Results.

(a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

(b) The description of undesirable results shall include the following:

(2) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.

(c) The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.

(d) An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.

Conditions that may lead to an undesirable result for groundwater in storage in the Basin are related to chronic lowering of groundwater levels and include the following:

- **Extended drought.** Extensive droughts may lead to excessively low groundwater levels, a reduced amount of groundwater in storage, and undesirable results. Short-term impacts due to drought are anticipated in the SGMA regulations with recognition that management actions need sufficient flexibility to accommodate drought periods and ensure short-term impacts can be offset by increases in groundwater levels or storage during normal or wet periods.
- **High rate pumping in the Paso Robles Formation.** If the amount of pumping in the Paso Robles Formation exceeds the long-term rate of recharge derived from mountain front recharge, stream percolation, percolation of direct precipitation, septic return flow, irrigation return flow, and discharges from the Careaga Formation (in western portion of the Basin), then groundwater levels may decline, which could affect Paso Robles Formation well production, groundwater discharge into Barka Slough, GDEs, and the volume of groundwater in storage.
- **High rate pumping in the Careaga Sand.** If the amount of pumping in the Careaga Sand exceeds the long-term rate of natural recharge derived from mountain front recharge, stream percolation, percolation of direct precipitation, septic return flow, irrigation return flow, and recharge from the Paso Robles Formation, then groundwater levels may decline, which could affect Careaga Sand well production, reduce groundwater discharge into Barka Slough, GDEs, and the volume of groundwater in storage.

Significant and unreasonable reductions in the quantity of groundwater in storage are characterized as follows:

- Groundwater levels in the Paso Robles Formation or Careaga Sand drop below the minimum threshold (see Section 4.5.2) after average and above-average precipitation periods in 20 percent of representative wells for three consecutive quarters. By disqualifying periods of below-average precipitation or periods of drought that cause lowering of groundwater levels, this approach focuses periods when groundwater levels expected to increase to identify groundwater level decline associated with groundwater pumping.
- Reduction of groundwater in storage results in an inability to produce estimated annual volume of groundwater equal to the sustainable yield for the Basin determined using the water budget method described in this GSP.

The practical effect of this GSP for protecting against undesirable results arising from a reduction of groundwater in storage is that it encourages the maintenance of long-term stability in groundwater levels and storage during average hydrologic conditions over multiple years and decades. Maintaining long-term stability in groundwater levels maintains long-term stability in groundwater storage and prevents chronic declines, thereby providing beneficial uses and users with access to groundwater on a long-term basis and preventing undesirable results associated with groundwater withdrawals. Pumping at the long-term sustainable yield during drought years would likely temporarily lower groundwater levels and reduce the amount of groundwater in storage. Such short-term impacts due to drought are anticipated in the SGMA regulations with recognition that management actions need sufficient flexibility to accommodate drought periods and ensure short-term impacts can be offset by increases in groundwater levels or storage during normal or wet periods. Prolonged reductions in the amount of groundwater in storage could lead to undesirable results affecting beneficial users and uses of groundwater. In particular, groundwater pumpers that rely on water from shallow wells (e.g., domestic wells) in the Los Alamos and Harris Canyon areas of the Basin may be temporarily impacted by temporary reductions in the amount of groundwater in storage and lower groundwater levels in their wells. Domestic wells located in the fringe areas above the valley floor portion of the Basin could be affected by pumping in the lower portion of the Basin. There is a lack of water level data for shallow domestic wells, which is a data gap to be addressed in the Section 6 of this GSP.

4.6.2 Minimum Thresholds [§354.28(a),(b)(1),(c)(2),(e), and (d)]

§354.28 Minimum Thresholds.

(a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.

(b) The description of minimum thresholds shall include the following:

(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by the uncertainty in the understanding of the basin setting.

(c) Minimum thresholds for each sustainability indicator shall be defined as follows:

(2) Reduction of Groundwater Storage. The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.

(e) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.

(d) An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.

Section 354.28(c)(2) of the SGMA regulations states that “The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.”

The minimum threshold for reduction of groundwater in storage is based on the minimum thresholds for chronic level decline and therefore are established for the Basin as a whole, not for individual aquifers. Consequently, any reduction in storage that would cause an undesirable result in only a limited portion of the Basin, as determined through continuation of the groundwater elevation monitoring program, shall be addressed in that area or in areas where declining groundwater levels indicate management actions or projects will be effective.

In accordance with the SGMA regulation cited above, the minimum threshold metric is a volume of pumping per year, or an annual pumping rate. Conceptually, the sustainable yield is the total volume of groundwater

that can be pumped annually from the Basin on a long-term (multi-year/multi-decadal) basis without leading to undesirable results. As discussed in Section 3.3.5, absent the addition of supplemental water, the 2042 projected future long-term basin yield of the Basin under reasonable climate change assumptions is approximately 12,900 AFY.

This GSP adopts changes in groundwater levels as a proxy for the change of groundwater in storage metric. As allowed in Section 354.36(b)(1) of the SGMA regulations, an average of the groundwater elevation data at the RMSs will be reported annually as a proxy to track changes in the amount of groundwater in storage.

Based on well-established hydrogeologic principles, maintaining long-term stability in groundwater levels above the minimum threshold for chronic lowering of groundwater levels will limit continued depletion of groundwater from storage. Therefore, using groundwater elevation levels as a proxy, the minimum threshold for chronic reduction of groundwater in storage at each RMS is defined by the minimum threshold for chronic lowering of groundwater levels.

4.6.2.1 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators [§354.28(b)(2)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(2) The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

The minimum threshold for reduction of groundwater in storage is based on the groundwater level minimum thresholds established for chronic groundwater level decline at RMSs. Therefore, the concept of potential conflict between minimum thresholds at different locations in the Basin is not applicable.

The minimum threshold for reduction of groundwater in storage could influence other sustainability indicators. The minimum threshold for reduction of groundwater in storage was selected to avoid undesirable results for other sustainability indicators, as outlined below.

- **Avoid Chronic Lowering of Groundwater Levels.** Because groundwater levels will be used as a proxy for estimating groundwater pumping and changes in groundwater storage, the groundwater in storage sustainability criteria would not cause undesirable results for this sustainability indicator.
- **Avoid Degraded Groundwater Quality.** The minimum threshold proxy of long-term stability in groundwater levels helps minimize the potential for experiencing degraded groundwater quality or exceeding regulatory limits for constituents of concern in supply wells.
- **Avoid Land Subsidence.** Future groundwater levels would likely have to be substantially lower than are predicted to occur in the future to produce significant subsidence. Should significant and unreasonable subsidence be observed from future groundwater levels, the groundwater level minimum thresholds for this sustainability indicator will be raised to avoid this subsidence.
- **Avoid Depletion of Interconnected Surface Water.** A significant and unreasonable condition for depletion of surface water is a pumping-induced reduction in groundwater discharge to surface water and resulting impacts GDEs (Barka Slough). As discussed in Section 4.10, groundwater levels and related groundwater in storage that continues to decline below historical levels in the future may have an impact on GDEs. No

significant or unreasonable effects have been observed thus far in association with interconnected surface water during periods of historical low groundwater levels and groundwater in storage. In order to avoid impacts to Barka Slough, a groundwater level minimum threshold has been established at RMS well 16G3, located in Barka Slough, that is 15 feet (246 feet NAVD 88) below the average surface elevation of the slough (261 feet NAVD 88). This minimum threshold was selected because it represented the lowest rooting depth that plants living in the slough would likely have. Capillary action in the fine-grained wetland sediments will also bring water farther up (as much as several feet) into the vicinity of the plant roots.

- **Avoid Seawater Intrusion.** This sustainability indicator is not applicable to this Basin.

4.6.2.2 Effects of Minimum Thresholds on Neighboring Basins [§354.28(b)(3)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

According to DWR Bulletin 118, there is no adjacent downstream groundwater basin; therefore, this section of the SGMA regulations is not applicable to the Basin or this GSP. However, removing groundwater from storage in the Basin may result in a lowering of groundwater levels thus reducing groundwater flow into Barka Slough and then reducing flow to surface water that exits in the Basin in San Antonio Creek and flows west toward the Pacific Ocean.

4.6.2.3 Effects on Beneficial Uses and Land Uses [§354.28(b)(4)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

The minimum thresholds for reduction of groundwater in storage and lowering of groundwater levels have been established to avoid undesirable results. For this reason, groundwater serving beneficial uses (including GDEs) and land uses will not be adversely affected.

4.6.2.4 Relevant Federal, State, or Local Standards [§354.28(b)(5)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.

No federal, state, or local standards exist for reductions in groundwater storage.

4.6.2.5 Methods for Quantitative Measurement of Minimum Thresholds [§354.28(b)(6)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

The measurement program for evaluating the minimum thresholds for reductions in groundwater in storage will rely on the groundwater elevation monitoring program described previously for chronic lowering of groundwater levels (see Section 4.5). Groundwater levels (as a surrogate for change of groundwater in storage) that drop below the minimum threshold values for decline in groundwater levels in 20 percent of the same representative wells over three consecutive quarters may lead to long-term reduction of groundwater in storage.

4.6.3 Measurable Objectives [§354.30(a),(c),(d), and (g)]

§354.30 Measurable Objectives.

(a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.

(c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.

(d) An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.

(g) An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.

The sustainability indicators for avoiding chronic reductions of groundwater in storage use groundwater Interim milestones to show how the GSA would move from current conditions to meeting the measurable objectives in the 20-year GSP implementation horizon. For this Basin, interim milestones are proposed every 5 years, beginning after the GSP is submitted in 2022 and continuing through 2042 (see Table 4-1). A period of 2 years following submittal of this GSP has been allotted to allow time for planning and funding of projects and management actions to be initiated. After the 2-year planning period, interim milestones identify target groundwater levels to be achieved every 5 years so that progress toward reaching the measurable objective target can be evaluated. Achievement of these targets will depend on both the effectiveness of any set of projects and management actions but also climate (precipitation) during that time. If new data identify undesirable results in the future, additional or modifications to existing interim milestones may be proposed as part of a GSP update that is planned for every 5 years.

4.6.4 Interim Milestones [§354.30(e)]

§354.30 Measurable Objective.

(e) Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin with 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.

Interim milestones show how the GSA would move from current conditions to meeting the measurable objectives in the 20-year GSP implementation horizon. For this Basin, interim milestones for groundwater in storage are proposed every 5 years, beginning after the GSP is submitted in 2022 and continuing through

2042 (see Table 4-1). Because chronic reduction in storage indicators rely on groundwater levels as a proxy, interim milestones for storage are the same as those set for chronic water level declines. A period of 2 years following submittal of this GSP has been allotted to allow time for planning and funding of projects and management actions to be initiated. After the 2-year planning period, interim milestones identify target groundwater levels to be achieved every 5 years so that progress toward reaching the measurable objective target can be evaluated. Achievement of these targets will depend on both the effectiveness of any set of projects and management actions but also climate (precipitation) during that time. If new data identify undesirable results in the future, additional or modifications to existing interim milestones may be proposed as part of a GSP update that is planned for every 5 years.

4.7 Seawater Intrusion Sustainable Management Criterion (Not Applicable)

The seawater intrusion sustainability indicator is not applicable to this Basin.

4.8 Degraded Groundwater Quality Sustainable Management Criterion

This sustainability indicator takes into consideration protection of municipal drinking water supplies, domestic uses, and agricultural uses of groundwater in the Basin. For municipal wells and drinking water supplied by domestic wells, state and federal regulatory standards (SMCLs and MCLs) established by the SWRCB DDW and U.S. Environmental Protection Agency (EPA), respectively, were used to establish thresholds. For agricultural uses, thresholds were established using WQOs presented in the Basin Plan (RWQCB, 2019). The GSA has no responsibility to manage groundwater quality unless it can be shown that water quality degradation is caused by pumping in the basin or the GSA implements a project that degrades water quality.

4.8.1 Undesirable Results [§354.26(a),(b)(1),(b)(2), and (d)]

§354.26 Undesirable Results.

- (a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.
- (b) The description of undesirable results shall include the following:
- (1) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.
 - (2) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.
- (d) An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.

Conditions that may lead to an undesirable result for groundwater quality in the Basin include the following:

- **Concentrations of regulated contaminants** in untreated groundwater from private domestic wells, agricultural wells, or municipal wells exceed regulatory thresholds as a result of pumping or GSA activities.
- **Groundwater pumping or GSA activities** cause concentrations of total dissolved solids (TDS), chloride, sulfate, boron, sodium, and nitrate to increase and exceed WQOs since SGMA was enacted in January 2015.

4.8.2 Minimum Thresholds [§354.28(b)(1),(c)(4), and (e)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by the uncertainty in the understanding of the basin setting.

(c) Minimum thresholds for each sustainability indicator shall be defined as follows:

(4) **Degraded Water Quality.** The minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.

(e) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.

Section 354.28(c)(2) of the SGMA regulations states that “The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin.” The purpose of the minimum thresholds for constituents of concern in this Basin is to avoid increased degradation of groundwater quality from baseline concentrations measured since enactment of SGMA in January 2015. Minimum thresholds established for contaminants and for salts and nutrients are presented in the following subsections.

4.8.2.1 Contaminants

Minimum thresholds that pertain to contaminants measured in groundwater are as follows:

- No minimum thresholds have been established for contaminants because state regulatory agencies, including RWQCB and DTSC, have the responsibility and authority to regulate and direct actions that address contamination.

Groundwater quality samples have been collected and analyzed throughout the Basin for various studies and programs. A broad survey of groundwater quality has been conducted by USGS as part of its GAMA Program. Historical groundwater quality data is available from USGS NWIS and the SWRCB GeoTracker GAMA database. Water quality data was also obtained for the LACSD and VAFB wells as part of the SWRCB DDW compliance monitoring program.

Except for the SWRCB ILRP, which reports select constituent concentrations in domestic wells associated with agricultural irrigation wells, groundwater quality data are not available for private domestic wells at this time. This is a data gap that will be addressed as part of the Projects and Management Actions section of this GSP. It is hoped that private domestic well owners will volunteer to be included in a monitoring program

to establish an initial baseline water quality database for private domestic wells. Once a baseline is established, exceedance of water quality standards in the Basin Plan in 20 percent of the private wells will be the basis for minimum thresholds for degraded groundwater quality at private domestic wells. It may be necessary to adjust the threshold for the percentage of wells exceeding the limit if there are many wells in a particular area that experience degraded groundwater quality. Table 4-3 presents regulatory standards for selected constituents of concern for drinking water listed in the Basin Plan (RWQCB, 2019) and California Code of Regulations, Title 22 drinking water quality standards (SWRCB, 2019), and concentration of select constituents of concern in groundwater around the time SGMA was enacted (January 2015).

Groundwater in the basin is of widely varying quality and generally decreases in quality from east to west. Concentrations of total dissolved solids (TDS) generally increase from east to west along San Antonio Creek; and are greatest near the Barka Slough, along western San Antonio Creek, and in Harris Canyon. Concentrations of boron, sodium, and chloride are also elevated in the Barka Slough area, along western San Antonio Creek, and in Harris Canyon. Detected chloride concentrations exceeding the WQO were collected from wells located in the western portion of the basin along San Antonio Creek, near Barka Slough, or in Harris Canyon. Boron concentrations exceeding the WQO were collected from wells located in the western portion of the basin along San Antonio Creek, near Barka Slough, or in Harris Canyon. Based on available information, the east to west trend of increasing TDS and salts concentrations is consistent between the Paso Robles Formation and the Careaga Sand. Analytical results from samples collected from a nested monitoring well (SACR) along San Antonio Creek, in the western portion of the Basin, indicate that concentrations of TDS decreased with depth.

Constituent concentrations detected at or above their respective MCL include arsenic, chromium, antimony, beryllium, cadmium, and lead. None of the samples from LACSD wells exceed MCLs. Samples collected in 2019 and analyzed for concentrations of antimony from three separate LACSD wells indicated concentrations equal to the MCL (0.01 mg/L). TDS, chloride, and nitrate concentrations indicate an increasing trend in LACSD well LACSD 4 located east of Los Alamos; however, concentrations of these constituents remain below MCLs, SMCLs, and WQOs.

Potential point sources of groundwater quality degradation were identified from the SWRCB GeoTracker data management system. Information for open/active contaminated sites and completed/case closed sites were reviewed. Based on available information, there are no known impacts to groundwater associated with these cases.

Table 4-3. Water Quality Standards for Selected Constituents of Concern

Constituent	MCL (mg/L)	SMCL ² (mg/L)	WQO (mg/L)
Nitrate ¹	10	--	5
Arsenic	0.01	--	--
Chromium ³	0.05	--	--
Antimony	0.006	--	--
Beryllium	0.004	--	--
Cadmium	0.005	--	--
Lead	0.015	--	--
Iron	--	0.3	--
Manganese	--	0.05	--
Boron	--	--	0.2
Chloride	--	500	150
Sodium	--	--	100
Sulfate	--	500	15
Total Dissolved Solids	--	1,000	600

Notes:¹: Nitrate concentration measured as nitrogen (U.S. EPA MCL)²: Upper consumer acceptance level³: State of California DDW MCL

--: No value

mg/L: Milligram per liter

MCL: Maximum contaminant level (drinking water)

SMCL: Secondary maximum contaminant level (drinking water)

WQO: Water quality objective (median groundwater objective)

References:

California State Water Resources Control Board. (2019). California Code of Regulations, Title 22. April 16.

Central Coast Regional Water Quality Control Board. (2019). Water Quality Control Plan for the Central Coastal Basin, June 2019 Edition. California Environmental Protection Agency.

4.8.2.2 Salts and Nutrients [§354.28(a) and (d)]**§354.28 Minimum Thresholds.**

(a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.

(d) An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.

Minimum thresholds pertaining to salts and nutrients measured in groundwater are as follows:

- Concentrations of TDS, chloride, sulfate, boron, sodium, and nitrate are equal to or less than WQOs in 20 percent of wells monitored or is equal to concentrations present when SGMA was enacted (January 2015).

The WQOs for each constituent presented in Table 4-2 are considered the minimum thresholds for salts and nutrients. In cases where the ambient (prior to January 2015) water quality exceeds the WQO, the ambient water quality is considered the minimum threshold.

4.8.2.3 Relationship between Individual Minimum Thresholds and Other Sustainability Indicators [§354.28(b)(2) and (c)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(2) The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

(c) The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.

The groundwater quality minimum thresholds were set based on state and federal drinking water quality standards as well as WQOs included in the Basin Plan.

Because SGMA regulations do not require projects or actions to improve groundwater quality beyond what existed prior to January 1, 2015, or beyond that required by other regulatory agencies with clear jurisdiction over the matter, there will be no direct actions under the GSP associated with the groundwater quality minimum thresholds. Therefore, there are no actions that directly influence other sustainability indicators.

- **Avoid Chronic Lowering of Groundwater Levels.** Groundwater quality minimum thresholds could influence groundwater level minimum thresholds by limiting the types of water that can be used for recharge to raise groundwater levels. Water used for recharge cannot exceed any of the groundwater quality minimum thresholds.
- **Avoid Chronic Reduction of Groundwater in Storage.** Nothing in the groundwater quality minimum thresholds promotes pumping in excess of the sustainable yield. Therefore, the groundwater quality minimum thresholds will not result in an exceedance of the groundwater storage minimum threshold.
- **Avoid Land Subsidence.** Nothing in the groundwater quality minimum thresholds promotes a condition that will lead to additional subsidence; therefore, the groundwater quality minimum thresholds will not result in a significant or unreasonable level of subsidence.
- **Avoid Depletion of Interconnected Surface Waters.** There is no information indicating that the groundwater quality minimum thresholds would have significant and unreasonable effects on interconnected surface waters. Nothing in the groundwater quality minimum thresholds promotes additional pumping or lower groundwater levels in areas where interconnected surface waters may exist.

Therefore, the groundwater quality minimum thresholds will not result in a significant or unreasonable depletion of interconnected surface waters.

- **Avoid Seawater Intrusion.** This sustainability indicator is not applicable to this Basin.

4.8.2.4 Effects of Minimum Thresholds on Neighboring Basins [§354.28(b)(3)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

According to DWR Bulletin 118, there is no adjacent downstream groundwater basin; therefore, this section of the SGMA regulations is not applicable to the Basin or this GSP.

4.8.2.5 Effects of Minimum Thresholds on Beneficial Uses and Land Uses [§354.26(b)(3)]

§354.26 Undesirable Results.

(b) The description of undesirable results shall include the following:

(3) Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.

The minimum thresholds for degraded groundwater quality have been established to avoid undesirable results. For this reason, groundwater serving beneficial uses (including GDEs) and land uses will not be adversely affected.

- **Agricultural land uses and users.** The degraded groundwater quality minimum thresholds generally benefit the agricultural water users in the Basin. For example, setting the minimum threshold for salts and nutrients at the WQOs described in the Basin Plan ensures that a supply of usable groundwater will exist for beneficial agricultural use.
- **Municipal uses and users.** The degraded groundwater quality minimum thresholds generally benefit the municipal water users in the Basin because there are existing regulatory programs and agencies that ensure there is an adequate supply of good quality groundwater for drinking water uses.
- **Domestic users.** The degraded groundwater quality minimum thresholds for municipal wells benefit the domestic water users in the Basin because these uses share the aquifer with municipal water supply wells. In addition, water quality standards for contaminants, salts, and nutrients are intended to be protective of drinking water uses.
- **Ecological land uses and users.** Although the degraded groundwater quality minimum thresholds do not directly benefit ecological uses, it can be inferred that the degraded groundwater quality minimum thresholds will benefit ecological water uses in the Basin because these thresholds limit future increases in concentrations of constituents of concern from what they are now, or prior to what they were when SGMA was enacted in January of 2015.

4.8.2.6 Relevant Federal, State, or Local Standards [§354.28(b)(5)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.

The degraded groundwater quality minimum thresholds specifically incorporate federal and state drinking water standards.

4.8.2.7 Methods for Quantitative Measurement of Minimum Thresholds [§354.28(b)(6)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

Degraded groundwater quality minimum thresholds will be directly measured from existing or new municipal (DDW compliance monitoring program), domestic (if landowners participate in monitoring) and agricultural supply wells (ILRP). Exceedances of regulatory standards and WQOs will be assessed on an annual basis in accordance with the monitoring program (refer to Section 5).

4.8.3 Measurable Objectives [§354.30(a),(b),(c),(d), and (g)]

§354.30 Measurable Objectives.

- (a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.
- (b) Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.
- (c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.
- (d) An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.
- (g) An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.

4.8.3.1 Measurable Objectives Pertaining to Contaminants

Improving groundwater quality is not a requirement under SGMA; however, protecting it from degradation is important to the beneficial users and uses of the resource in this Basin so that pumping can be maintained at desired levels. Thus, the measurable objective as it relates to contaminants is to maintain groundwater quality equal to or below regulatory standards or, equal to or below concentrations present in groundwater when SGMA was enacted.

4.8.3.2 Measurable Objectives Pertaining to Salts and Nutrients

The measurable objective as it relates to salts and nutrients (TDS, chloride, sulfate, boron, sodium, and nitrate) is to maintain groundwater quality equal to or below Water Quality Objectives presented in the Basin Plan, or equal to or below concentrations present in groundwater when SGMA was enacted.

4.8.4 Interim Milestones [§354.30(e)]

§354.30 Measurable Objective.

(e) Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin with 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.

Interim milestones show how the GSA anticipates moving from current conditions to meeting the measurable objectives. No significant or unreasonable results have been observed in the Basin in association with degraded groundwater quality. Therefore, no interim milestones are being proposed.

4.9 Land Subsidence Sustainable Management Criterion

4.9.1 Undesirable Results [§354.26(a),(b)(1),(b)(2), and (d)]

§354.26 Undesirable Results.

(a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

(b) The description of undesirable results shall include the following:

(1) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.

(2) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.

(d) An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.

Conditions that may lead to an undesirable result in the Basin include a shift in pumping locations or substantial increase in pumping beyond what has been observed, which could lead to a substantial decline in groundwater levels that could result in subsidence. Shifting or increasing a significant amount of pumping that causes groundwater levels to fall in an area that is susceptible to subsidence could trigger subsidence exceeding the minimum thresholds.

Locally defined significant and unreasonable conditions for land subsidence are land subsidence rates exceeding rates observed from 2000-2020 at the UNAVCO CGPS Station ORES, located in the town of Los

Alamos, near Los Alamos Park; and land subsidence that causes damage to groundwater supply, land uses, infrastructure, and property interests. For clarity, this SMC adopts two related concepts:

- **Land subsidence** is a gradual settling of the land surface caused by, among other processes, compaction of subsurface materials due to lowering of groundwater levels from groundwater pumping. Land subsidence from dewatering subsurface clay layers can be an inelastic process and the potential decline in land surface could be permanent. This can also be caused by exploitation of oil and gas from fields located within or near the basin.
- **Land surface fluctuation.** Land surface may rise or fall, elastically, in any one year. Land surface fluctuation may or may not indicate long-term permanent subsidence. This can be caused by tectonic activity in the earth.

By regulation, the ground surface subsidence undesirable result is a quantitative combination of subsidence minimum threshold exceedances. For the Basin, no long-term subsidence that impacts groundwater supply, land uses, infrastructure, and property interests is acceptable. Therefore, the ground surface subsidence undesirable results include the following:

- Substantially interferes with surface land uses.
- Land surface deformation that impacts the use of critical infrastructure and roads.
- Pumping results in land subsidence greater than minimum thresholds at the UNAVCO CGPS Station ORES.

Currently, ground surface elevation is being monitored at one continuous global positioning system site in the Basin as reported by UNAVCO from its Data Archive Interface.⁴ Since the beginning of data collection in 2000, the net vertical displacement is negative (0.82 feet). This means that the land surface elevation has decreased (negative displacement) 0.82 feet in the last 20 years. The Basin is located near the intersection of the Coastal Ranges and Transverse Ranges California Geomorphic Provinces. Consequently, the Basin is in a very tectonically active region. The 0.82 feet of vertical displacement measured at the UNAVCO station could be due to tectonic activity, groundwater extraction, oil and gas extraction, or a combination of the three. In addition, InSAR data provided by DWR shows that meaningful land subsidence did not occur during the period between June 2015 and June 2019 in the Basin (see Section 3.2.4).

Should potential subsidence be observed, the GSA will first assess whether the subsidence may be due to (1) groundwater pumping and (2) elastic processes (subsidence that will recover with rising groundwater). If the subsidence is not elastic or is due to pumping, the GSA will undertake a program to correlate the observed subsidence with measured groundwater elevations.

Staying above the minimum threshold will avoid the subsidence undesirable result and protect the beneficial uses and users from impacts to groundwater supply, land uses, infrastructure, and property interests.

⁴ The UNAVCO Data Archive Interface is available at <http://www.unavco.org/data/data.html>.

4.9.2 Minimum Thresholds [§354.26(c) and 354.28(a),(b)(1),(c)(5)(A)(B),(d), and (e)]

§354.26 Undesirable Results.

(c) The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.

§354.28 Minimum Thresholds.

(a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.

(b) The description of minimum thresholds shall include the following:

(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by the uncertainty in the understanding of the basin setting.

(c) Minimum thresholds for each sustainability indicator shall be defined as follows:

(5) Land Subsidence. The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. Minimum thresholds for land subsidence shall be supported by the following:

(A) Identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those affects.

(B) Maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.

(d) An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.

(e) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.

Section 354.28(c)(5) of the SGMA regulations states that “The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results.”

The subsidence minimum threshold is as follows and summarized in Table 4-4:

- The rate of subsidence does not exceed 0.05 feet (0.6 inches) per year for 3 consecutive years measured at the UNAVCO CGPS Station ORES.

This minimum threshold was selected because undesirable results have not been observed in the last 20 years and this rate of subsidence is consistent with what has been observed over the last 20 years at the UNAVCO CGPS Station.

Table 4-4. Land Subsidence Minimum Threshold

RMS ID	Minimum Threshold
	Rate of Land Subsidence (feet per year)
UNAVCO CGPS Station ORES	0.05 ¹

Notes

¹ And land subsidence that causes damage to groundwater supply, land uses, infrastructure, and property interests

RMS = representative monitoring site

UNAVCO = University NAVSTAR Consortium

CGPS = Continuous Global Positioning System

ORES = Name of UNAVCO CGPS Station

4.9.2.1 Relationship between Individual Minimum Thresholds and Other Sustainability Indicators [§354.28(b)(2)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(2) The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

Subsidence minimum thresholds have little or no impact on other minimum thresholds, as described below.

- **Avoid Chronic Lowering of Groundwater Levels.** Subsidence minimum thresholds will not result in significant or unreasonable lowering of groundwater levels.
- **Avoid Chronic Reduction of Groundwater in Storage.** The subsidence minimum thresholds will not change the amount of groundwater pumping and will not result in a significant or unreasonable change of groundwater in storage.
- **Avoid Degraded Groundwater Quality.** The subsidence minimum thresholds will not change the groundwater flow directions or gradients of groundwater pumping and therefore and will not result in a significant or unreasonable change in groundwater quality.

- **Avoid Depletion of Interconnected Surface Waters.** The groundwater level subsidence minimum thresholds will not change the amount or location of groundwater pumping and will not result in a significant or unreasonable depletion of interconnected surface waters.
- **Avoid Seawater Intrusion.** This sustainability indicator is not applicable in the Basin.

4.9.2.2 Effects of Minimum Thresholds on Neighboring Basins [§354.28(b)(3)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

The ground surface subsidence minimum thresholds are set to prevent any long-term subsidence that could harm groundwater supply, land uses, infrastructure, and property interests. Currently, no groundwater basin as defined by DWR Bulletin 118 or GSA has been created for this region and therefore this section of the SGMA regulations is not applicable to the Basin or GSP.

4.9.2.3 Effects of Minimum Thresholds on Beneficial Uses and Land Uses [§354.28(b)(4)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

The subsidence minimum thresholds are set to prevent subsidence that could harm groundwater supply, land uses, infrastructure, and property interests. Available data indicate that there is currently little subsidence occurring in the Basin that affects groundwater supply, land uses, infrastructure, and property interests. Therefore, there is no likely negative impact on any beneficial user.

4.9.2.4 Relevant Federal, State, or Local Standards [§354.28(b)(5)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.

There are no federal, state, or local regulations related to subsidence.

4.9.2.5 Methods for Quantitative Measurement of Minimum Thresholds [§354.28(b)(6)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

Minimum thresholds will be assessed using a combination of DWR-supplied InSAR data and UNAVCO CGPS station data (see Section 3.2.4).

4.9.3 Measurable Objectives [§354.30(a)]

§354.30 Measurable Objectives.

(a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.

4.9.3.1 Methodology for Setting Measurable Objectives

The measurable objectives are set based on maintaining current conditions and changes are measured by a combination of DWR-supplied InSAR data and UNAVCO CGPS station data.

4.9.3.2 Measurable Objectives for the Basin [§354.30(b),(c),(d), and (g)]

§354.30 Measurable Objectives.

(b) Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.

(c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.

(d) An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.

(g) An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.

The measurable objectives for subsidence represent target subsidence rates in the Basin. Available information does not suggest the occurrence of significant and unreasonable subsidence in the Basin. Therefore, the measurable objective for subsidence is the average rate of subsidence as measured at the UNAVCO CGPS Station ORES from 2000 to 2020 (0.5 inches per year) and is summarized in Table 4-5.

Table 4-5. Land Subsidence Measurable Objective

RMS ID	Measurable Objective
	Rate of Land Subsidence (feet per year)
UNAVCO CGPS Station ORES	0.04

Notes

RMS = representative monitoring site
UNAVCO = University NAVSTAR Consortium
CGPS = Continuous Global Positioning System
ORES = Name of UNAVCO CGPS Station

4.9.4 Interim Milestones [§354.30(e)]

§354.30 Measurable Objective.

(e) Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin with 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.

Interim milestones show how the GSA anticipates moving from current conditions to meeting the measurable objectives. No significant or unreasonable effect has been observed in the Basin in association with land subsidence. Therefore, no interim milestones are being proposed.

4.10 Depletion of Interconnected Surface Water Sustainable Management Criterion

4.10.1 Undesirable Results [§354.26(a),(b)(1)(2), and (d)]

§354.26 Undesirable Results.

(a) Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

(b) The description of undesirable results shall include the following:

(1) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.

(2) The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.

(d) An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.

Conditions that may lead to an undesirable result for interconnected surface water in the Basin include the following:

- **Groundwater level declines** caused by groundwater pumping in the basin could reduce the amount of groundwater discharging to interconnected surface water and Barka Slough resulting in an impact to GDEs.
- **Severe drought** that reduces mountain front recharge, streamflow percolation, percolation of direction precipitation, and recharge to the Paso Robles Formation and Careaga Sand; thus, lowering groundwater levels and reducing surface water flow into the slough, resulting in an impact to GDEs. Short-term impacts due to drought are anticipated in the SGMA regulations with recognition that management actions need sufficient flexibility to accommodate drought periods and ensure short-term impacts can be offset by increases in groundwater levels or storage during normal or wet periods.

Locally defined significant and unreasonable conditions for depletion of interconnected surface water were assessed using several resources:

- Potential GDE identification utilizing the NCCAG data set from DWR (see Figure 3-11)
- A biological assessment of Barka Slough completed in 2019 by AECOM to evaluate the potential effects that the development of the Vandenberg Dunes Golf Courses project located west of the Basin could have on federally and state listed species (see Section 3.2.6)
- Identification of interconnected surface water (see Section 3.2.5)

- Groundwater elevation monitoring data including calculations of vertical groundwater flow into the Slough (see Section 3.2.1.2)

Avoiding adverse impacts on beneficial uses of interconnected surface water present in the Basin and preserving existing habitat are the focus of this sustainability indicator. Direct uses of surface water (for recreation, irrigation, or municipal purposes) are not present or expected as a future significant beneficial use in the Basin, therefore the sustainability criterion for depletion of interconnected surface water is focused on avoiding impacts to GDEs and sensitive species. There is no intention at this time, nor a regulatory requirement, to create new habitat or restore habitat that existed prior to the enactment of SGMA in January of 2015. In conjunction with the NCCAG data set available from DWR, measured groundwater elevation data was used to identify locations within the Basin where groundwater levels were within 30 feet of ground surface. The Nature Conservancy Guidelines suggests that areas overlying groundwater by more than 30 feet may be removed from the GDE category since the depth is too great to support habitat (The Nature Conservancy, 2019). The evaluation mapped GDEs in the watershed that include both aquatic and riparian habitat types located in Barka Slough.

No studies were identified that evaluated historical or existing habitat condition at Barka Slough. Without completing additional assessment, it cannot be determined whether the Barka Slough's ability to support GDEs has changed over time as a result of drought conditions in the region or whether pumping in the basin has caused impacts. Groundwater levels measured in wells located near the Slough indicate that groundwater levels have fallen below the Slough elevation in a number of locations since about 1983. In addition, upward vertical gradients within the Careaga Sand near the Slough (see Figure 3-57) have been reduced. This indicates that groundwater flow into the Slough has likely declined. Surface water also discharges into the Slough; there is a strong correlation between precipitation and measured flow at the Casmalia Streamgage (11136100) located in San Antonio Creek west of Barka Slough. It is not known if surface water flow into the Slough has been decreasing due to the lack of a streamgage at the east end of the slough. This is a data gap that will be addressed in the projects and management actions section of the GSP. Due to gaps in recorded data at the Casmalia Streamgage (2003-2015) it is not possible to determine direct effect of pumping in the basin on measured surface water flow using the Casmalia Streamgage. Regardless, the existing condition supports significant habitat values. As a result, significant and unreasonable effects to GDEs at the Slough would include the following:

- Permanent loss or significant degradation of existing native riparian or aquatic habitat due to lowered groundwater levels and reduced surface water flow into Barka Slough caused by groundwater pumping.

A sustained drop in groundwater levels below root zones caused by groundwater pumping could result in permanent loss of GDEs and, as such, a monitoring program and management actions that are focused on preventing continued decline in groundwater levels is needed. Monitoring of groundwater levels in the Barka Slough area is being conducted by the GSA as part of existing Basin monitoring programs (see Section 5) to assess whether there is potential for a long-term decline in the health of the vegetation and eventual permanent habitat loss.

The surface water component of flow into the Slough is equally as important as groundwater discharge into the Slough. Currently no streamgage exists where surface water flow enters or exits the Slough. The Casmalia Streamgage is located over 2.5 miles west of the Slough and there appears to be groundwater use within this area. Due to a lack of streamgage data, the presence or absence of surface water flow entering and exiting the slough will be visually monitored during quarterly groundwater monitoring, as outlined in Section 5. Lack of surface water flow entering and exiting the slough would indicate that habitat could be impacted if groundwater does not continue to discharge into the Slough. All streams in the Basin have been classified as intermittent except for those located in Barka Slough (USGS, 2020). Consequently, surface water entering the Slough may not be observable during periods of reduced precipitation. During these

periods cessation of observable surface flow entering Barka Slough may or may not cause impacts unless groundwater levels near the Slough indicate that groundwater discharge to the Slough is also reduced and groundwater levels are not within the root zone for plants living in the slough. It is not known what the rooting depth is of all the plants living in the Slough, but they are expected to be within 30 feet of the surface of the Slough (The Nature Conservancy, 2019). The Arroyo Willow (*Salix lasiolepis*) has been identified in Barka Slough (see Figure 3-11). *Salix lasiolepis* has a maximum rooting depth of less than 3 feet (U.S. Department of Agriculture, 2021). Groundwater elevations in the Barka Slough area in October 2018 (see Figure 3-16 and Appendix D-3) were below the *Salix lasiolepis* maximum rooting depth in some areas of the slough. However, no impact to GDEs have been observed.

4.10.2 Minimum Thresholds [§354.28(a),(b)(1),(c)(6)(A)(B),(e), and (d)]

§354.28 Minimum Thresholds.

(a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.

(b) The description of minimum thresholds shall include the following:

(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by the uncertainty in the understanding of the basin setting.

(c) Minimum thresholds for each sustainability indicator shall be defined as follows:

(6) Depletions of Interconnected Surface Water. The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results. The minimum threshold established for depletions of interconnected surface water shall be supported by the following:

(A) The location, quantity, and timing of depletions of interconnected surface water.

(B) A description of the groundwater and surface water model used to quantify surface water depletion. If a numerical groundwater and surface water model is not used to quantify surface water depletion, the Plan shall identify and describe an equally effective method, tool, or analytical model to accomplish the requirements of this Paragraph.

(e) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.

(d) An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.

Section 354.28(c)(6) of the SGMA regulations states that “The minimum thresholds for depletion of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results.”

Avoiding adverse impacts on beneficial uses of interconnected surface water in the Basin is the focus of this sustainability indicator. Because direct uses of surface water for recreation, irrigation, or municipal purposes are not present or expected future significant beneficial uses of surface water in the Basin, the minimum

thresholds for depletion of interconnected surface water are focused on avoiding impacts to GDEs. The Barka Slough area is the only location in the Basin where groundwater is interconnected with surface water.

The Barka Slough exhibits a diverse and complex interaction between surface water and groundwater. Therefore, distinguishing between areas sustained by surface water flows and areas sustained by groundwater is not straightforward. The current GDEs have survived through a recent drought that saw historical low groundwater levels in nearby wells. When groundwater levels are above the historical lows, it can be inferred that GDEs are not adversely affected. As a result, groundwater levels measured at monitoring wells adjacent to the Slough and quarterly visual observations for presence or absence of surface water flow entering and exiting Barka Slough will be used to assess whether impacts to the Slough are likely to occur.

Minimum thresholds for interconnected groundwater and surface water include the following two elements and is summarized in Table 4-6:

- There is no observable surface water flow entering or leaving Barka Slough and there is no measurable surface water flow at the Casmalia Streamgage west of the slough.
This threshold was selected because surface water entering and exiting the Slough indicates that there is likely enough water to maintain the Slough habitat even if groundwater levels are low.
- If no surface flow is leaving the slough as defined in the previous bullet, the minimum threshold measured at well 16G3 (located adjacent to Barka Slough) would be equal to 15 feet (246 feet NAVD 88) below the average surface elevation of the slough (261 feet NAVD 88) for three consecutive quarterly monitoring events. This minimum threshold was selected because it represented the lowest rooting depth that plants living in the Slough would likely have. Capillary action in the fine-grained wetland sediments will also bring water farther up (as much as several feet) into the vicinity of the plant roots.

Table 4-6. Depletion of Interconnected Surface Water Minimum Thresholds

RMS ID	Minimum Threshold
Observation Point 1 ¹	Observable Surface Water Inflow
Observation Point 2 ¹	Observable Surface Water Outflow
Casmalia Streamgage	Measurable Surface Water Flow
16G3	246 ²

Notes

¹ See Figure 4-1 for locations of Observation Points 1 and 2. Observation Point 1 may be changed to a streamgage when one is installed.

² Value reported as feet North American Vertical Datum of 1988 (NAVD 88). To meet the minimum threshold, groundwater levels in well 16G3 must be equal to or below 246 feet NAVD 88 for three consecutive quarterly monitoring events.

RMS = representative monitoring site

Figure 4-1 shows the location of the representative monitoring well (16G3) within the identified GDE area (Barka Slough), the proposed location for visual observation of surface water flow entering Barka Slough and the location of the existing Casmalia Streamgage. Figure 4-2 shows the hydrograph for representative monitoring well 16G3, with the Slough average surface elevation, the measurable objective, and minimum threshold elevation superimposed.

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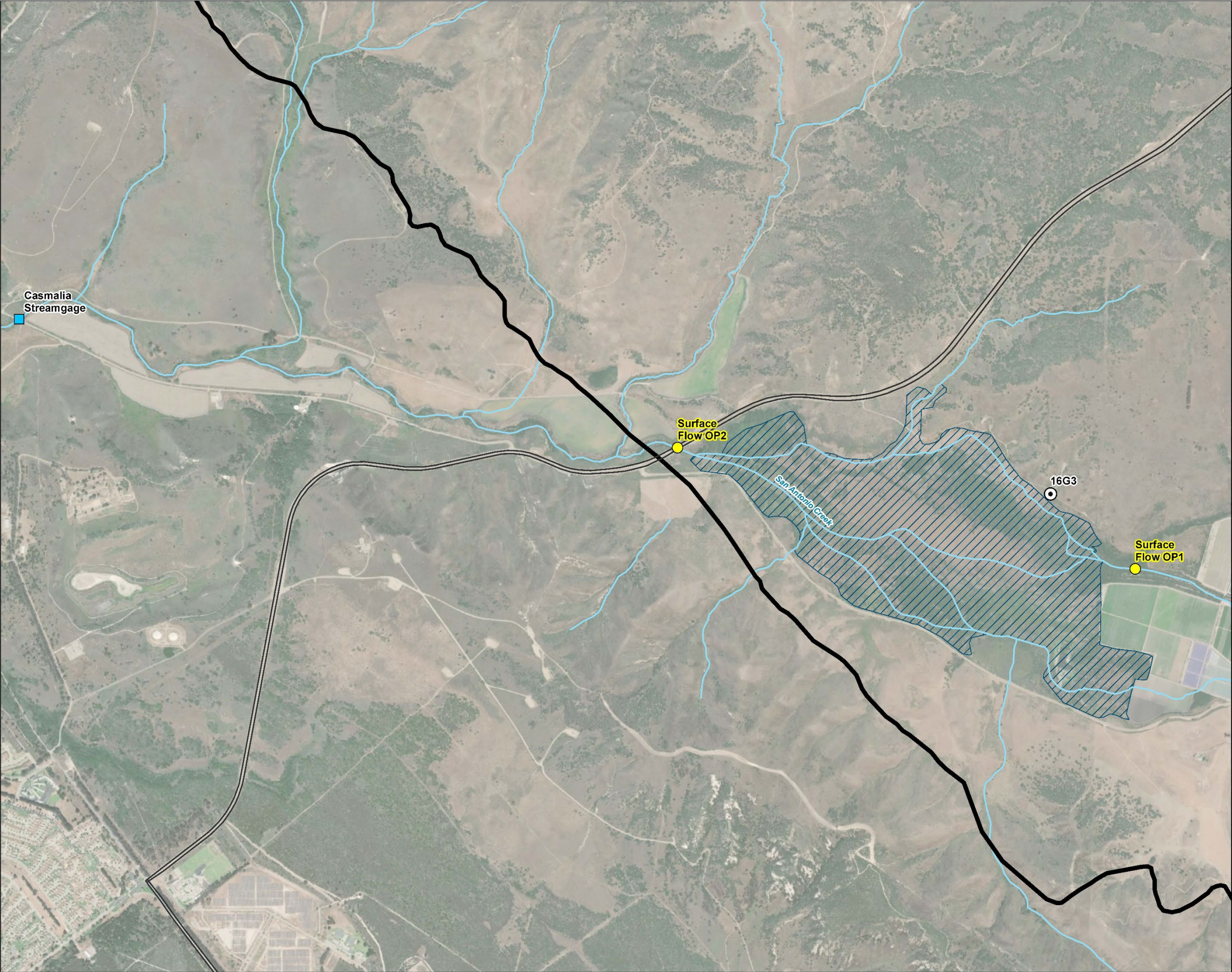


FIGURE 4-1
Interconnected Surface Water
Monitoring Network
Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

- LEGEND**
- Observation Point
 - Streamgage
 - Well
- All Other Features**
- San Antonio Creek or Tributary
 - Major Road
 - San Antonio Creek Valley Groundwater Basin
 - Barka Slough
 - City Boundary

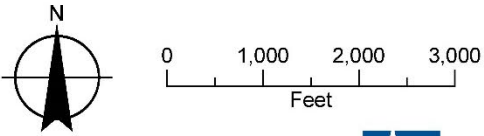
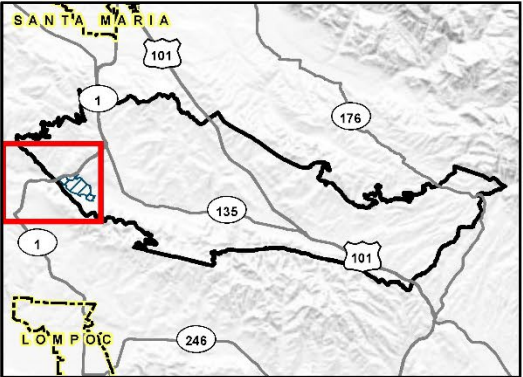
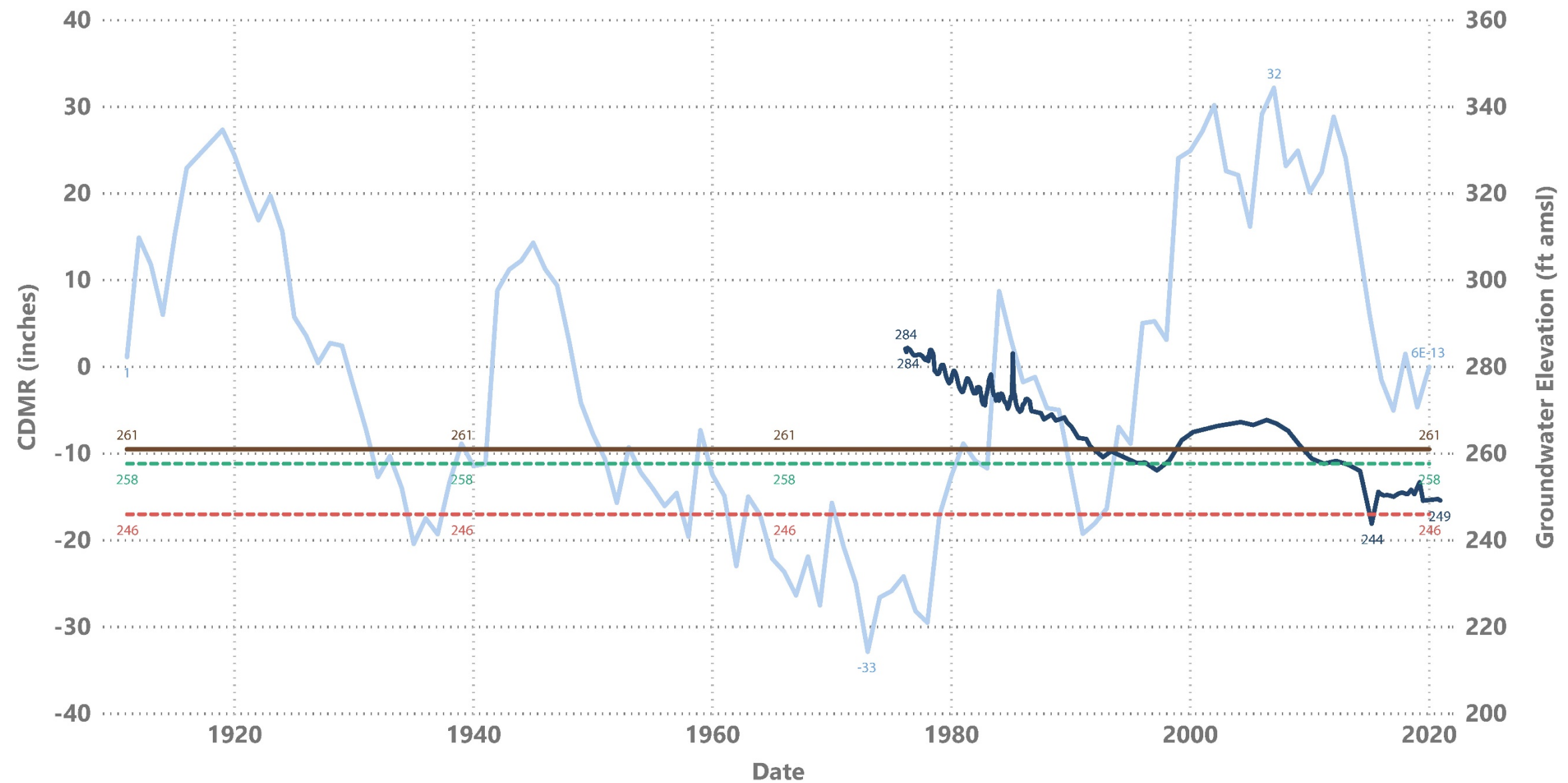



FIGURE 4-2
Representative Monitoring Site -
16G3 Hydrograph
 Groundwater Sustainability Plan
 San Antonio Creek Valley
 Groundwater Basin



- LEGEND**
- Cumulative Departure from Mean Annual Rainfall (CDMR)
 - Groundwater Elevation
 - Barka Slough Average Surface Elevation
 - Groundwater Dependent Ecosystem (GDE) Minimum Threshold
 - Measurable Objective (Pre-drought 2011)

NOTE
amsl: above mean sea level

Data Source: USGS



4.10.2.1 Relationship between Individual Minimum Thresholds and to Other Sustainability Indicators [§354.28(b)(2)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(2) The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.

Because of the interrelationship between groundwater level, changes in storage, and interconnected surface water, it is possible that one set of thresholds could affect the other set of thresholds for these indicators. The relationship between the depletion of interconnected surface water and the other sustainability indicators is presented below.

- **Avoid Chronic Lowering of Groundwater Levels.** The depletion of groundwater discharge to surface water to GDE minimum thresholds are related to groundwater level minimum thresholds because they are interdependent. If groundwater discharge to surface water depletion is suggested because groundwater levels reach GDE minimum thresholds, then monitoring, evaluations, and—potentially—management actions would be conducted in a timely manner to avoid impacts to GDEs.
- **Avoid Chronic Reduction of Groundwater in Storage.** Nothing about the GDE minimum thresholds promotes groundwater pumping in excess of the sustainable yield. Therefore, the GDE minimum thresholds will not result in an exceedance of the groundwater in storage minimum threshold.
- **Avoid Degraded Groundwater Quality.** The GDE minimum thresholds will not change the groundwater flow directions or gradients, and therefore will not result in a significant or unreasonable change in groundwater quality.
- **Avoid Land Subsidence.** Nothing about the GDE minimum thresholds promotes a condition that will lead to additional subsidence. Therefore, the GDE minimum thresholds will not result in a significant or unreasonable level of subsidence.
- **Avoid Seawater Intrusion.** This sustainability indicator is not applicable to this Basin.

4.10.2.2 Effects of Minimum Thresholds on Neighboring Basins [§354.28(b)(3)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.

As discussed in Section 3.1, the Basin is a closed basin; therefore, groundwater is not accounted for as an inflow or an outflow component of the water budget (see Section 3). However, depletion of interconnected surface waters is directly related to removing groundwater from storage in the Basin and lowering of groundwater levels. Lowering groundwater levels reduces the discharge of groundwater to surface water in Barka Slough. Surface water in Barka Slough exits the Basin in San Antonio Creek and flows west toward the

Pacific Ocean, becoming available to potential users outside the Basin. Currently, no groundwater basin as defined by DWR Bulletin 118 or GSA has been created for this region and, therefore, this section of the SGMA regulations is not applicable to the Basin or GSP.

4.10.2.3 Effects on Beneficial Uses and Land Uses [§354.28(b)(4)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.

The GDE minimum thresholds relating to depletion of interconnected surface water have been selected to avoid impacts to GDEs in the Basin while providing a reliable and sustainable groundwater supply. The minimum thresholds for reduction of groundwater in storage and lowering of groundwater levels have been established to avoid undesirable results. For this reason, groundwater serving beneficial uses (including GDEs) and land uses will not be adversely affected.

4.10.2.4 Relevant Federal, State, or Local Standards [§354.28(b)(5)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.

There are no federal, state, or local regulations related to interconnected surface water depletion other than those that are intended to protect aquatic and terrestrial threatened and endangered species. The thresholds and management actions described herein are intended to prevent impacts to these species and associated habitats.

4.10.2.5 Methods for Quantitative Measurement of Minimum Thresholds [§354.28(b)(6)]

§354.28 Minimum Thresholds.

(b) The description of minimum thresholds shall include the following:

(6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

As a surrogate for surface water flow measurements, groundwater levels will be measured in representative monitoring well 16G3 as well as quarterly visual observations for the presence or absence of surface water flow entering and existing Barka Slough as shown on Figure 4-3. Details of this monitoring program are presented in Section 5.

4.10.3 Measurable Objectives [§354.30(a),(b),(c),(d), and (g)]

§354.30 Measurable Objectives.

- (a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.
- (b) Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.
- (c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.
- (d) An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.
- (g) An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.

Groundwater and surface water exit the Basin as surface water flow from Barka Slough. Consequently, if surface water flow can be observed or measured exiting the Basin, then there is sufficient water available to GDEs in Barka Slough. If surface flow exiting Barka Slough ceased, there is a potential that there is no longer enough water, whether entering Barka Slough as groundwater or surface water, available to GDEs located in the slough.

The measurable objective for depletion of interconnected surface water is surface water flow measured at the Casmalia Streamgage equal to the average flow (1.5 cubic feet per second [cfs]) measured at the Casmalia Streamgage between 2015 and 2018 (since enactment of SGMA through the end of the historical and current water budget). Figure 4-3 shows the location of the Casmalia Streamgage in relation to Barka Slough as well as measured flow from 2015 through 2018. Daily measurements collected at the Casmalia Streamgage will be averaged during each 5 year GSP update period (i.e. 2027, 2032, 2037, and 2042) and compared to the measurable objective.

A second measurable objective is proposed for groundwater as a proxy for surface water that is intended to avoid impacts to the Slough. That measurable objective is equal to the groundwater elevation (258 feet NAVD 88) measured just prior to the last drought in March 2011 at well 16G3. To meet the measurable objective, groundwater levels in well 16G3 must be equal to or greater than 258 feet NAVD 88 for a minimum of three consecutive quarterly monitoring events. See Table 4-7 for a summary of depletion of interconnected surface water measurable objectives.

Table 4-7. Depletion of Interconnected Surface Water Measurable Objectives

RMS ID	Measurable Objectives
Casmalia Streamgage	1.5 ¹
16G3	258 ²

Notes

¹ Value reported as mean daily discharge measured in cubic feet per second (cfs) at the Casmalia Streamgage between 2015–2018.

² Value reported as feet North American Vertical Datum of 1988 (NAVD 88). To meet the measurable objective, groundwater levels in well 16G3 must be equal to or greater than 258 feet NAVD 88 for a minimum of three consecutive quarterly monitoring events.

RMS = representative monitoring site



Name ● Casmalia Streamgage ● Average Monthly Discharge (87 Acre-Feet)

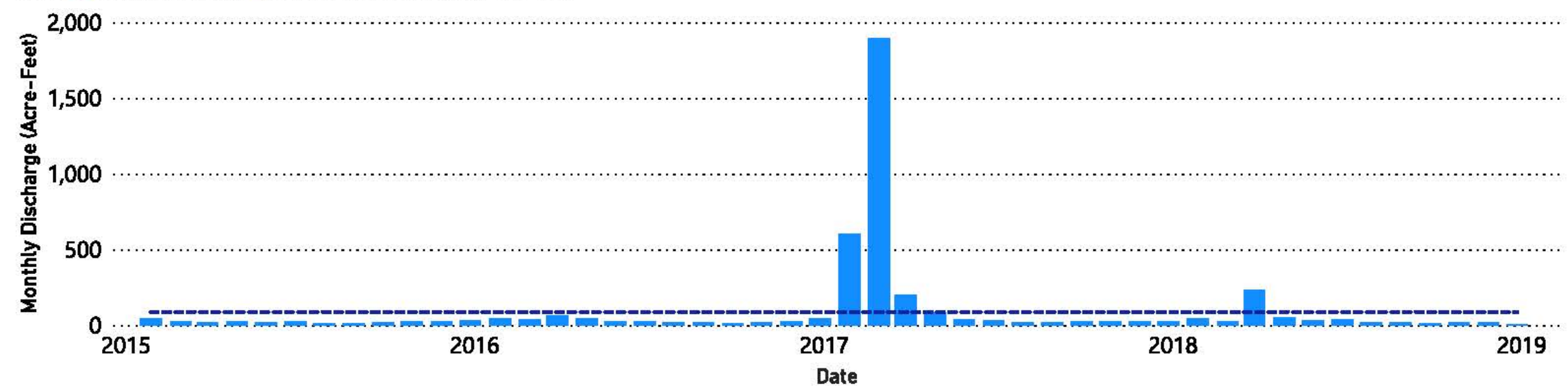


FIGURE 4-3
Casmalia Streamgage Location and Measured Flow
 Groundwater Sustainability Plan
 San Antonio Creek Valley Groundwater Basin

NOTE
 Data Sources: Bing, ESRI, PowerBI, USGS

4.10.4 Interim Milestones [§354.30(e)]

§354.30 Measurable Objective.

(e) Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin with 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.

Interim milestones show how the GSA anticipates moving from current conditions to meeting the measurable objectives. While no significant or unreasonable effects related to depletion of interconnected surface water have been observed in the Basin. Interim milestones are proposed for both surface water flow (as measured at the Casmalia Streamgage until a new streamgage is installed east of Barka Slough) and groundwater levels measured at RMS well 16G3. Table 4-8 presents measurable objectives and interim milestones for this sustainability indicator. It is anticipated that increasing groundwater level elevations basin-wide in order to achieve measurable objective for chronic groundwater level decline will result in higher groundwater levels and sustainable conditions at the Slough where groundwater is interconnected with groundwater.

Table 4-8. Depletion of Interconnected Surface Water Interim Milestones

RMS ID	Interim Milestones				
	2020	2027	2032	2037	2042 ³
Casmalia Streamgage ¹	0.2	0.5	0.8	1.1	1.5
16G3 ²	249	251	254	256	258

Notes

¹ All values reported as mean daily discharge measured in cubic feet per second (cfs) averaged over the previous 5 years.

² All values reported as feet North American Vertical Datum of 1988 (NAVD 88). To meet the interim milestone, groundwater levels in well 16G3 must be equal to or above the interim milestone for three consecutive quarterly monitoring events.

³ Value is equal to the measurable objective at the RMS for the respective sustainability indicator.

RMS = representative monitoring site

4.11 References and Technical Studies [§354.4(b)]

§354.4 General Information.

(b) Each Plan shall include the following general information: A list of references and technical studies relied upon by the Agency in developing the Plan. Each Agency shall provide to the Department electronic copies of reports and other documents and materials cited as references that are not generally available to the public.

- AECOM. (2019). *Biological Assessment, Potential Effects to California Red-legged Frog, El Segundo Blue Butterfly, Tidewater Goby, Unarmored Threespine Stickleback, and Beach Layia, Vandenberg Dunes Gold Courses Project, Vandenberg Air Force Base, Santa Barbara County*. September 25.
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- DWR. (2020, September). *SGMA Data Viewer*. Retrieved from California Department of Water Resources, SGMA Portal: <https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub>
- Hutchinson, C. B. (1980). *Appraisal of ground-water resources in the San Antonio Creek valley, Santa Barbara County, California: U.S. Geological Survey Open-File Report 80-750, 48 p.*
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- UNAVCO. (2020, September). *ORES - Overview | Station Page*. Retrieved from UNAVCO Web Site: <https://www.unavco.org/instrumentation/networks/status/nota/overview/ORES>
- UNAVCO. (2020). *UNAVCO Instrumentation Networks Map*. Retrieved September 29, 2020, from UNAVCO Web Site: <https://www.unavco.org/instrumentation/networks/map/map.html>
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- USGS. (2020). *Geohydrologic Framework Model: Section Locations and Sections*.
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APPENDIX D3

D3: Map and Hydrographs of Wells in the San Antonio Creek Valley Groundwater Basin

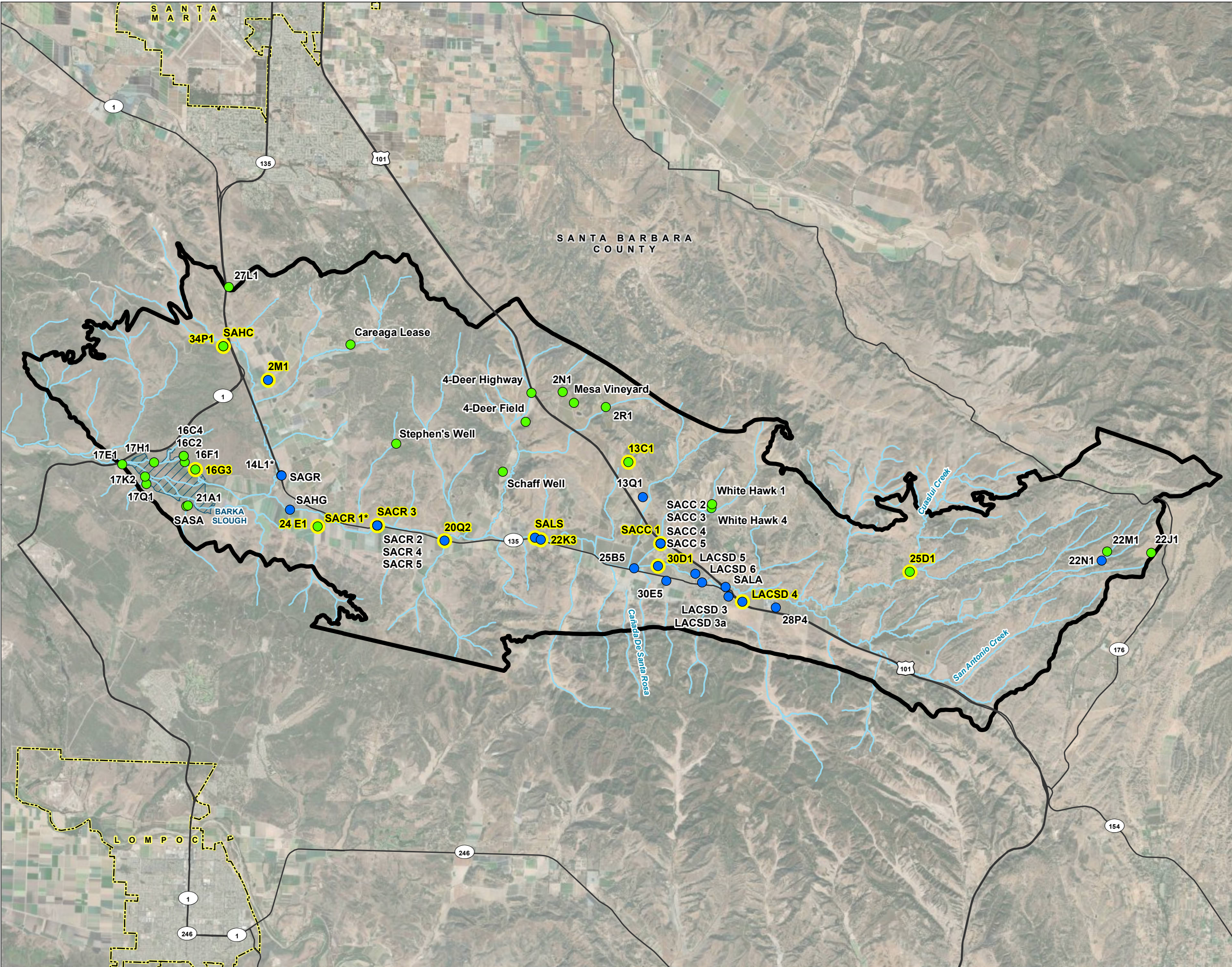
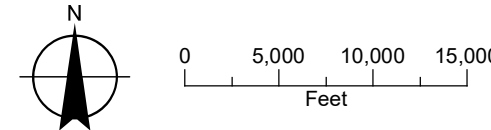


FIGURE 3-12
Wells Included in the
San Antonio Creek Valley
Groundwater Basin
Groundwater Sustainability Plan
San Antonio Creek Valley
Groundwater Basin

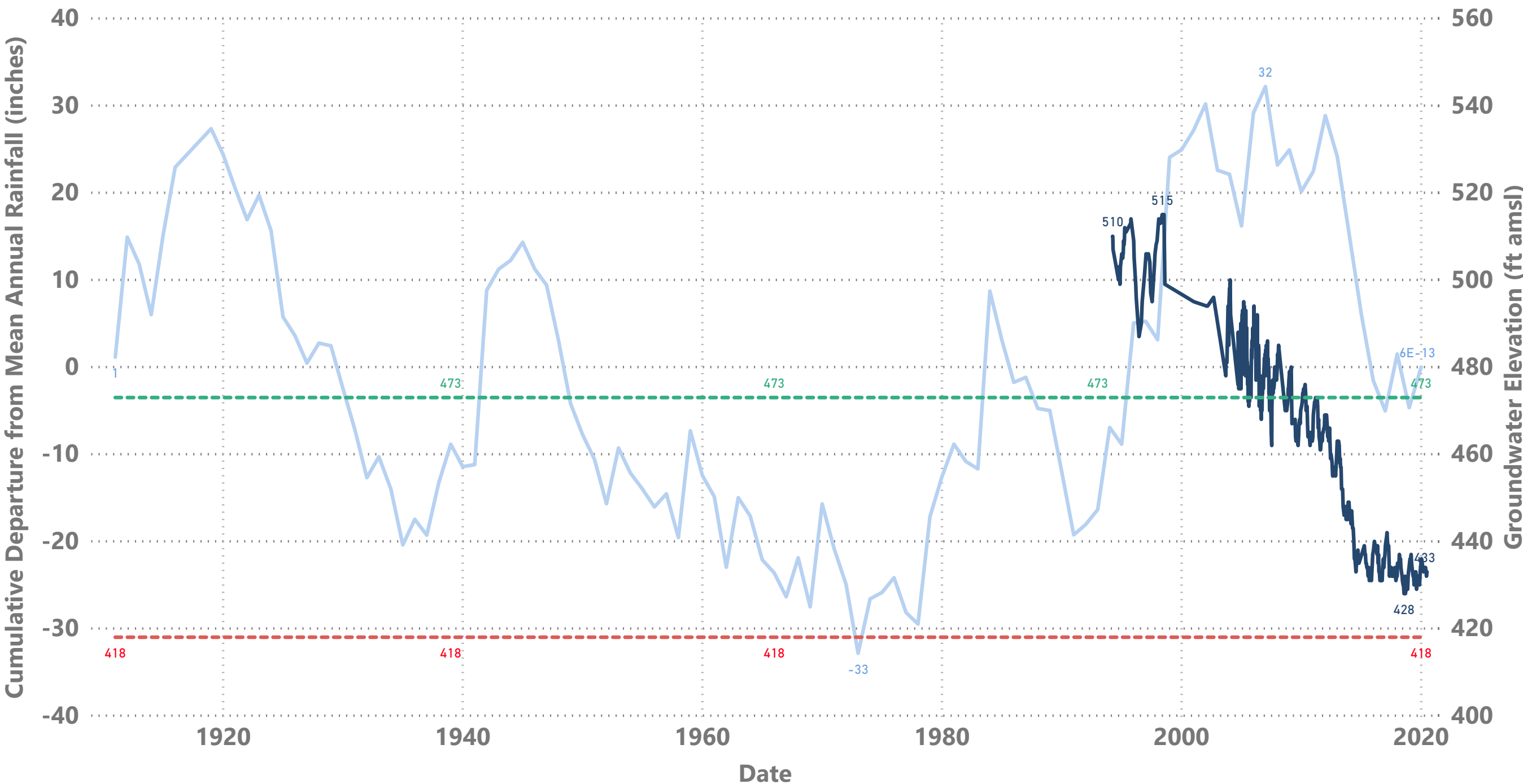
- LEGEND**
- Representative Well
 - Wells (by screened aquifer)**
 - Paso Robles Formation
 - Careaga Sand
 - All Other Features**
 - San Antonio Creek or Tributary
 - Major Road
 - San Antonio Creek Valley Groundwater Basin
 - Barka Slough
 - City Boundary

NOTES
*SACR 1 and 14L1 are screened in the Careaga Sand.
San Antonio Creek Valley Groundwater Basin Boundary as defined in the California Department of Water Resources Bulletin 118.



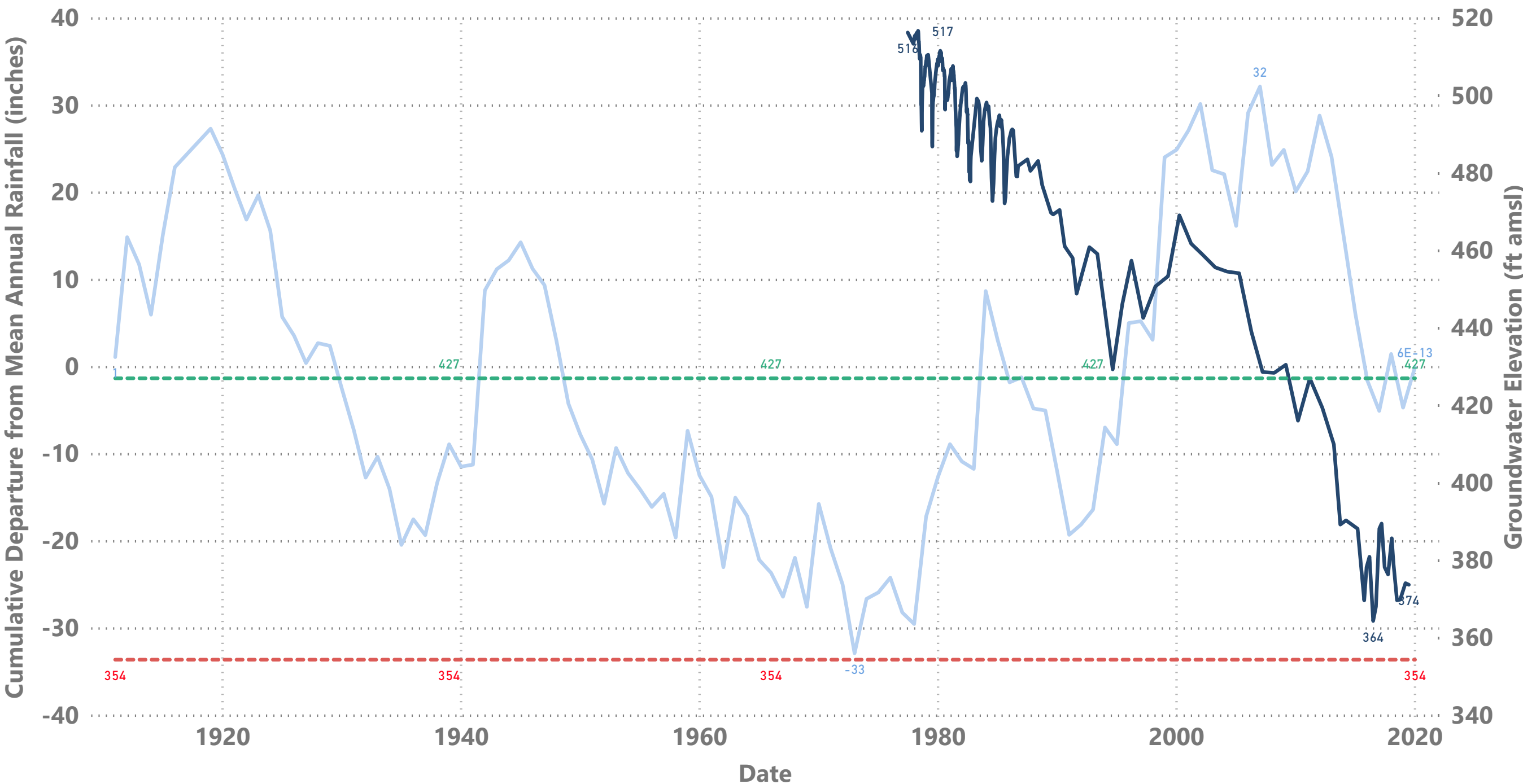
LACSD 4 - Paso Robles Formation

● Cumulative Departure from Mean Annual Rainfall (inches) ● Groundwater Elevation (feet amsl) ● Measurable Objective (Pre-drought 2011) ● Minimum Threshold (Historical low -10)

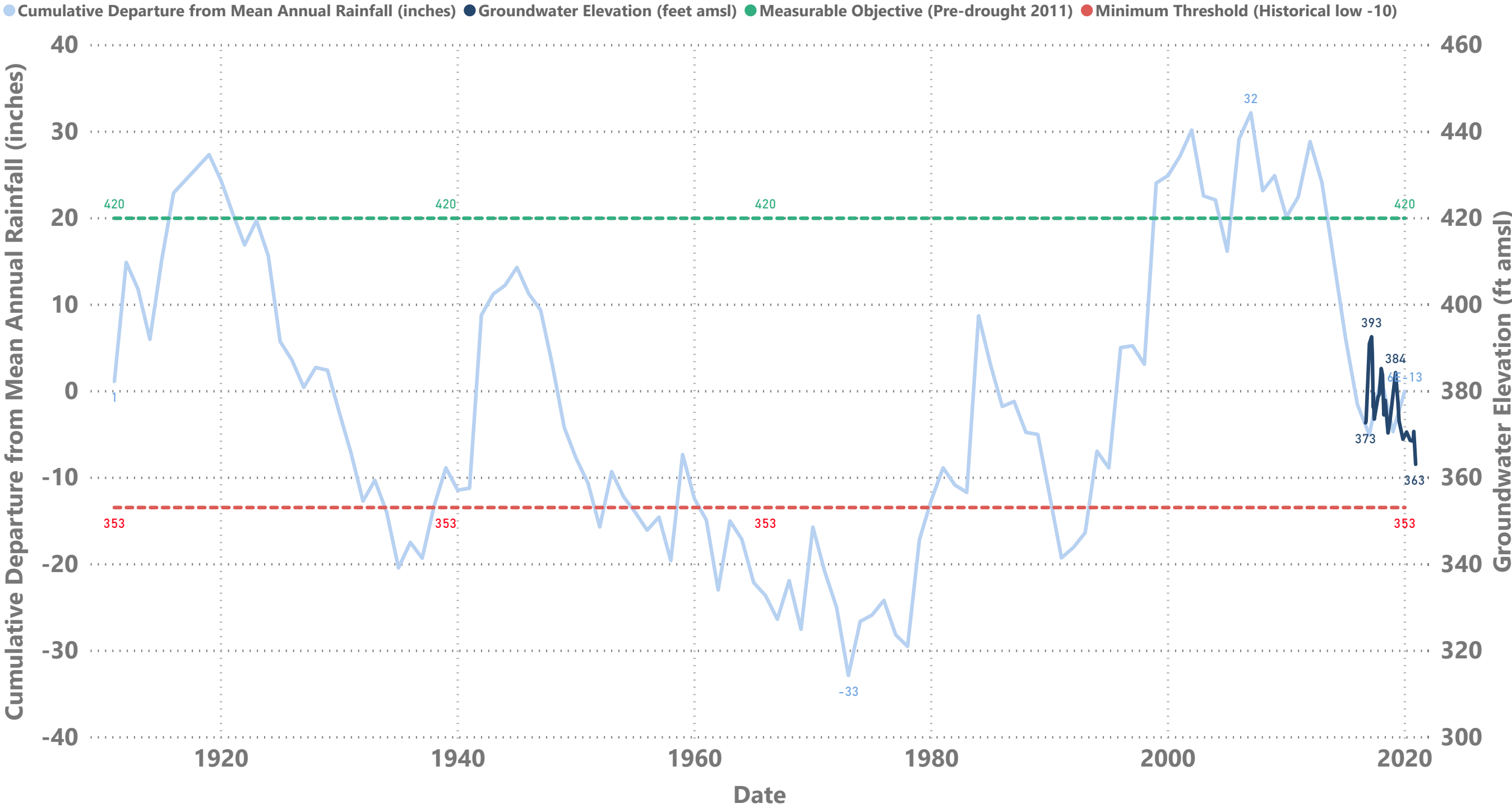


30D1 - Paso Robles Formation

● Cumulative Departure from Mean Annual Rainfall (inches) ● Groundwater Elevation (feet amsl) ● Measurable Objective (Pre-drought 2011) ● Minimum Threshold (Historical low -10)

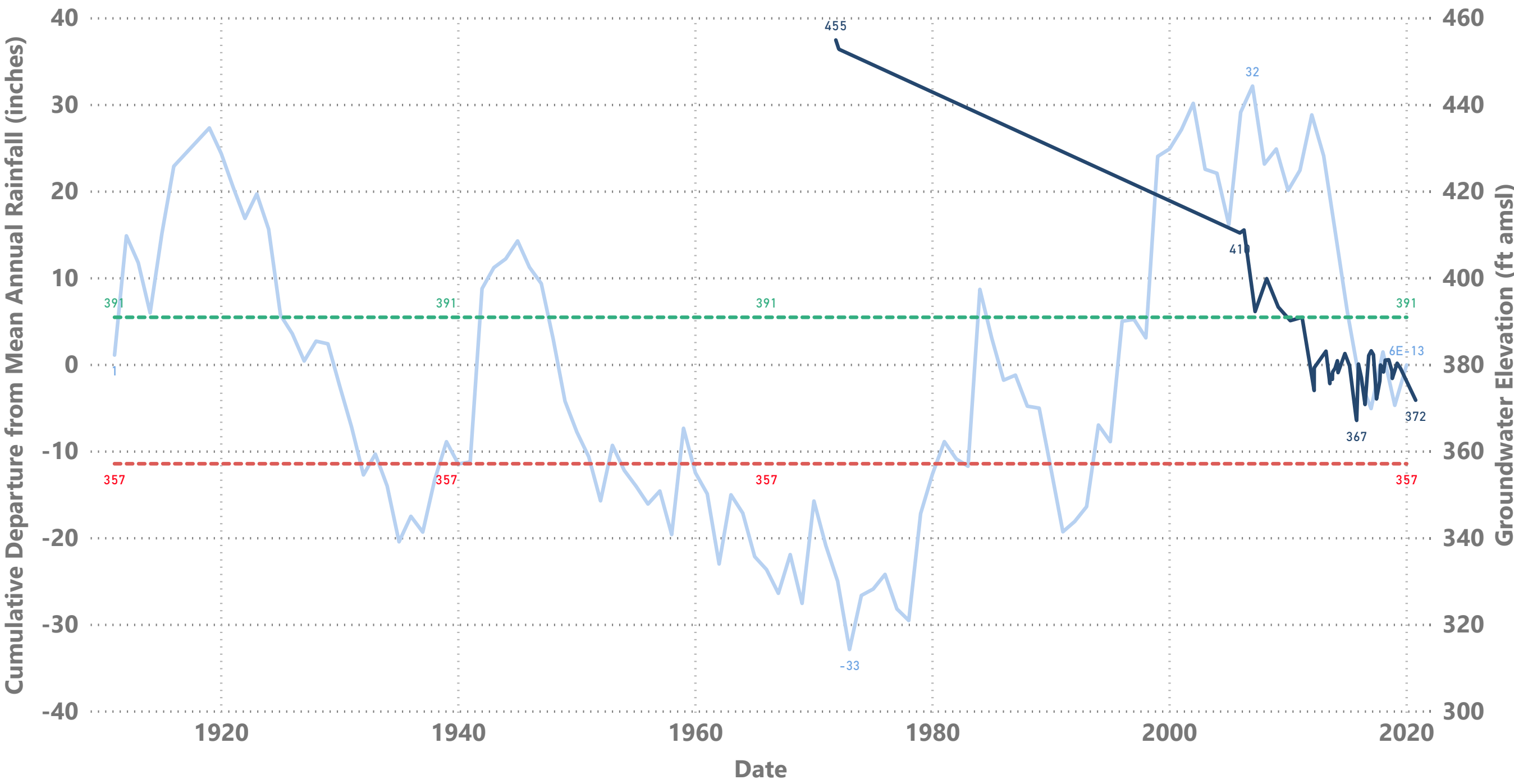


SACC 1 - Paso Robles Formation



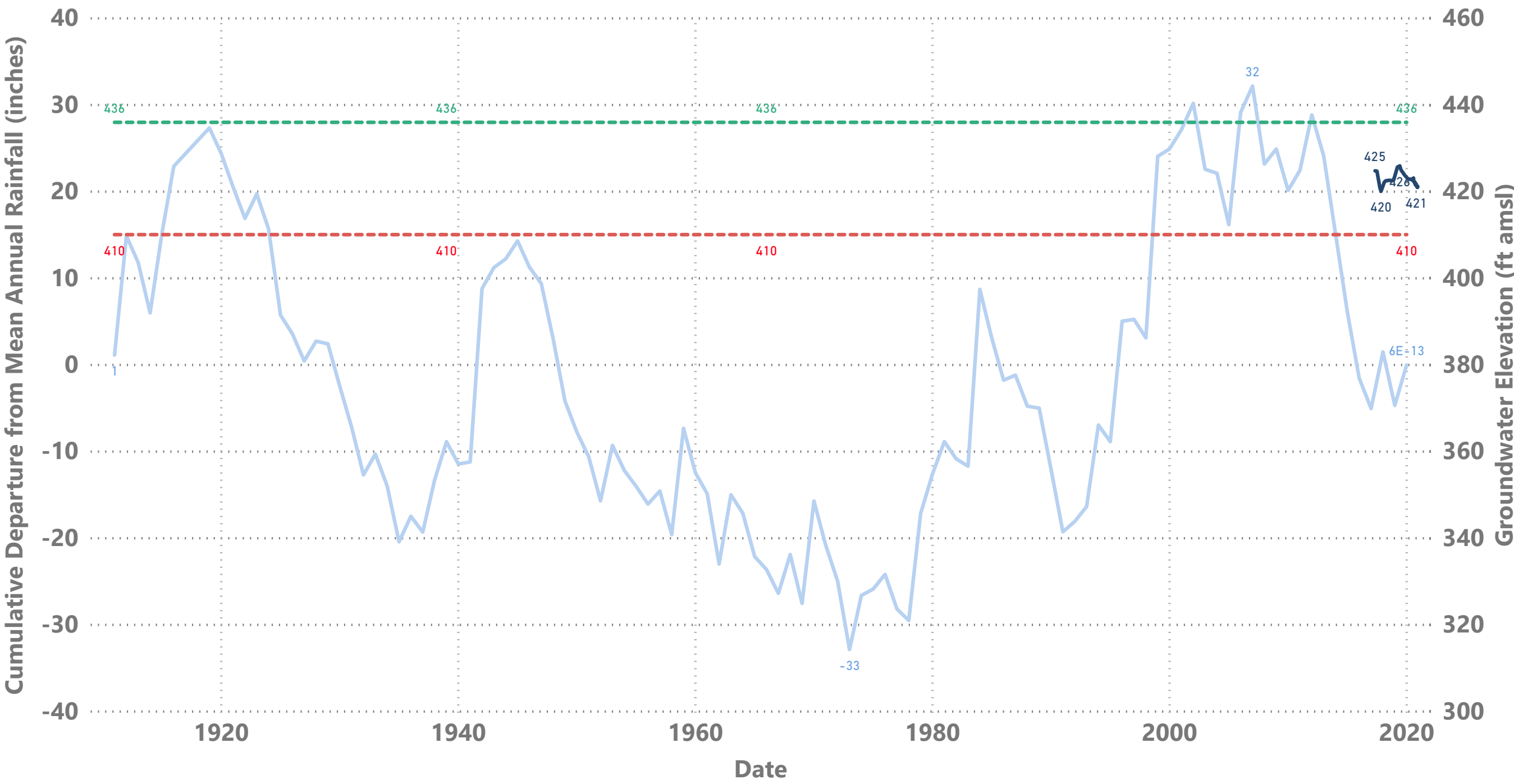
22K3 - Paso Robles Formation

● Cumulative Departure from Mean Annual Rainfall (inches) ● Groundwater Elevation (feet amsl) ● Measurable Objective (Pre-drought 2011) ● Minimum Threshold (Historical low -10)



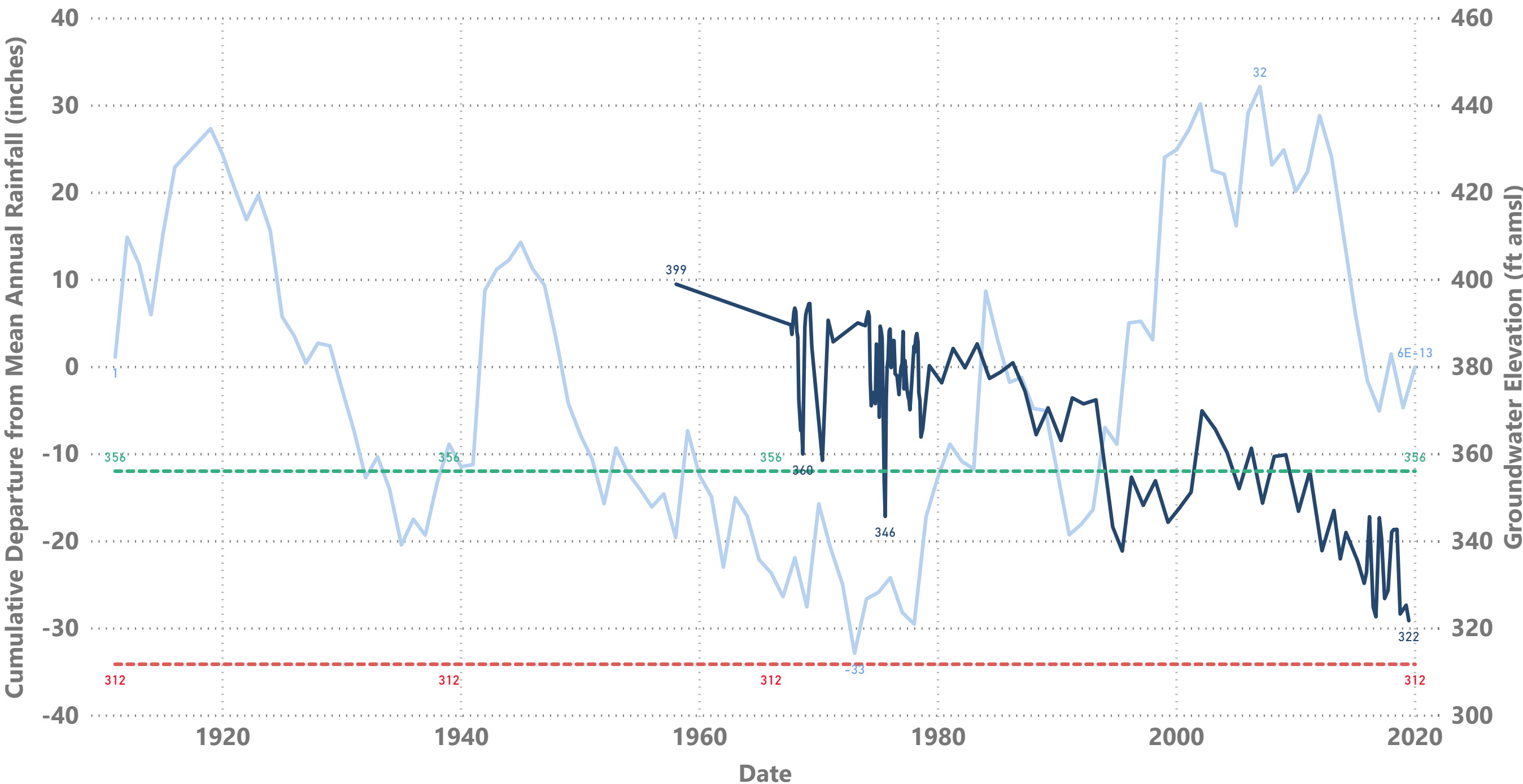
SALS - Paso Robles Formation

● Cumulative Departure from Mean Annual Rainfall (inches) ● Groundwater Elevation (feet amsl) ● Measurable Objective (Pre-drought 2011) ● Minimum Threshold (Historical low -10)



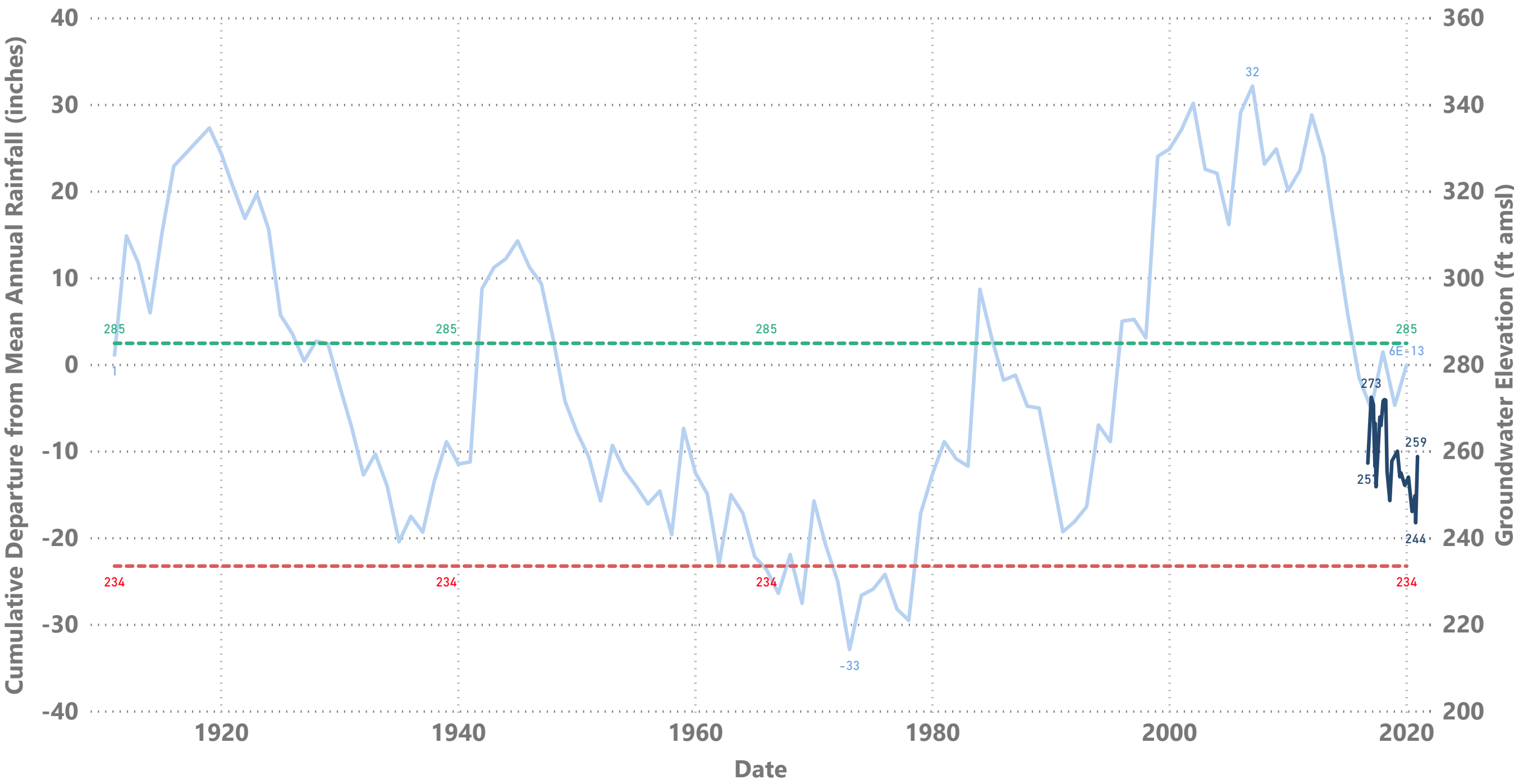
20Q2 - Paso Robles Formation

● Cumulative Departure from Mean Annual Rainfall (inches) ● Groundwater Elevation (feet amsl) ● Measurable Objective (Pre-drought 2011) ● Minimum Threshold (Historical low -10)



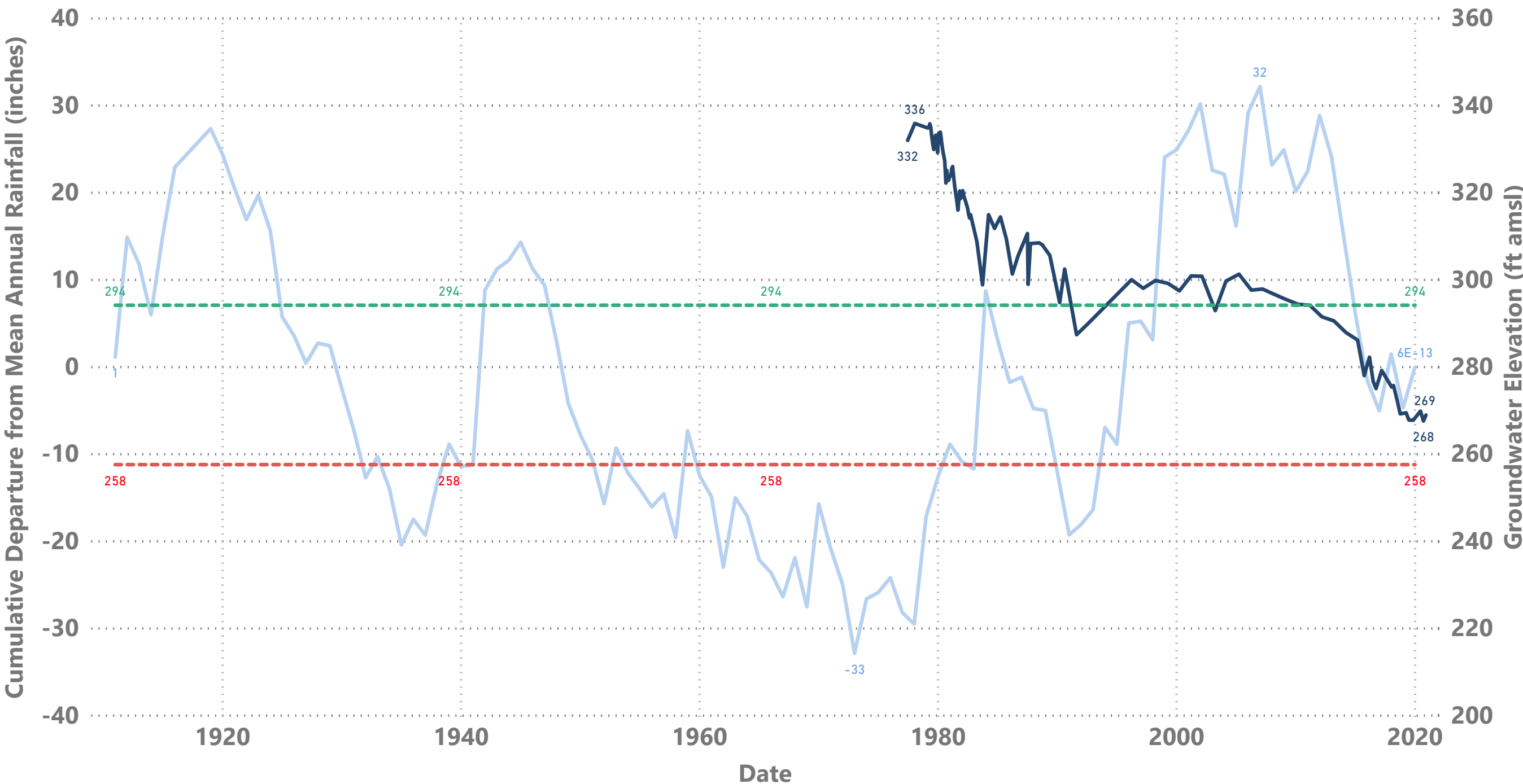
SACR 3 - Paso Robles Formation

● Cumulative Departure from Mean Annual Rainfall (inches) ● Groundwater Elevation (feet amsl) ● Measurable Objective (Pre-drought 2011) ● Minimum Threshold (Historical low -10)



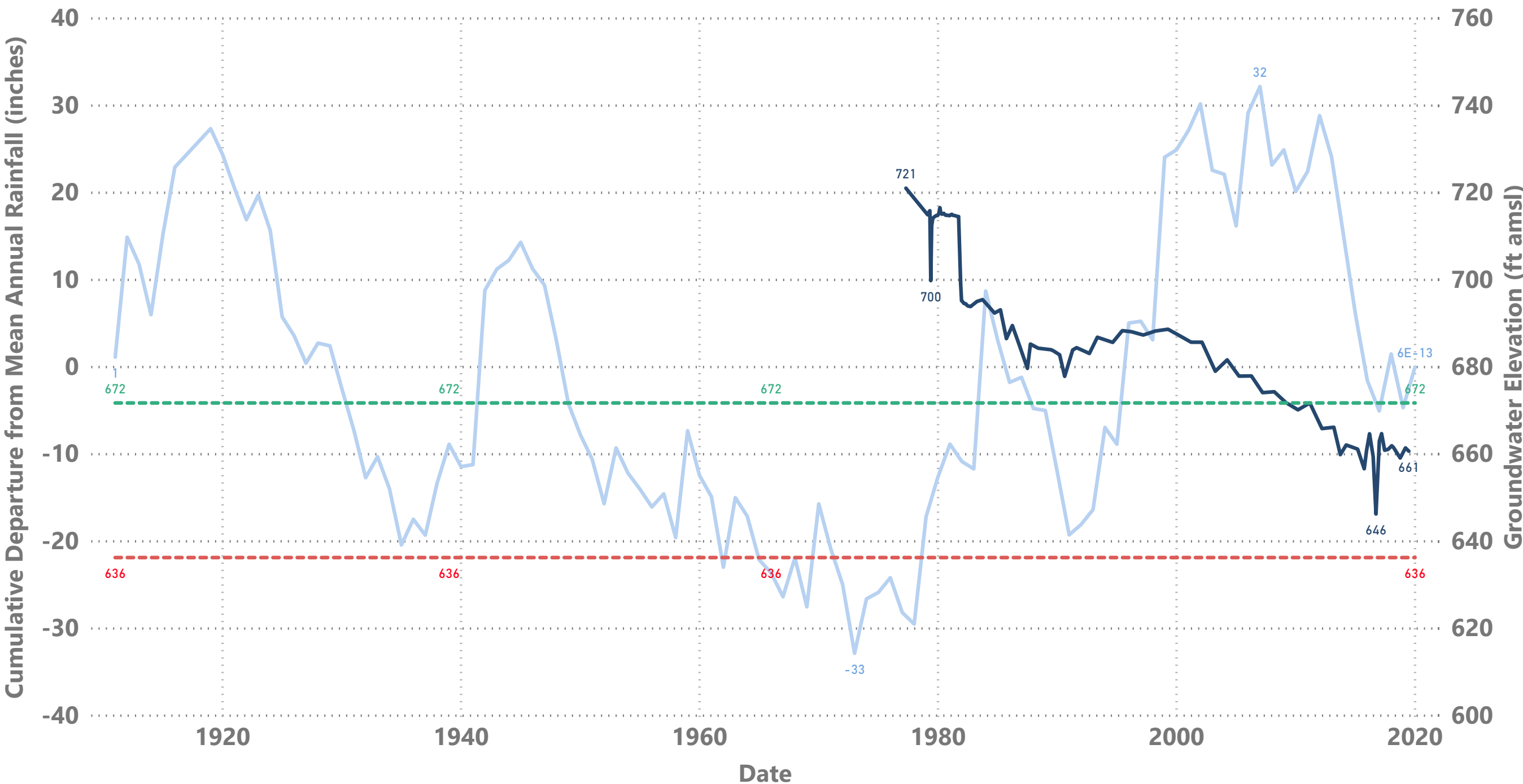
2M1 - Paso Robles Formation

● Cumulative Departure from Mean Annual Rainfall (inches) ● Groundwater Elevation (feet amsl) ● Measurable Objective (Pre-drought 2011) ● Minimum Threshold (Historical low -10)



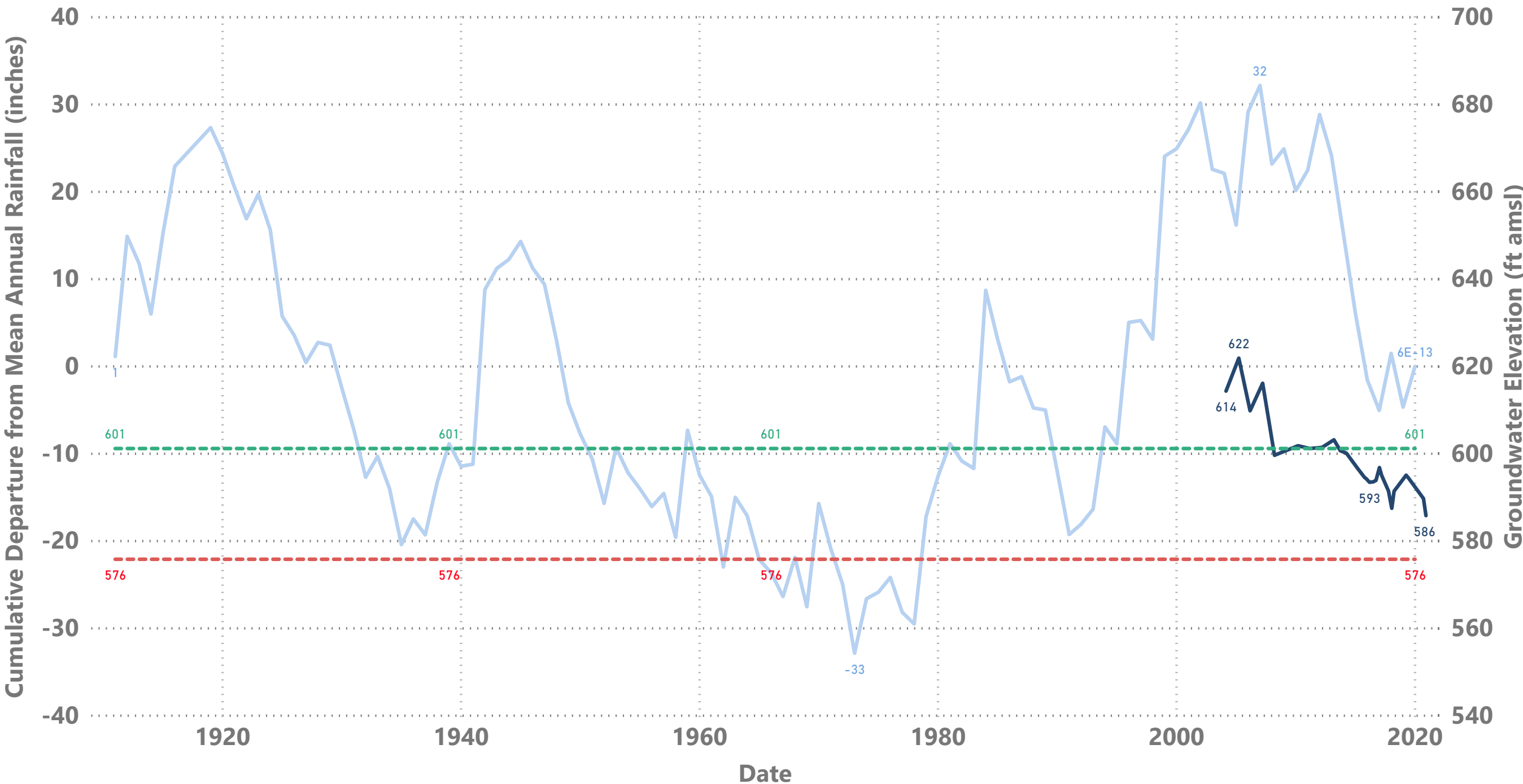
25D1 - Careaga Sand

● Cumulative Departure from Mean Annual Rainfall (inches) ● Groundwater Elevation (feet amsl) ● Measurable Objective (Pre-drought 2011) ● Minimum Threshold (Historical low -10)



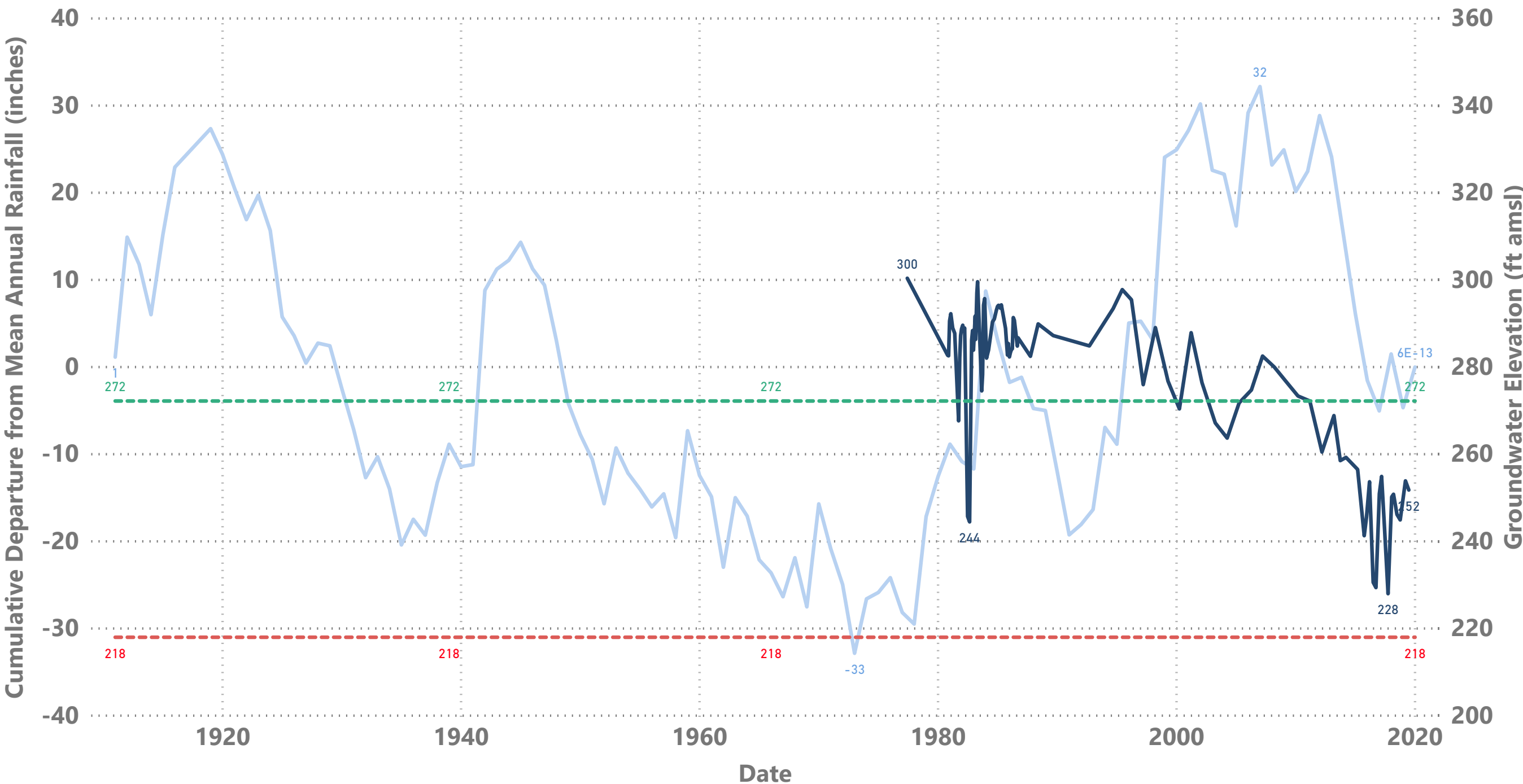
13C1 - Careaga Sand

● Cumulative Departure from Mean Annual Rainfall (inches) ● Groundwater Elevation (feet amsl) ● Average of Measurable Objective (Pre-drought 2011) ● Average of Minimum Threshold (Historical low -10)



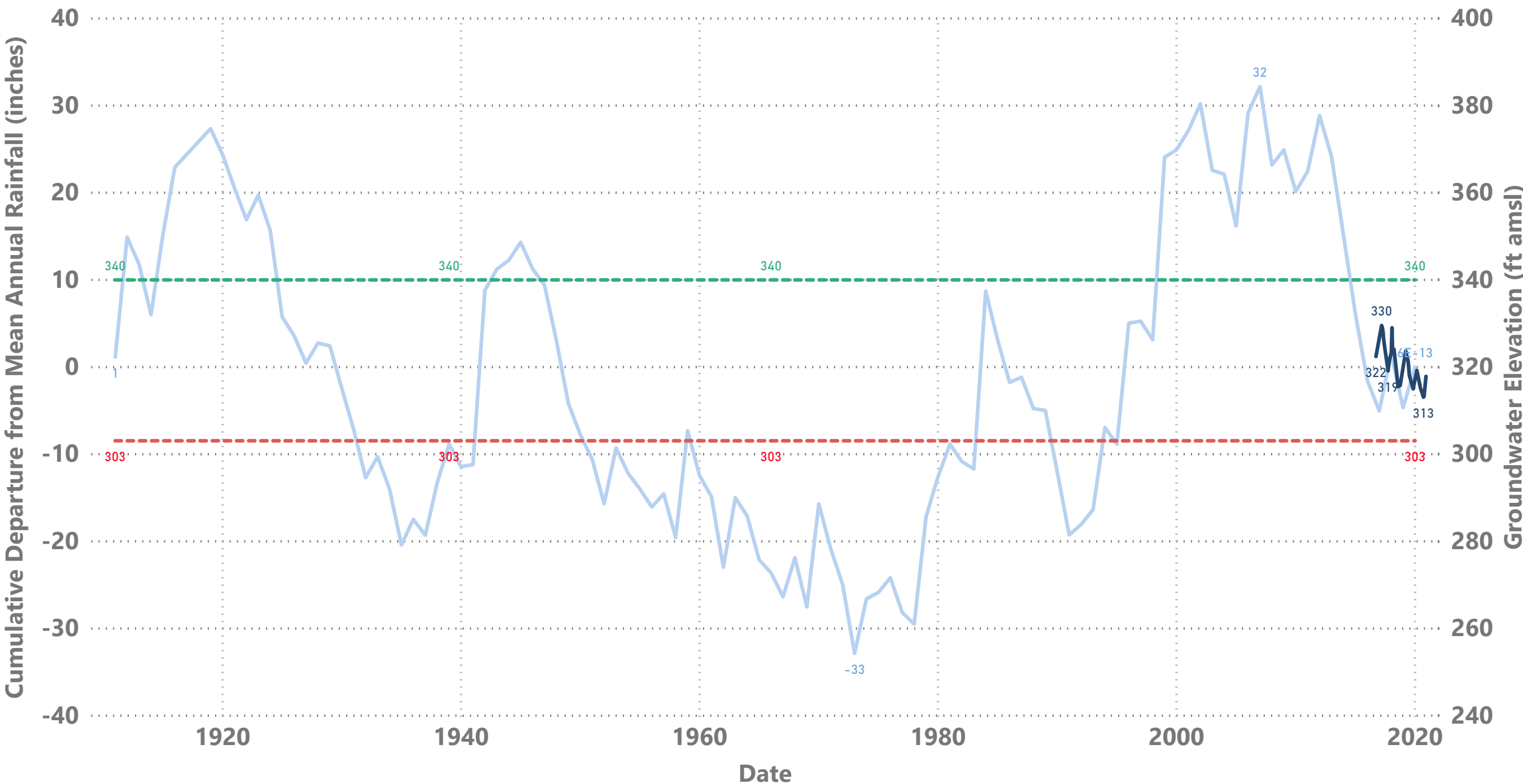
24E1 - Careaga Sand

● Cumulative Departure from Mean Annual Rainfall (inches) ● Groundwater Elevation (feet amsl) ● Measurable Objective (Pre-drought 2011) ● Minimum Threshold (Historical low -10)



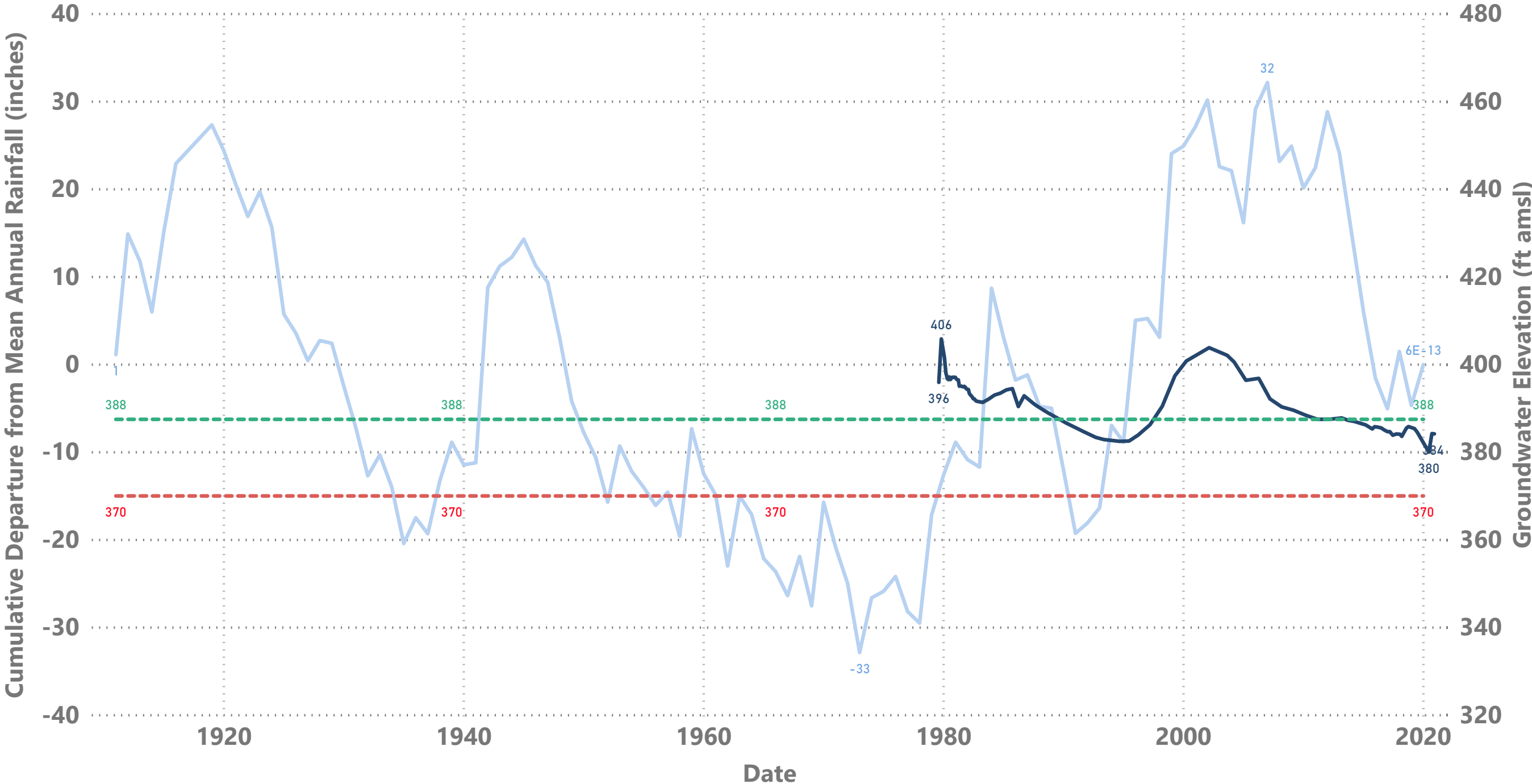
SACR 1 - Careaga Sand

● Cumulative Departure from Mean Annual Rainfall (inches) ● Groundwater Elevation (feet amsl) ● Measurable Objective (Pre-drought 2011) ● Minimum Threshold (Historical low -10)



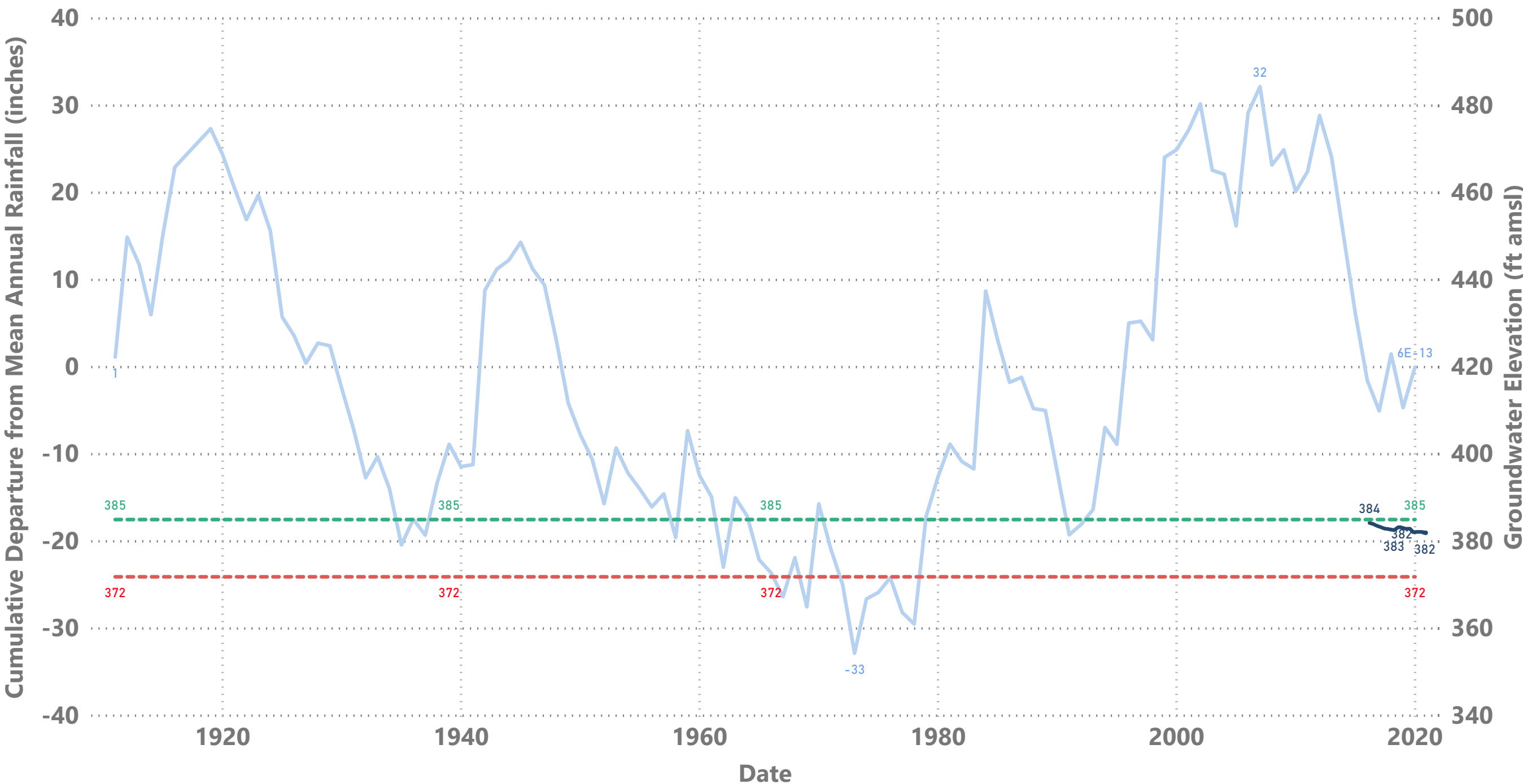
34P1 - Careaga Sand

● Cumulative Departure from Mean Annual Rainfall (inches) ● Groundwater Elevation (feet amsl) ● Measurable Objective (Pre-drought 2011) ● Minimum Threshold (Historical low -10)



SAHC - Careaga Sand

● Cumulative Departure from Mean Annual Rainfall (inches) ● Groundwater Elevation (feet amsl) ● Measurable Objective (Pre-drought 2011) ● Minimum Threshold (Historical low -10)



16G3 - Careaga Sand

● Cumulative Departure from Mean Annual Rainfall (CDMR) ● Groundwater Elevation ● Measurable Objective (Pre-drought 2011) ● Barka Slough Average Surface Elevation ● GDE Minimum Threshold

