

Contents

SECTION 5: Sustainable Management Criteria [Article 5, SubArticle 3].....5-1

5.1 Introduction to Sustainable Management Criteria [§354.22].....5-1

5.2 Definitipouons5-2

5.3 Sustainability Goal [§354.24].....5-4

5.3.1 Description of Sustainability Goal5-4

5.3.2 Strategies for Meeting the Sustainability Goal5-5

5.4 General Process for Establishing Sustainable Management Criteria [§ 354.22-30].....5-6

5.4.1 Technical and Public Input.....5-6

5.4.2 Criteria for Defining Undesirable Results and Information and Methodology
Used to Establish Minimum Thresholds and Measurable Objectives.....5-7

5.5 Chronic Lowering of Groundwater Levels Sustainable Management Criterion5-8

5.5.1 Undesirable Results for Chronic Lowering of Groundwater Levels [§354.26].....5-8

5.5.2 Minimum Thresholds for Chronic Lowering of Groundwater Levels [§354.28]5-11

5.5.3 Measurable Objectives for Chronic Lowering of Groundwater Levels
Sustainability Indicator [§354.30]5-29

5.5.4 Interim Milestones for Chronic Lowering of Groundwater Levels
Sustainability Indicator [§354.30(e)].....5-30

5.6 Reduction of Groundwater Storage Sustainable Management Criterion.....5-30

5.6.1 Undesirable Results for Reduction of Groundwater Storage [§354.26(a)].....5-31

5.6.2 Minimum Thresholds for Reduction of Groundwater Storage
[§354.28(a),(b)(1),(c)(2),(d), and (e)].....5-33

5.6.3 Measurable Objectives for Reduction of Groundwater Storage
Sustainability Indicator [§354.30(a),(c),(d), and (g)]5-38

5.6.4 Interim Milestones for Reduction of Groundwater Storage
Sustainability Indicator [§354.30(e)].....5-39

5.7 Seawater Intrusion Sustainable Management Criterion5-39

5.7.1 Undesirable Results for Seawater Intrusion [§354.26(a),(b)(2),(c), and (d)]5-40

5.7.2 Minimum Thresholds for Seawater Intrusion [§354.28(a),(b)(1),(c)(3),(d), and (e)]5-42

5.7.3 Measurable Objectives for Seawater Intrusion Sustainability Indicator
[§354.30(a),(c),(d), and (g)].....5-49

5.7.4 Interim Milestones for Seawater Intrusion Sustainability Indicator [§354.30(e)]5-50

5.8 Water Quality Degradation Sustainable Management Criterion.....5-50

5.8.1 Undesirable Results for Water Quality Degradation [§354.26(a) (b)(1),(b)(2), and (d)].....5-51

5.8.2 Minimum Thresholds for Water Quality Degradation [§354.28(b)(1)].....5-53

5.8.3 Measurable Objectives for Water Quality Degradation Sustainability Indicator
[§354.30(a),(b),(c),(d), and (g)]5-62

5.8.4 Interim Milestones for Water Quality Degradation Sustainability Indicator
§ 354.28(a)(e)5-63

5.9 Land Subsidence Sustainable Management Criterion5-64

5.9.1 Undesirable Results for Land Subsidence [§354.26(a)]5-64

5.9.2 Minimum Thresholds for Land Subsidence § 354.28(c)(5)5-65

5.9.3 Measurable Objectives for Land Subsidence § 354.30(a)-(g)5-67

5.9.4 Interim Milestones for Land Subsidence Sustainability Indicator § 354.28(a)(e).....5-67

5.10 Interconnected Surface Water Depletions Sustainable Management Criterion.....5-68

5.11 Management Areas.....5-68

5.12 References5-68

Tables

Table 5-1. Summary of Minimum Thresholds, Measurable Objectives, and Interim Milestones for Carpinteria Groundwater Basin Chronic Lowering of Groundwater Levels Sustainability Indicator.....5-9

Table 5-2. Minimum Thresholds for the Water Quality Degradation Sustainability Indicator5-54

Figures

Figure 5-1. Groundwater Elevations, Minimum Threshold, and Measurable Objective for RMS Well 19F45-13

Figure 5-2. Groundwater Elevations, Minimum Threshold, and Measurable Objective for RMS Well 20K4.....5-14

Figure 5-3. Groundwater Elevations, Minimum Threshold, and Measurable Objective for RMS Well 21L15-15

Figure 5-4. Groundwater Elevations, Minimum Threshold, and Measurable Objective for RMS Well 27F25-16

Figure 5-5. Groundwater Elevations, Minimum Threshold, and Measurable Objective for RMS Well 26A15-17

Figure 5-6. Groundwater Elevations, Minimum Threshold, and Measurable Objective for RMS Well 28F75-18

Figure 5-7. Groundwater Elevations, Minimum Threshold, and Measurable Objective for RMS Well 28J1.....5-19

Figure 5-8. Groundwater Elevations, Minimum Threshold, and Measurable Objective for RMS Well 29D75-20

Figure 5-9. Groundwater Elevations, Minimum Threshold, and Measurable Objective for RMS Well 35E15-21

Figure 5-10. Seawater Intrusion Isocontour SMC5-43

Figure 5-11. Maximum Nitrate Concentrations (2015–2021).....5-56

Figure 5-12. Maximum TDS Concentrations (2015–2021)5-57

Figure 5-13. Maximum Chloride Concentrations (2015–2021)5-58

Figure 5-14. Maximum Boron Concentrations (2015–2021).....5-59

SECTION 5: Sustainable Management Criteria [Article 5, SubArticle 3]

5.1 Introduction to Sustainable Management Criteria [§354.22]

§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 Carpinteria Groundwater Sustainability Agency (GSA) will characterize undesirable results and establish minimum thresholds and measurable objectives for the six sustainability indicators in the Carpinteria Groundwater Basin (Basin) in accordance with the Sustainable Groundwater Management Act (SGMA).

The methods and data used to develop the sustainable management criteria (SMCs) and how these criteria take into consideration current and future beneficial uses and groundwater users are described below. Defining the SMCs required technical analysis of historical data and input from the affected stakeholders in the Basin. The SMCs presented in this section are based on currently available data and application of the best available science. As noted in Section 3 of this Groundwater Sustainability Plan (Plan), several data gaps exist in the hydrogeologic conceptual model (HCM). The uncertainty created by these data gaps was considered when developing the SMCs. The 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 six sustainability indicators are applicable in the Basin and could lead to significant and unreasonable effects caused by groundwater conditions occurring throughout the Basin:

- Chronic lowering of groundwater levels (Section 5.5)
- Reduction of groundwater storage (Section 5.6)
- Seawater intrusion (Section 5.7)
- Water quality degradation (Section 5.8)
- Land subsidence (Section 5.9)
- Interconnected surface water depletions (Section 5.10)

According to SGMA regulations (§354.26(a)), “Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.”

For each sustainability indicator discussion in this section, the same format is used for a consistent approach. Each SMC description includes the information required by § 354.22 et seq. of the 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 effects was developed.
- How undesirable results were identified, including:
 - The criteria for defining when and where the 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 (§ 354.26 (b)(2))
 - The potential causes of undesirable results (§ 354.26 (b)(1))
 - The effects of these undesirable results on beneficial users and uses, and on land uses and property interests (§ 354.26 (b)(3))
- How minimum thresholds were developed, including the following:
 - The information and methodology used to develop minimum thresholds (§ 354.28 (b)(1))
 - The relationship between minimum thresholds and each sustainability indicator (§ 354.28 (b)(2))
 - The effect of minimum thresholds on neighboring basins (§ 354.28 (b)(3))
 - The effect of minimum thresholds on beneficial uses and users, and on land uses and property interests (§ 354.28 (b)(4))
 - How minimum thresholds relate to relevant federal, state, or local standards (§ 354.28 (b)(5))
 - The method for quantitatively measuring minimum thresholds (§ 354.28 (b)(6))
- How measurable objectives and interim milestones were developed, including the following:
 - The methodology for setting measurable objectives (§ 354.30)
 - The methodology for setting interim milestones (§§ 354.30 (a), 354.30 (e), and 354.34 (g)(3))

5.2 Definitions

SGMA and the GSP Emergency Regulations include several terms relevant to the SMCs. The terms below are used in this Plan and follow the definitions in the SGMA regulations (§ 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 appropriate, 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 ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface.

Interconnected surface water refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted.

Interim milestone refers to a target value representing measurable groundwater conditions, in increments of 5 years, set by an Agency as part of a Plan.

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 have been established at representative monitoring sites. *Minimum thresholds are set after potential undesirable results are defined when 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 or depletion of supply.*

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 any of the effects caused by groundwater conditions due to groundwater use occurring throughout the basin that, when significant and unreasonable, cause undesirable results. *These are 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 § 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 § 10721(x) of SGMA, which states that:

Undesirable result means one or more of the following effects caused by groundwater conditions 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.

¹ The Carpinteria GSA is the Agency referred to in this definition.

² The Carpinteria Groundwater Sustainability Plan is the Plan referred to in this definition.

Section 354.26(b)(2) of the SGMA regulations states that “The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.”

5.3 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.

This Plan’s discussion of the sustainability goal consists of three parts, per § 354.24 of the SGMA regulations:

- A description of the sustainability goal (Section 5.3.1)
- A discussion of the measures that will be implemented to ensure the Basin will be operated within sustainable yield (Section 5.3.2, Section 6)
- An explanation of how the sustainability goal is likely to be achieved and maintained (Section 6)

5.3.1 Description of Sustainability Goal

The sustainability goal for the Basin is to manage the groundwater resources to ensure beneficial uses and groundwater users have access to a safe, reliable groundwater supply that meets current and future demand without causing undesirable results.

The sustainability goal adopted for the Basin is as follows:

In accordance with the Sustainable Groundwater Management Act (SGMA), the sustainability goal for the Carpinteria Groundwater Basin (Basin) is to ensure that beneficial uses and basin users have access to a safe and reliable groundwater supply that meets current and future demands without causing undesirable results. The absence of undesirable results, as defined by SGMA and the Groundwater Sustainability Plan (Plan), will indicate that the sustainability goal has been achieved. Sustainable groundwater management as implemented through the Plan is designed to ensure that:

1. *Long-term groundwater elevations are adequate to support existing and future reasonable and beneficial uses throughout the Basin.*
2. *A sufficient volume of groundwater storage remains available during drought conditions and recovers during wet conditions (as defined using minimum thresholds expressed in terms of water levels).*
3. *Groundwater production, and projects and management actions undertaken through SGMA, do not degrade water quality conditions to support ongoing reasonable and beneficial uses of groundwater for agricultural, municipal, domestic, industrial, and environmental purposes.*

4. *Groundwater production, and projects and management actions undertaken in response to SGMA will mitigate against the significant advance of brackish or saline groundwater into areas of the aquifer currently used for production and supply.*

Groundwater resources will be managed through projects and management actions implemented under the Plan by the Carpinteria Groundwater Sustainability Agency (GSA). Management of the Basin will be supported by monitoring groundwater levels, groundwater in storage, groundwater quality, land surface elevations, interconnected surface water, and seawater intrusion. The Carpinteria GSA will adaptively manage any projects and management actions to ensure that the Plan is effective and undesirable results are avoided.

This Plan includes a monitoring program (Section 4) that addresses each of the sustainability indicators. If, based on the results of the monitoring program, minimum thresholds are exceeded such that undesirable effects are present or imminent, the Carpinteria GSA will identify management actions and projects that will be implemented to avoid an undesirable result (Section 6). Other projects and management actions may be implemented upon Plan adoption to address data gaps and collect important data regarding basin conditions.

5.3.2 Strategies for Meeting the Sustainability Goal

The sustainability strategies were developed and discussed at numerous public workshops and meetings. Implementation of the sustainability strategy will be addressed through the implementation of numerous projects and management actions during the 20-year implementation horizon. Details of these projects and management actions are presented in Section 6. The projects and management actions that make up the sustainability strategy were developed in collaboration with GSA staff.

The projects and management actions will be implemented while maintaining a principle of adaptive management. Adaptive management allows the Carpinteria GSA to assess the relative success or effectiveness of projects implemented in the Basin, and to make management decisions to redirect management efforts if new data indicate new actions will be more effective in achieving the goal of sustainable management.

5.4 General Process for Establishing Sustainable Management Criteria [§ 354.22-30]

§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.

§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.

§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.

§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.

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

5.4.1 Technical and Public Input

5.4.1.1 Technical Advisory Committee

During the course of Plan development, a Technical Coordination Committee (TCC) of consultants selected by the Carpinteria GSA met twice a month to discuss various iterative approaches to defining SMCs. The TCC consisted of the general manager of the Carpinteria Valley Water District (CVWD), and representatives from GSI Water Solutions, Inc.; Pueblo Water Resources, Inc.; Montgomery & Associates, Inc.; and Bondy Groundwater Consulting, Inc. During the bimonthly meetings, iterative approaches to defining the SMCs for each of the sustainability indicators were discussed, and the technical merits and implications of each were analyzed until the TCC reached a general consensus on the approach.

5.4.1.2 Groundwater Sustainability Planning Advisory Committee

In addition to the TCC, a Groundwater Sustainability Public Advisory Committee (GSPAC) was created, consisting of seven groundwater users in the Basin and one GSA Board Director. Following an interview process conducted by the GSA Board of Directors, the GSPAC members were selected as being representative of the various beneficial uses and users of groundwater in the Basin because they have an interest in maintaining sustainable groundwater resources in the Basin for future generations, a healthy agricultural and business community, good water quality, and a healthy environment. Eight GSPAC meetings were held between February and October 2023 to present information and society stakeholder comment and input. These meetings were conducted in accordance with Brown Act requirements and were accessible to the public at large.

5.4.1.3 Public Workshops

The public input process was developed in conjunction with the GSA member agencies and included engagement with local stakeholders and interested parties on basin issues. Eight public workshops were held between October 2022 and September 2023, during which technical information supporting the development of the Plan was presented and stakeholders had opportunities to ask questions and provide feedback. These meetings were posted in advance and were accessible to the public at large.

5.4.1.4 Individual Agricultural Stakeholder Interviews

To assess whether significant undesirable results occurred in the Basin during the recent drought, GSA consultants conducted interviews with representatives of the beneficial users of groundwater in the Basin from April to June 2023. These users were primarily representatives of the agricultural community, but interviews were also conducted with management and staff from the CVWD.

5.4.2 Criteria for Defining Undesirable Results and Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

The general process for establishing minimum thresholds and measurable objectives for each sustainability indicator and assessing significant and unreasonable conditions constituting undesirable results in the Basin was iterative and included the following:

- Evaluating historical data on groundwater elevations, water quality, and pumping volumes from wells monitored by the CVWD.
- Evaluating historical water budget information presented in Section 3.
- Holding a series of public workshops that outlined the Plan development process and introduced stakeholders to SMCs, measurable objectives, minimum thresholds, and related information.
- Soliciting public comment and input on several alternative minimum threshold and measurable objective options based on preliminary technical analysis presented at public workshops and GSPAC meetings.
- Evaluating public comment to understand stakeholder perceptions of significant and unreasonable effects relevant to SMCs. Public comments from outreach meetings were analyzed to assess if different areas in the Basin had different perspectives regarding what constitutes an undesirable result in the Basin and how minimum thresholds and measurable objectives should be established.
- Combining hydrogeologic data evaluation, public comment, outreach efforts, and considering the interests of beneficial uses and groundwater users, land uses, and property interests in the Basin to describe undesirable results and set preliminary conceptual minimum thresholds and measurable objectives.

- Performing groundwater model simulations that incorporate projects and management actions discussed in Section 6 to assess if the SMCs are achievable.
- Conducting public meetings to present recommended preliminary conceptual minimum thresholds and measurable objectives and receiving additional public input. Reviewing and considering public and GSPAC input on recommended preliminary SMCs with GSA staff.
- Recommending final SMCs to the Carpinteria GSA for approval.

A number of alternative options for minimum thresholds and measurable objectives were considered for each RMS after evaluation of the historical record of data at each well, assessment of trends of groundwater elevation decline and recovery, and input from stakeholders regarding their desired conditions. Details with respect to each sustainability indicator are discussed in Sections 5.5 through 5.10.

5.5 Chronic Lowering of Groundwater Levels Sustainable Management Criterion

This section describes the SMC for the chronic lowering of groundwater levels sustainability indicator. It defines undesirable results (Section 5.5.1), presents minimum thresholds (Section 5.5.2) and measurable objectives for each RMS in the monitoring network (Section 5.5.3), and provides interim milestones (Section 5.5.4).

5.5.1 Undesirable Results for Chronic Lowering of Groundwater Levels [§354.26]

§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.

(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.

The definition of undesirable results for the chronic lowering of groundwater levels sustainability indicator for the purposes of this Plan is as follows:

The Basin will be considered to have undesirable results if water levels in municipal supply wells decline to the point that it could impact water supply operations at CVWD, or if water levels in agricultural supply wells decline to the point that inadequate supply is available for historical farming operations, requiring fallowing or reduction of operations. The possible occurrence of undesirable results will be assessed if 33 percent or more RMSs for water levels within the Basin display exceedances of the minimum threshold groundwater

elevation values for three consecutive fall measurements (bracketing 2 consecutive water years). For the current monitoring network of nine RMS wells, this equates to three wells with minimum threshold exceedances.

Details addressing specific minimum thresholds and measurable objectives are presented in Sections 5.5.2 and 5.5.3. **Table 5-1** presents a summary of minimum thresholds and measurable objectives used in the definition of undesirable conditions for the chronic lowering of groundwater levels sustainability indicator and interim milestones for each RMS well.

Table 5-1. Summary of Minimum Thresholds, Measurable Objectives, and Interim Milestones for Carpinteria Groundwater Basin Chronic Lowering of Groundwater Levels Sustainability Indicator

RMS Well	MT (ft NAVD 88)	2029 IM (ft NAVD 88)	2034 IM (ft NAVD 88)	2039 IM (ft NAVD 88)	MO (ft NAVD 88)	Land Surface Elevation (ft NAVD 88)
19F4	-30	-18	-5	7	20	102
20K4	-77	-58	-39	-20	0	47
21L1	-85	-61	-37	-13	10	69
27F2	-92	-62	-32	-3	25	136
26A1	140	160	180	200	220	425
28J1	-40	-23	-5	13	30	103
28F7	-90	-64	-38	-12	15	65
29D7	-45	-34	-23	-12	0	28
35E1	12	21	30	41	50	243

Notes

ft = foot or feet

IM = interim milestone (see Section 5.5.4)

MO = measurable objective goal for 2044

MT = minimum threshold

NAVD 88 = North American Vertical Datum of 1988

RMS = representative monitoring site

5.5.1.1 Criteria for Establishing Undesirable Results [§354.26(b)(2)]

Significant and unreasonable chronic lowering of groundwater levels in the Basin are those that:

- Reduce the ability of existing municipal supply wells to produce adequate water for their users in the Basin.
- Cause significant financial burden to agricultural users who rely on the groundwater basin.
- Reduce the ability of domestic wells to produce adequate supply for domestic purposes.
- Interfere with other SGMA sustainability indicators.

According to CVWD records, two private domestic well exists within the basin boundary; therefore, conditions in domestic supply wells are not a significant factor to be considered.

Lowering of groundwater levels that are likely to cause undesirable results are characterized as follows:

- Groundwater levels in the basin aquifer remain below minimum thresholds (see Section 5.5.2) for 3 consecutive fall measurements that bracket two calendar years of average and above-average precipitation in 33 percent of representative wells.
- Existing municipal wells are unable to produce the quantities of groundwater needed to supply potable water to the District customers, or agricultural users are unable to maintain recent production to support the agricultural economy in the GSA, due to chronic lowering of groundwater levels caused by groundwater conditions occurring throughout the Basin (i.e., significant and unreasonable depletion of supply).

5.5.1.2 Possible Causes of Undesirable Results [§354.26(b)(1)]

Conditions in the Basin that could lead to significant and unreasonable effects on groundwater levels include the following:

- **Increased Rates of Pumping in the Basin Aquifer.** If the amount of pumping in the Basin were to increase to the point where it exceeds the long-term rate of recharge, then groundwater levels may decline, which could affect basin well production and result in depletion of supply.
- **Extended Drought.** Minimum thresholds are established based on reasonable anticipated future climatic conditions, based on the best available science and climatological models being used to characterize climate change currently in use. Extensive, unanticipated droughts more severe than those on record 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.

As discussed in Section 3.2.1, basin well hydrographs illustrate that water levels rise and fall in response to changes in rainfall. Recent water levels have begun to recover from the recent severe drought observed between water years 2012 and 2020. Based on input from water users in the Basin and review of available water level data, no significant and unreasonable effects associated with groundwater level declines have been observed in the Basin, including the period since 2015, after SGMA came into effect. (This does not include other sustainability indicators, such as sea water intrusion, that may be associated with water level conditions.) A representative from the TCC conducted interviews with representatives from the agricultural community and the CVWD. These interviews did not generate any specific reports from stakeholders that wells have needed to be deepened or replaced, or that agricultural operations needed to be significantly curtailed, fields fallowed, or similar measures taken. DWR's database of dry domestic wells in the state was reviewed, and there was no data showing domestic wells going dry within the Basin. Local drillers were also consulted, and they indicated that there have not been a significant number of deeper replacement wells drilled in the Basin. If current and/or increased rates of pumping continue and drought conditions persist (see Section 3.3.5), undesirable results could occur in the future.

5.5.1.3 Effects of Undesirable Results on Beneficial Users and Land Uses [§354.26(b)(3)]

The primary effects of undesirable results on the beneficial users in the Basin would be a reduction of supply available for municipal and agricultural uses. The occurrence of three exceedances (bracketing a period of 2 years) in a network of nine RMS wells will result in an assessment of the occurrence of undesirable effects in the Basin. If the exceedances are clustered in a limited area, it indicates that significant unreasonable effects are being experienced by a localized group of landowners. An exceedance at a single RMS well will require investigation to determine the significance, extent, and possible causes of the observed conditions.

5.5.2 Minimum Thresholds for Chronic Lowering of Groundwater Levels [§354.28]

§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.

(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)(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.”

After the nine RMS wells had been selected and discussed with the TCC, the GSPAC, and at public workshops, numerous iterations of alternative draft minimum thresholds were developed based on the evaluation of historical groundwater elevations during the available period of record (i.e., consideration of average water levels during various time periods, long-term trends, and response to the recent drought), consideration of likely future use of groundwater, well construction data, assessment of remaining available saturated thickness, and public input from stakeholders. The following sections present details on the development of minimum thresholds for specific RMSs in the Basin.

5.5.2.1 Information and Methods Used for Establishing Chronic Lowering of Groundwater Levels Minimum Thresholds - §354.28(b)(1)

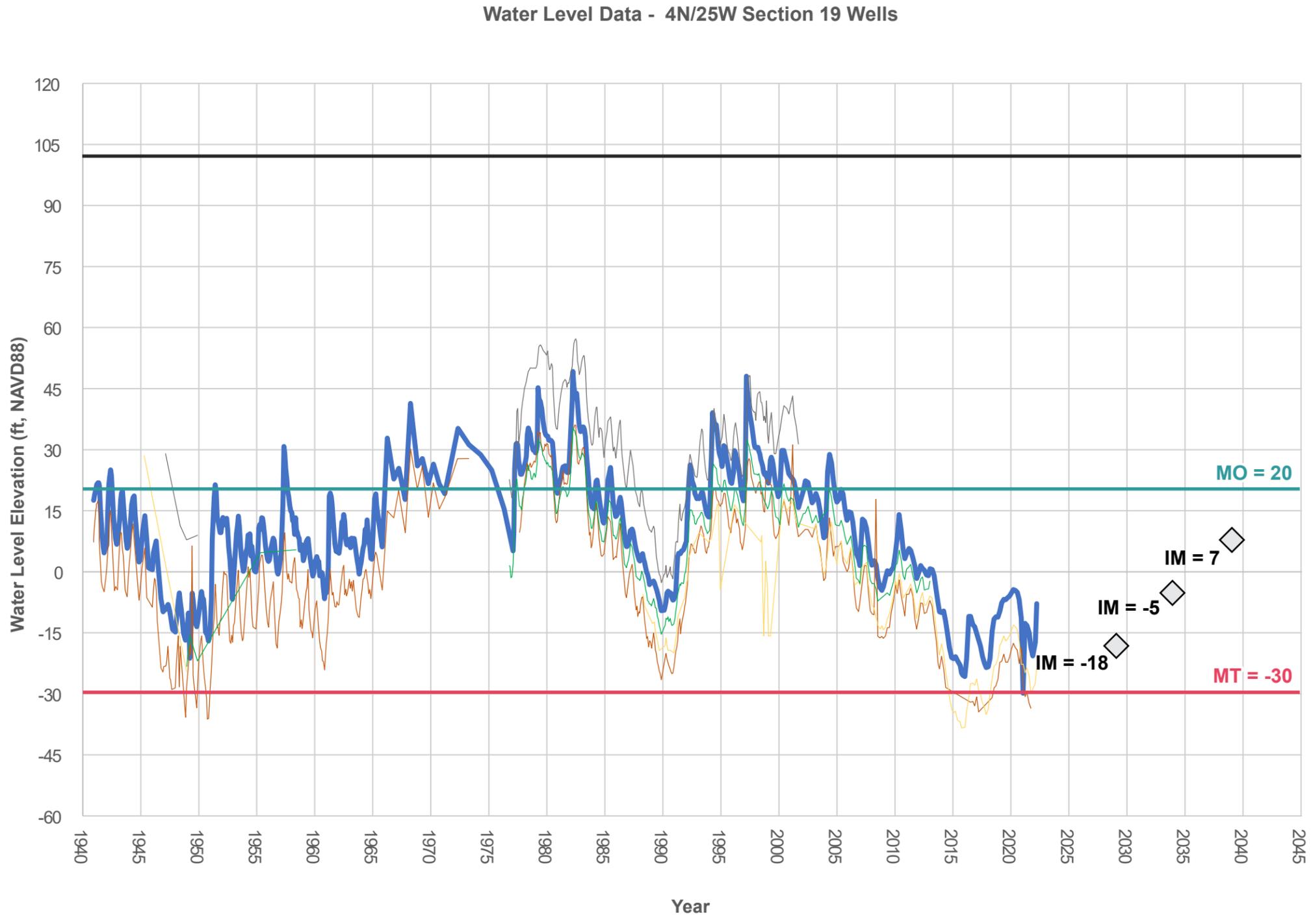
The primary source of data that was evaluated for the sustainability indicator of chronic lowering of groundwater levels is historical groundwater elevation data collected by CVWD and its predecessor agencies. Water level data has been collected under the Assembly Bill 3030 program since 2000, and many wells have data extending back for decades before that period. The information used for establishing the measurable objectives and minimum thresholds for the chronic lowering of groundwater levels sustainability indicator included:

- Historical groundwater elevation data from wells monitored by the CVWD.
- Depths, locations, and available construction details of existing wells.
- Maps of current and historical groundwater elevation data.
- Input from stakeholders regarding significant and unreasonable conditions and desired current and future groundwater elevations communicated during public meetings and solicitation of public comment on various options for minimum thresholds and measurable objectives presented in the public forum.
- Results of modeling of various project scenarios of future groundwater level conditions.
- Results of oral interviews with stakeholders from the agricultural community in the Basin regarding their experiences and operations during the recent drought period.

The network of RMS wells selected for the chronic lowering of groundwater levels sustainability indicator for this Plan is presented in **Figure 4-1**. **Figures 5-1 through 5-9** present the historical record of water level data for these wells (displayed using the bold line type on the graph), and data for other nearby wells in the same section (displayed using the thinner line types). The non-RMS well hydrographs are included to demonstrate that the RMS wells are representative of water levels in the nearby area. **Figures 5-1 through 5-8** each include groundwater elevation hydrograph data (for either the RMS well or one of the surrounding wells) that extend back to the 1940s. During this period of record, three observed drought periods are identifiable from the lower water levels evident during these periods: from late 1940s through the 1950s and early 1960s, from the late 1980s through the early 1990s, and the recent drought period from about 2012 through 2022. In each of these periods, water levels are observed to decline and stay at lower levels for the periods just described in response to the drought conditions.

It is important to note that the context of the historical data, such as land use practices, availability of State Water Project surface water supplies, local population density, and other factors, are not consistent during each of these three drought periods. However, at the conclusion of each of these drought periods, it is evident from the hydrograph shapes that when rainfall resumed to normal amounts, water levels responded by rising back to the higher levels associated with non-drought periods. This is important to note because this pattern of water level response does not indicate a steady, inexorable decline of water levels in response to over-pumping such as those observed in the Central Valley of California. When the dominant sources of basin recharge (i.e., percolation of precipitation and percolation of streamflow) recover from the periodic drought conditions, water levels have responded by rising above the levels observed during the droughts. Recent low water levels observed in the RMS wells in the years from about 2018 to 2022 were used as an initial benchmark to consider during development of minimum thresholds by the TCC and the GSPAC.

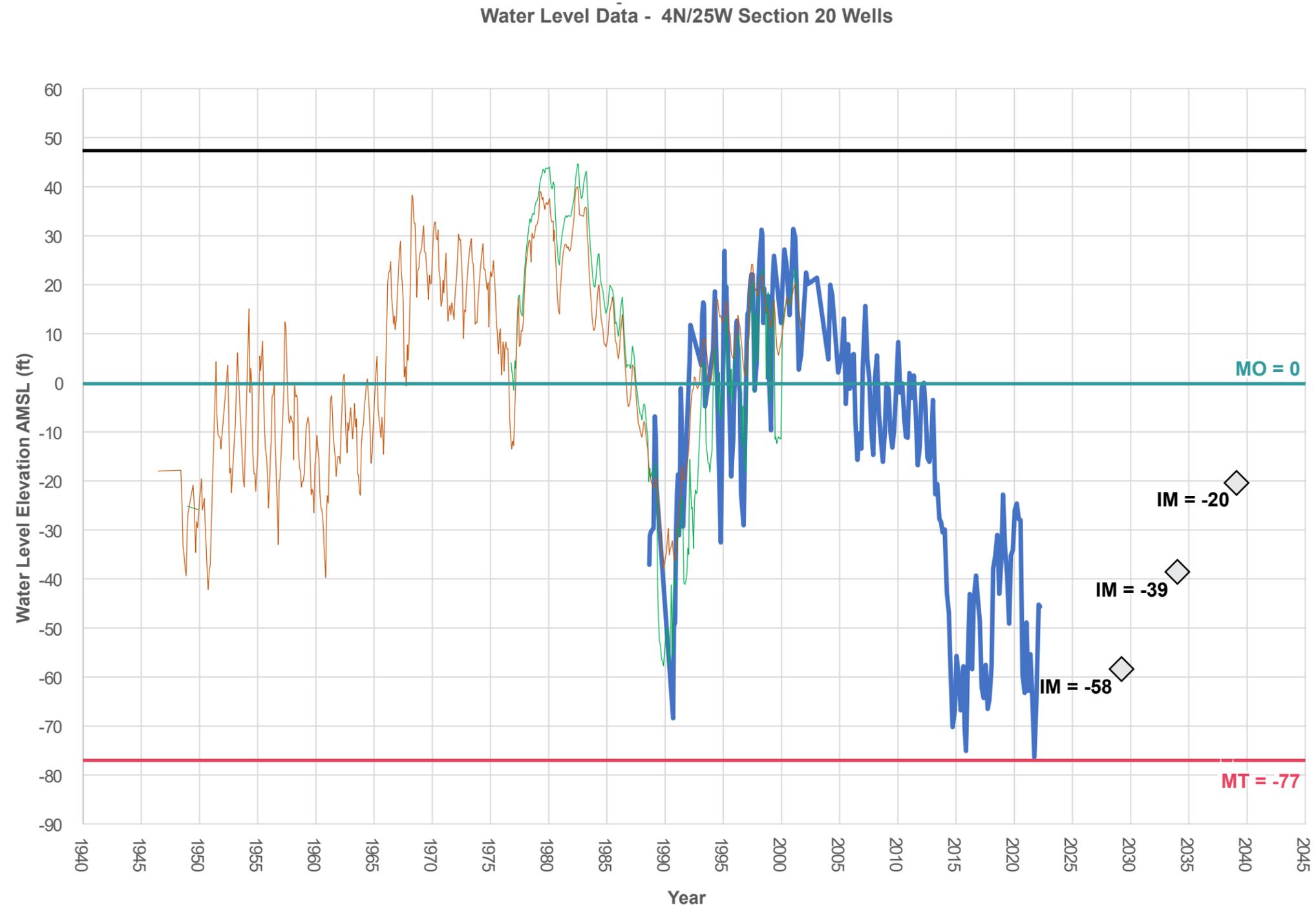
FIGURE 5-1
Groundwater Elevations, Minimum
Threshold, and Measurable
Objective for RMS Well 19F4
 Carpinteria Basin
 Groundwater Sustainability Plan



- LEGEND**
- MT (Minimum Threshold)
 - MO (Measurable Objective)
 - 19F4 (RMS)
 - 19J5
 - 19H1
 - 19K5
 - 19M3
 - Land Surface Elevation (19F4)
 - ◇ Interim Milestone (IM)



FIGURE 5-2
Groundwater Elevations, Minimum
Threshold, and Measurable
Objective for RMS Well 20K4
 Carpinteria Basin
 Groundwater Sustainability Plan



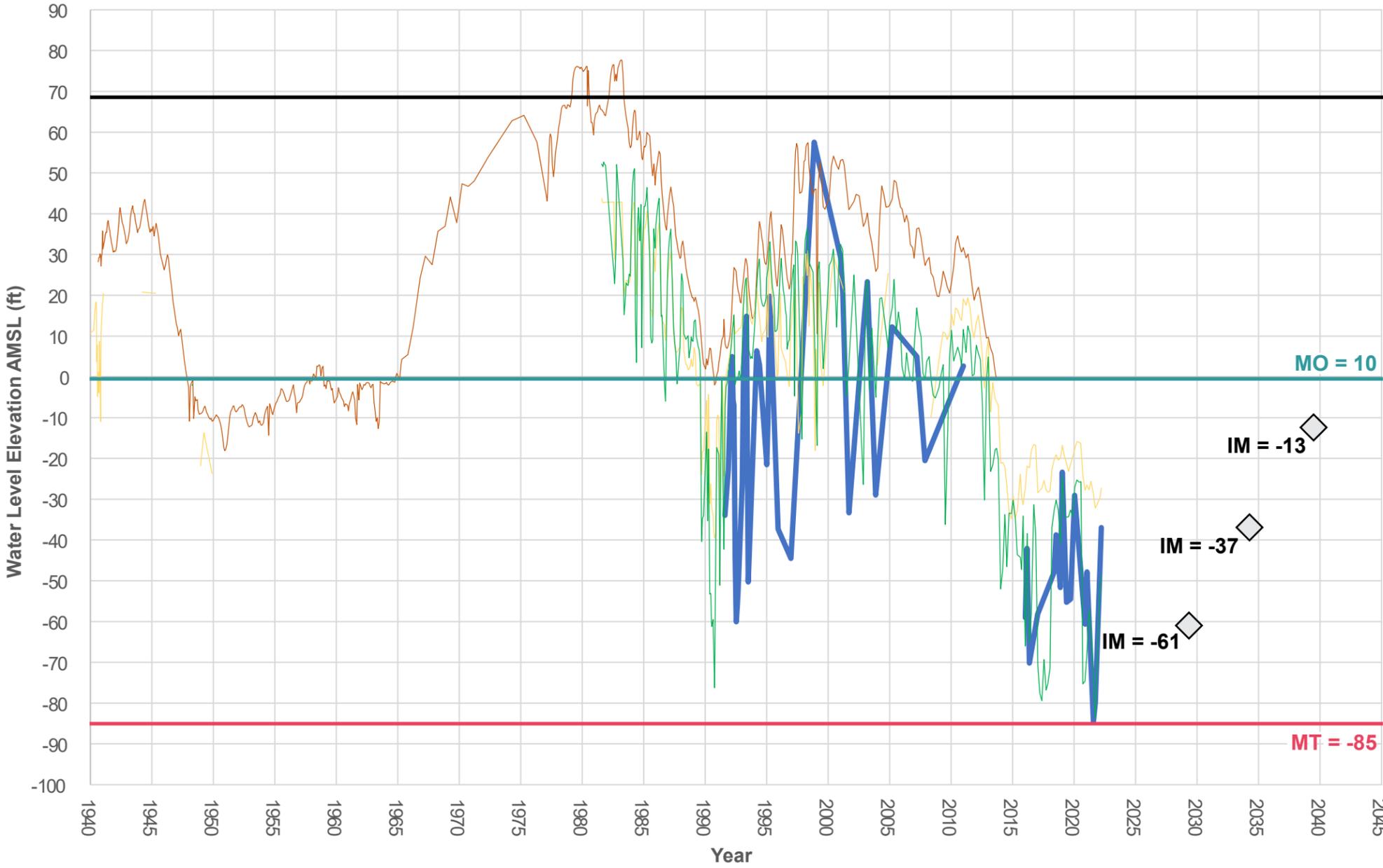
- LEGEND**
- MT (Minimum Threshold)
 - MO (Measurable Objective)
 - 20K4 (High School)(RMS)
 - 20K3
 - 20L4
 - Land Surface Elevation (20K4)
 - ◇ Interim Milestone (IM)



Water Level Data - 4N/25W Section 21 Wells

FIGURE 5-3
Groundwater Elevations, Minimum
Threshold, and Measurable
Objective for RMS Well 21L1
 Carpinteria Basin
 Groundwater Sustainability Plan

- LEGEND**
- MT (Minimum Threshold)
 - MO (Measurable Objective)
 - 21L1 (RMS)
 - 21R1
 - 21N1
 - 21N4
 - Land Surface Elevation (21L1)
 - ◇ Interim Milestone (IM)



Water Level Data - 4N/25W Section 27 Wells

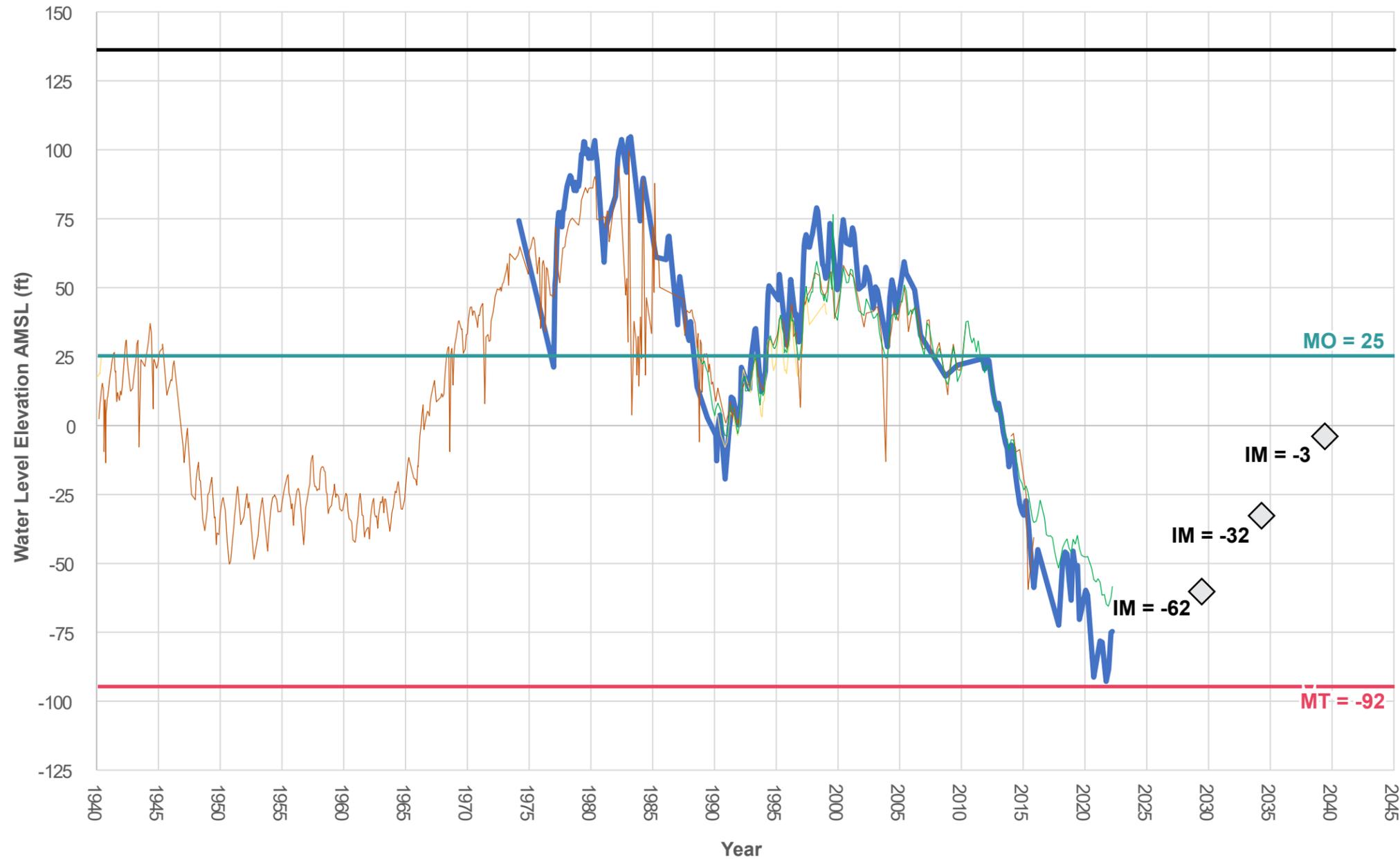


FIGURE 5-4
Groundwater Elevations, Minimum
Threshold, and Measurable
Objective for RMS Well 27F2
 Carpinteria Basin
 Groundwater Sustainability Plan

- LEGEND**
- MT (Minimum Threshold)
 - MO (Measurable Objective)
 - 27F2 (Smillie)(RMS)
 - 27F1
 - 27R2
 - 27Q6
 - Land Surface Elevation (27F2)
 - ◇ Interim Milestone (IM)

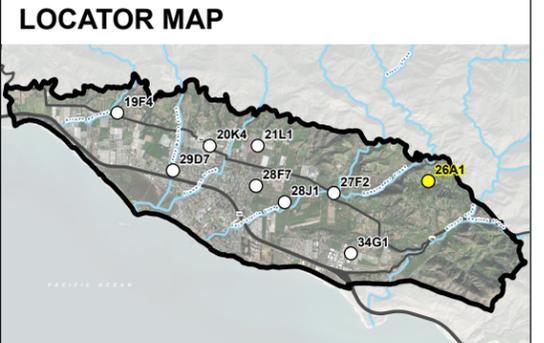
LOCATOR MAP



FIGURE 5-5
Groundwater Elevations, Minimum
Threshold, and Measurable
Objective for RMS Well 26A1
 Carpinteria Basin
 Groundwater Sustainability Plan



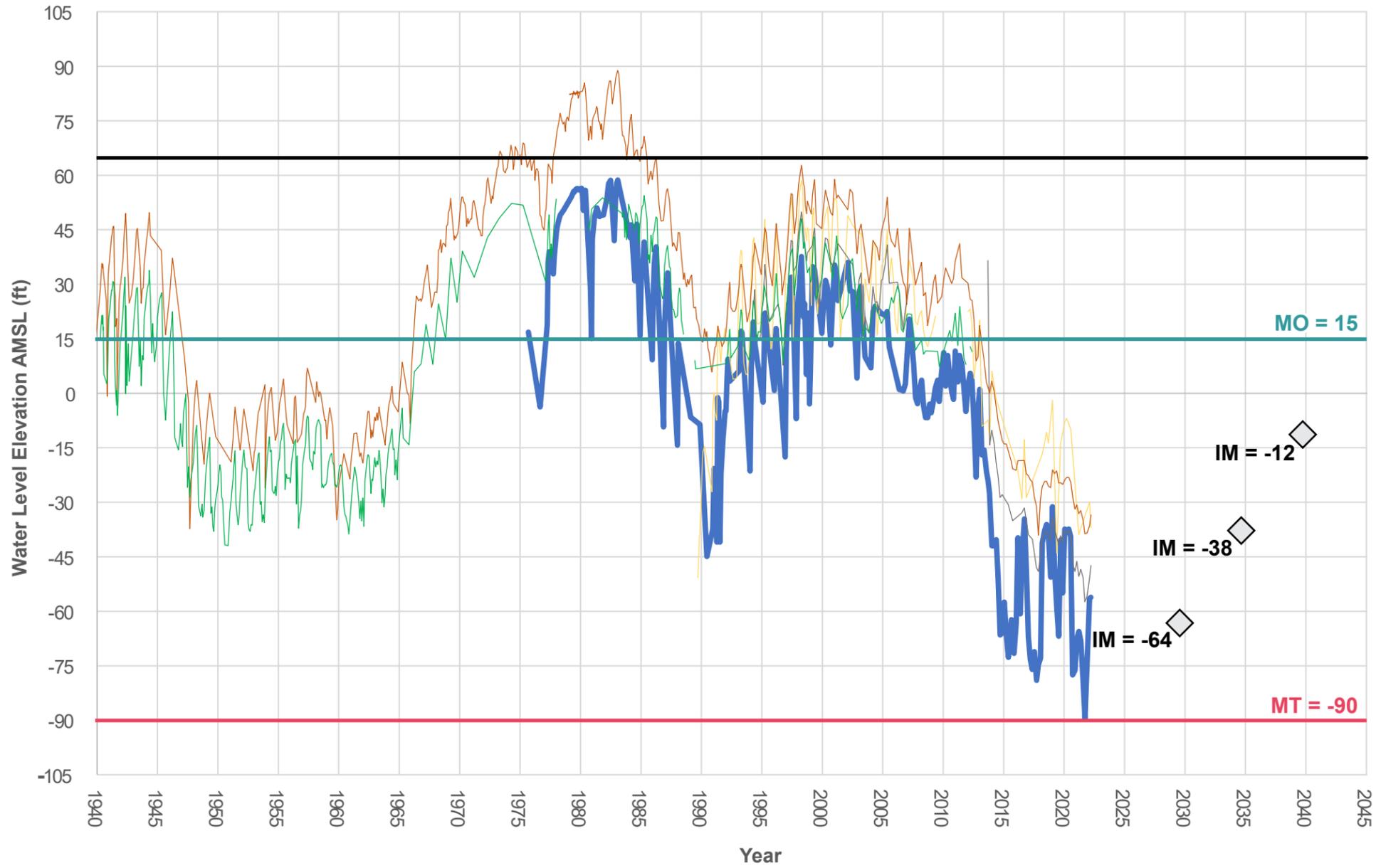
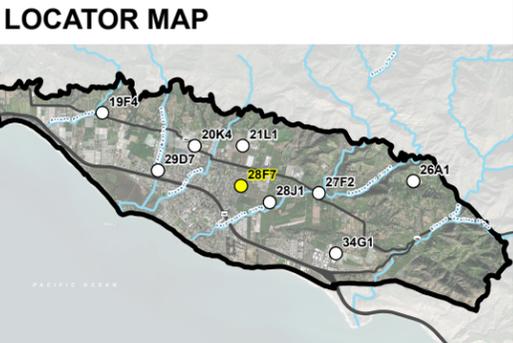
- LEGEND**
- MT (Minimum Threshold)
 - MO (Measurable Objective)
 - 26A1 (RMS)
 - 26C1
 - 26C6
 - Land Surface Elevation (26A1)
 - ◇ Interim Milestone (IM)



Water Level Data - 4N/25W Section 28 Wells

FIGURE 5-6
Groundwater Elevations, Minimum
Threshold, and Measurable
Objective for RMS Well 28F7
 Carpinteria Basin
 Groundwater Sustainability Plan

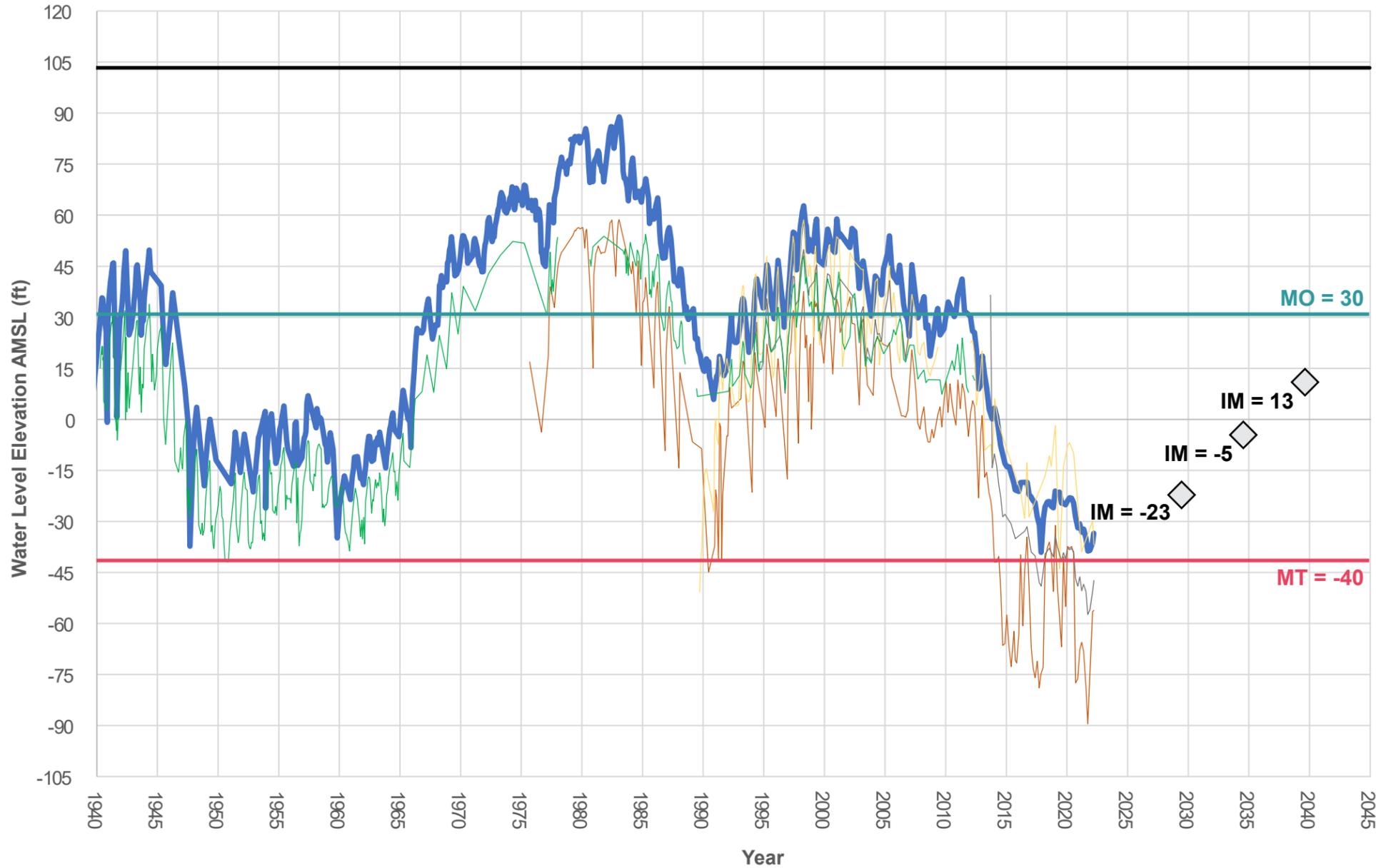
- LEGEND**
- MT (Minimum Threshold)
 - MO (Measurable Objective)
 - 28F7 (Lyons)(RMS)
 - 28D2/D4 (El Carro #1, 2)
 - 28G3
 - 28J1
 - 28M1
 - Land Surface Elevation (28F7)
 - ◇ Interim Milestone (IM)



Water Level Data - 4N/25W Section 28 Wells

FIGURE 5-7
Groundwater Elevations, Minimum
Threshold, and Measurable
Objective for RMS Well 28J1
 Carpinteria Basin
 Groundwater Sustainability Plan

- LEGEND**
- MT (Minimum Threshold)
 - MO (Measurable Objective)
 - 28F7 (Lyons)
 - 28J1 (RMS)
 - 28D2/D4 (El Carro #1, 2)
 - 28M1
 - 28G3
 - Land Surface Elevation (28F7)
 - ◇ Interim Milestone (IM)



Water Level Data - 4N/25W Section 29 Wells

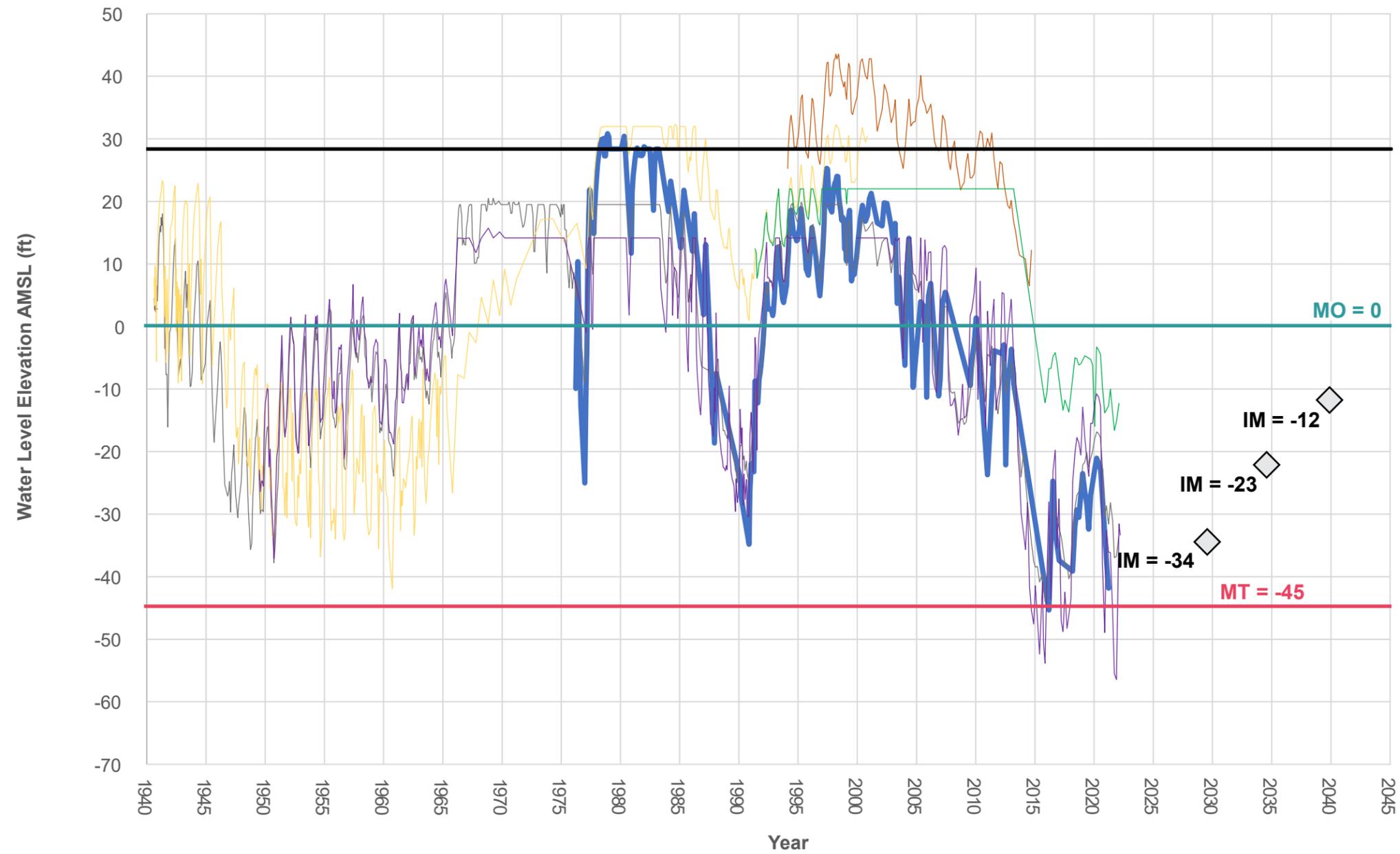


FIGURE 5-8
Groundwater Elevations, Minimum
Threshold, and Measurable
Objective for RMS Well 29D7
 Carpinteria Basin
 Groundwater Sustainability Plan

- LEGEND**
- MT (Minimum Threshold)
 - MO (Measurable Objective)
 - 229D7 (Santa Ynez)(RMS)
 - 29D1
 - 29R1
 - 29H2
 - 29K2
 - 29L1
 - Land Surface Elevation (29D7)
 - ◇ Interim Milestone (IM)



Water Level Data - 4N/25W Section 35 Wells

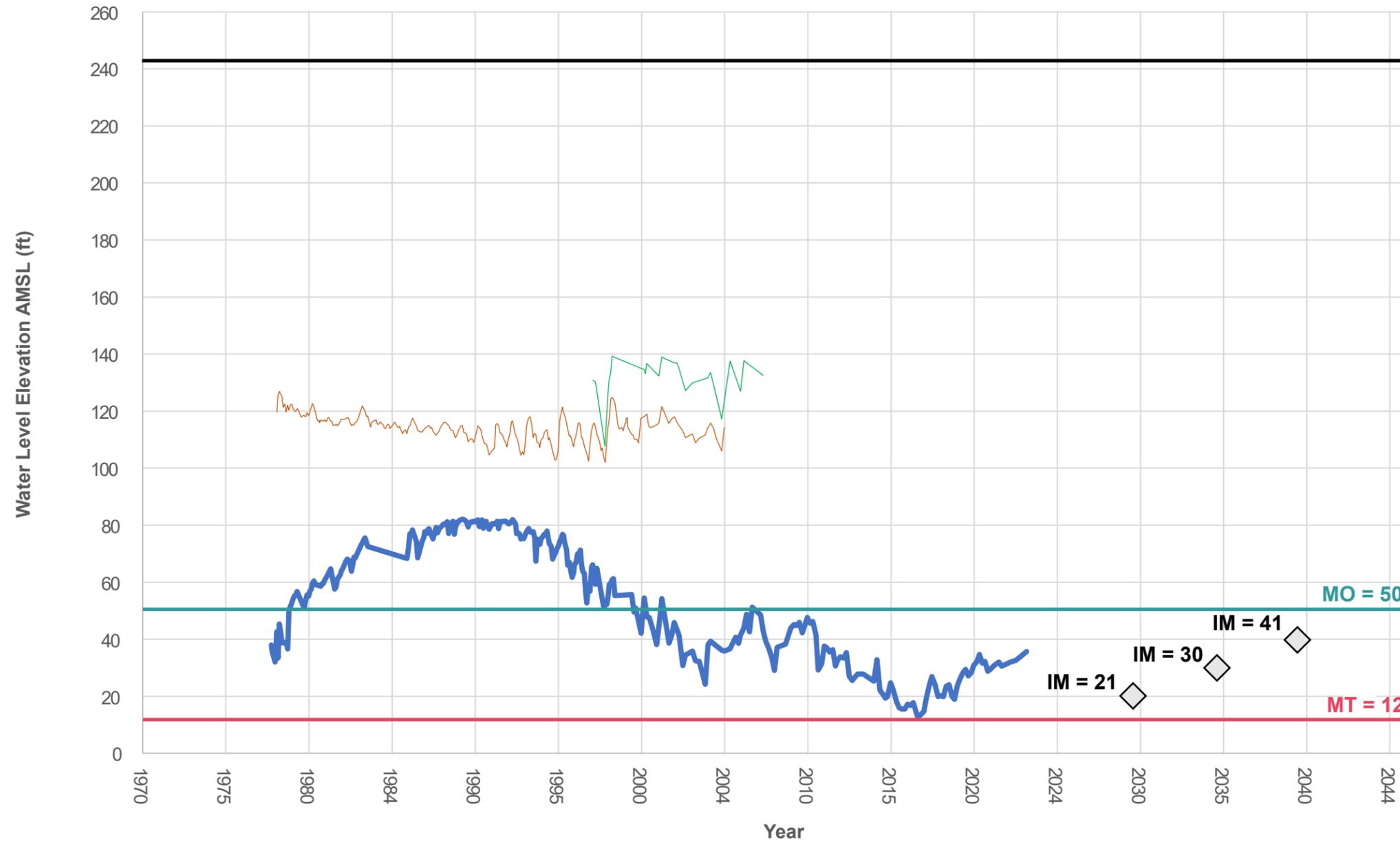


FIGURE 5-9
Groundwater Elevations, Minimum
Threshold, and Measurable
Objective for RMS Well 35E1
 Carpinteria Basin
 Groundwater Sustainability Plan

- LEGEND**
- MT (Minimum Threshold)
 - MO (Measurable Objective)
 - 35E1 (RMS)
 - 35A3
 - 35B6
 - Land Surface Elevation (35E1)
 - ◇ Interim Milestone (IM)



To assess whether significant undesirable results occurred in the Basin during the recent drought, GSA consultants conducted interviews with representatives of the beneficial users of groundwater in the Basin from April to June 2023. These users were primarily representatives of the agricultural community, but interviews were also conducted with management and staff from the CVWD. Four agricultural representatives that were members of the GSPAC were interviewed,³ as well as a prominent local manager of third-party agricultural properties.⁴ After collecting basic information (e.g., acreage, crops, and length of time farming in the Basin) discussions turned to the impact on operations experienced during the recent drought. The GSPAC agricultural stakeholders provided information and perspectives on their individual operations, and Mr. Shade provided a good perspective on basin-wide conditions for the numerous different properties that he helps to manage.

Some interviewees had family farming interests in the Basin dating back a hundred or more years. The interviewees' total acreage farmed or managed ranged from 20 acres to about 600 acres. The dominant crop grown by the interviewees is avocados; other crops grown include raspberries, cherimoya, cannabis, and citrus. One important fact related to agriculture in the Basin is that most, if not all, agricultural users in the Basin are connected to the CVWD distribution network, and thus are not solely dependent on groundwater to irrigate their fields. Although groundwater is certainly a cheaper alternative for irrigation water supply compared to CVWD water, and water is one of the more significant operating expenses, most of the interviewees used a combination of CVWD water and pumped groundwater to irrigate their crops. In some cases, the CVWD water is used as a supplemental supply for additional volume, and in some cases, it is purchased to blend with groundwater to achieve a more desirable water quality for sensitive crops.

In addition, it was related during the interviews that some of the greenhouse operations in the western portion of the Basin near Arroyo Paredon, where documented conditions of relatively poor water quality exist, operate onsite reverse osmosis units to treat their water to adequate quality for any salt-sensitive crops grown in the greenhouses. In any case, the availability of CVWD water as a supplemental supply is an important factor in the management of agricultural properties in the Basin, as is the current practice of treating poorer quality groundwater onsite before irrigation application. These conditions were in place at the time of SGMA implementation in 2015. Therefore, they are not considered undesirable conditions, and it is not the goal of SGMA implementation in the Basin to achieve conditions wherein these practices are no longer required.

During discussions regarding the use of groundwater during the recent drought, a few significant facts were determined:

- No wells in the Basin are known to have gone dry because of a decline in water levels during the drought.
- Only one agricultural well in the Basin was identified as having had to lower the pump in the well because of a decline in water levels in the well during the drought. While it is acknowledged that well maintenance work such as this is an unwanted operational expense, it is not uncommon during the long-term use of agricultural wells, and it does not rise to the level of a significant and unreasonable undesirable condition in the Basin.
- No agricultural operations were required to implement reductions of crops, fallowing, or any other measures that caused them significant economic hardships.
- Between pumped groundwater, treated groundwater, and CVWD water, farmers in the Basin were able to maintain their operations and continue production through the drought.

³ The four GSPAC members interviewed were Jim Bailard, Ivan Van Wingerden, Scott Van Der Kar, and Robert Abbott.

⁴ The local manager interviewed was Rick Shade.

- The CVWD was able to maintain deliveries without significant operational constraints and deliver adequate water for municipal and agricultural customers during the drought.
- Given these observations of operations during the drought, it can be stated that no significant and unreasonable undesirable effects were experienced during the drought.

After it was established that significant and unreasonable effects had been avoided during the recent drought, the members of the TCC and the GSPAC discussed whether it might be advantageous to the beneficial users in the Basin (particularly the agricultural community) to use water level data from the drought as an acceptable level at which to set the minimum thresholds in the RMS wells. Proceeding from the supposition that no undesirable effects had been encountered at the groundwater levels observed during the drought, there was discussion and analysis about whether water levels lower than those observed during the recent drought could be suggested as minimum thresholds and, if so, how much lower than recent water levels would be acceptable. Because of the lack of private domestic wells in the Basin, the primary beneficial users in the Basin are the agricultural users and CVWD, the primary potable supply agency in the Basin. To estimate the level of impact on existing well users in the Basin from setting minimum thresholds lower than the recent lows, a well impact analysis was performed using the well data maintained by the CVWD. The methodology used in this well impact analysis is described below.

Existing data provided by the CVWD were used in the analysis. Water levels from the fall 2018 groundwater elevation contour map prepared for the CVWD's annual report were used as representative of the lowest recent water levels. These contours were then converted to a spatial raster dataset, and fall 2018 groundwater elevations were assigned to each of 177 wells in the CVWD database. Then the raster surface was lowered in increments of 5 feet from 5 to 50 feet below the fall 2018 water levels, and the lowered water levels were compared against physical well data in the database, including screen interval and total water column in each well. Although the construction data for the wells in the database is incomplete, it was possible to use the impact analysis to assess the potential of significant impact to existing wells. Two pieces of data from each well in the database were used in the analysis to identify proxy conditions that might indicate significant impacts to existing wells: (1) well screen interval and (2) total water column in the well. As the water surfaces were lowered from 5 to 50 feet below the fall 2018 levels, well data were evaluated to measure the increased number of wells with the lowered water levels intersecting the well screen, and wells in which the lowered water levels resulted in lowering of the water column to less than 75 percent of the original water column (75 percent was used as a proxy indicator of a significant level of decline that could lead to unreasonable results).

Results indicated that a groundwater elevation surface 20 feet lower than the fall 2018 surface would result in an approximately 10 percent increase in the number of wells with water levels intersecting the well screen (18 additional wells), and that these lowered groundwater elevations would result in a 4 percent increase in the number of database wells (7 database wells) having a water column less than 75 percent of the original well water column. After presenting this information in public workshops and GSPAC meetings, stakeholders expressed some concern about the implications of defining a minimum threshold that would be lower than the lowest water level observed during the drought. The well impact analysis was performed to aid in identifying undesirable results and selecting minimum thresholds for the chronic lowering of groundwater levels sustainability indicator. Ultimately, the Carpinteria GSA decided not to pursue the approach of defining minimum thresholds lower than recent low water levels.

The Carpinteria GSA staff and the members of the TCC then evaluated an approach to defining minimum thresholds that used a running average of groundwater elevations to define the thresholds. Running averages of water levels for 3, 5, and 10 years were evaluated to assess whether this approach would be useful in defining minimum thresholds for this sustainability indicator. Ultimately, the GSA opted not pursue this approach because the complexities of the statistical approach might be difficult to convey to the public.

In the final analysis, given that no significant undesirable effects were reported in the Basin during the low water level conditions observed in the recent drought, and for the purposes of simplicity and ease of communication, the minimum thresholds for the chronic lowering of groundwater levels sustainability indicator was set in each RMS well at the observed lowest water level during the recent drought conditions. To avoid the circumstance where an additional dry year would result in immediate undesirable results, the undesirable results criteria are defined such that if the minimum thresholds are exceeded for three consecutive fall measurements (bracketing 2 calendar years), then this occurrence will trigger action to address the undesirable results.

5.5.2.2 Relationships Between 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.

(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 of the SGMA regulations requires a discussion of the relationship between the minimum thresholds for each sustainability indicator. Groundwater level minimum thresholds can potentially influence other sustainability indicators, as described below:

- **Reduction of Groundwater Storage.** Changes in groundwater elevations are directly correlated to changes in the amount of stored groundwater. Pumping at, or less than, the sustainable yield will maintain long-term average groundwater levels in the Basin. Likewise, the groundwater level minimum thresholds will maintain an adequate amount of groundwater in storage during an extended period when pumping is equal to or less than the sustainable yield. Thus, maintaining groundwater levels at or above minimum thresholds will not result in long-term significant and unreasonable reduction of groundwater storage.

- **Seawater Intrusion.** Seawater intrusion may be induced if groundwater elevations in the Basin near the coast are maintained at low levels for significant periods of time. As a result of the density difference between seawater and fresh water, coastal groundwater elevations higher than sea level can still result in seawater intrusion at depth. Pumping demands for municipal and agricultural beneficial uses during the past decades have resulted in a depression in the groundwater elevation surface over the center of the Basin (**Figures 3-19 through 3-23**). The Sentinel monitoring well in the C-zone (the deepest productive zone in the Basin) was recently installed along the coast and has begun to detect increasing levels of chloride during the past few years. If water levels are maintained at or below the minimum thresholds for significant periods of time without any offsetting projects or management actions, this could lead to conditions of lower water levels at the coast that could induce or fail to halt seawater intrusion from occurring. However, as will be discussed in Section 6, a project is being planned that will mitigate this potential risk.
- **Water Quality Degradation.** Protecting groundwater quality is critically important to all groundwater users in the Basin, particularly for drinking water and agricultural uses. Maintaining groundwater levels generally protects against water quality degradation for constituents of interest in the Basin in municipal supply wells due to groundwater management actions. Water quality in the Basin could theoretically be affected through two processes:
 1. Low groundwater levels caused by pumping in an area could cause deeper, poor-quality groundwater to flow into existing supply wells. There is no evidence that this has occurred in the Basin, and it is not considered to be a threat to water quality in the Basin. Because minimum thresholds are set to avoid significant declines of groundwater elevations below historically observed levels, and the historical low water levels did not result in water quality degradation, this is not expected to occur.
 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 or plumes to flow laterally towards supply wells that would not have otherwise been impacted. There is no evidence that this is occurring in the Basin.
- **Land Subsidence.** A significant and unreasonable condition for subsidence is permanent pumping-induced subsidence that substantially interferes with surface land use and damages infrastructure. One cause of subsidence is dewatering and compaction of clay and peat-containing sediments in response to lowered groundwater levels. The groundwater level minimum thresholds are set at recently observed historical groundwater elevations, during which time no subsidence was known to occur. Therefore, the groundwater level minimum thresholds that have been established are unlikely to induce additional subsidence.
- **Interconnected Surface Water Depletions.** As discussed in Sections 3.2.6 and 5.10, available data indicate that there are no interconnected surface water systems in the Basin,

The minimum thresholds set for chronic lowering of groundwater levels are protective of all beneficial uses and users of groundwater and are not anticipated to result in significant and unreasonable effects for the other sustainability indicators, assuming the projects and/or management actions presented in this Plan to address seawater intrusion are implemented.

5.5.2.3 Minimum Thresholds in Relation to Adjacent 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 Basin is bounded to the west by the Montecito Groundwater Basin (Montecito Basin). The shared boundary between the basins is not extensive, and the HCM posits that a groundwater divide separates the groundwater between the Montecito Basin and the Carpinteria Basin, and no significant flow has been observed or documented between the Montecito Basin and the Carpinteria Basin. Water budget results from recent modeling indicate an average of 50 acre-feet per year inflow from the Montecito Basin to the Carpinteria Basin. The two GSPs appear to be consistent in their understanding of aquifer conditions along their common boundary. It is not anticipated that actions associated with the Plan will have any significant impact that could alter the hydraulic communication between the two basins.

Additionally, the Carpinteria GSA has developed and maintained a cooperative working relationship with the Montecito GSA based on previous communications between the respective water districts. Hydrogeologic conditions near the basin boundary will be monitored, and any issues observed that may potentially affect the Montecito Basin will be communicated to the Montecito GSA.

5.5.2.4 Impact of Minimum Thresholds on Beneficial Uses and Users [§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. This section briefly addresses the effects of the minimum thresholds on the beneficial uses and users in the Basin.

Municipal Supply Uses and Users. Municipal supply is a primary beneficial use in the Basin. Representatives of the CVWD have maintained a leading role in the development of this Plan through assuming lead roles in the GSA and the GSPAC. Additionally, the CVWD and the GSA are the primary sponsors and administrators of any projects and management actions that are to be incorporated into basin management during the 20-year- SGMA implementation period. The groundwater elevation minimum thresholds place a practical limit on the potential future increase of groundwater pumping in the Basin. The minimum thresholds have been selected not to exceed conditions that were observed during the recent drought. The CVWD was able to provide supply to all customers during the recent drought. However, additional water supply projects are needed due to changing surface water supply reliability, and in part to achieve sustainability within the 20-year implementation time frame. As the primary sponsor of any such projects, the impact of the minimum thresholds on the municipal supply beneficial users could be the necessity of financial sponsorship and

implementation of projects, which could result in assumption of debt and rate increases for the paying customers in their service base.

Agricultural Uses and Users. The agricultural stakeholders in the Basin have maintained an active role during the development of this Plan. The groundwater elevation minimum thresholds place a practical limit on the acceptable lowering of groundwater levels in the Basin, thus conceptually preventing increased agricultural production beyond the current level of agriculture in the region without projects to augment water supply to the Basin. In the absence of other mitigating measures, this has the practical effect of potentially limiting the amount of groundwater pumping in the Basin. Limiting the amount of groundwater pumping could limit the additional amount and type of crops that can be grown in the Basin, which could result in capping the economic viability for some properties. The groundwater elevation minimum thresholds could therefore create an upper limit for the Basin's agricultural economy. This could have various effects on beneficial users and land uses, such as the following:

- There could be an economic impact on agricultural employees and suppliers of agricultural production products and materials. Many parts of the local economy rely on a vibrant agricultural industry, and they too may be impacted if irrigated agriculture is not expanded beyond current levels.
- Growth of city, county, and state tax rolls could be slowed or reduced because of the limitations imposed on agricultural growth and associated activities.

However, it should be noted that the projects and management actions discussed in Section 6 will be pursued to allow for continued agricultural pumping at recent levels.

Domestic Uses and Users. As discussed previously in Section 2.5.1, the CVWD supplies water to nearly 100 percent of residential and domestic users in the Basin. A CVWD records search identified only a two private wells being used for domestic supply in the Basin (both locations are capable of connecting to the CVWD distribution network, if desired). Therefore, the minimum thresholds are not expected to have any impact on domestic well uses and users.

Ecological Uses and Users. Groundwater elevation minimum thresholds protect the groundwater resource and the existing ecological habitats that rely on it at current conditions because they are set to avoid long-term declines in groundwater levels. As noted previously in this section, groundwater level minimum thresholds may limit increases in municipal and agricultural groundwater uses. Ecological land uses and users may benefit from this maintenance of municipal and agricultural groundwater uses at recent levels.

5.5.2.5 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.

5.5.2.6 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 RMS wells. The groundwater level monitoring program will be conducted in accordance with the monitoring plan outlined in Section 4 and will consist of collecting groundwater level measurements that reflect non-pumping (static) 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.

It is acknowledged that there are potential data gaps in the Carpinteria Basin with respect to groundwater dependent ecosystems (GDEs), which the GSA can continue to pursue. GDEs are affected by groundwater elevations in their vicinity. Two areas of potential GDEs were identified that may require additional investigation during the first 5-year SGMA implementation period.

5.5.3 Measurable Objectives for Chronic Lowering of Groundwater Levels Sustainability Indicator [§354.30]

§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 provide a target to be managed toward during the 20-year Plan implementation period to ensure conditions that avoid the occurrence of undesirable results. Measurable objectives for chronic lowering of groundwater levels are aspirational objectives that 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 are subject to change during the 20-year Plan implementation period, as new information and hydrologic data become available.

5.5.3.1 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; review of data and strategies with the TCC; and input from the GSPAC, other public stakeholders, and the GSA management. The measurable objective levels were set so that: (1) natural variations in groundwater levels as were observed in the past during wet and dry periods are considered, (2) there is enough groundwater in storage to get through a multi-year drought as was observed in water years 2012 to 2021 with 2 wet years in water years 2017 and 2019 without undesirable results, and (3) water levels typical of pre-drought conditions are used to establish measurable objectives (i.e., measurable objectives are not reflective of drought conditions). **Table 5-1** includes the estimated elevations for the measurable objectives established for the basin aquifer.

5.5.3.2 Measurable Objectives for the Principal Aquifer

The measurable objectives for the Basin RMS wells were selected using available groundwater elevation monitoring data and climatic data. They represent average conditions before the recent drought, and conditions observed during non-drought periods in the hydrographs of each RMS well. **Table 5-1** includes the measurable objectives for the chronic lowering of groundwater levels sustainability indicator.

5.5.4 Interim Milestones for Chronic Lowering of Groundwater Levels Sustainability Indicator [§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 are required to be included in the Plan. Interim milestones show how the Basin would move from current conditions to meeting the measurable objectives in the 20-year Plan implementation horizon. **Table 5-1** includes interim milestones at 5-year intervals toward the established measurable objectives.

The interim milestones were established by calculating equal intervals between the minimum threshold and the measurable objective, and then assigning proportional increases in groundwater levels with time. This approach assumes a relatively uniform change in water levels during the 20-year period, but hydrologic conditions and project implementation may be significantly variable.

5.6 Reduction of Groundwater Storage Sustainable Management Criterion

This section describes the SMC for the reduction of groundwater storage sustainability indicator. It defines undesirable results (Section 5.6.1), presents minimum thresholds (Section 5.6.2) and measurable objectives for each RMS in the monitoring network (Section 5.6.3), and provides interim milestones (Section 5.6.4). A number of alternative options for both minimum thresholds and measurable objectives were considered for each RMS after evaluation of the historical record of data at each well, assessment of trends of groundwater elevation declines and recovery, and input from stakeholders regarding their desired conditions.

Based on well-established hydrogeologic principles, the reduction of groundwater storage sustainability indicator is directly correlated to the chronic lowering of groundwater levels sustainability indicator, as described below.

5.6.1 Undesirable Results for Reduction of Groundwater Storage [§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.
- (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.

Per Section 354.26 of the SGMA regulations, locally defined significant and unreasonable conditions for the reduction of groundwater storage sustainability indicator were assessed based on the review of available historical groundwater data, stakeholder input during the public process, analysis of available data, and discussions with GSA staff. Based on well-established hydrogeologic principles, it is understood that the reduction of groundwater storage sustainability indicator is directly correlated to the chronic lowering of groundwater levels sustainability indicator. Significant and unreasonable changes in groundwater storage in the Basin are those that:

- May lead to long-term reduction of groundwater storage
- Interfere with other sustainability indicators

Assessment of groundwater in storage was evaluated using the same RMS network and associated water level minimum thresholds and measurable objectives as the chronic lowering of groundwater levels SMC. As additional data are collected in the monitoring network described in Section 4, new RMS sites may be established during the 20-year SGMA implementation period, and SMCs may be amended as determined by the GSA as new data are collected.

For the purposes of this Plan, the definition of undesired conditions for the reduction of groundwater storage sustainability indicator is as follows:

The Basin will be considered to have undesirable results if water levels in municipal supply wells decline to the point that they are in the screen, which could impact water supply operations, or if water levels in agricultural supply wells decline to the point that inadequate supply is available for farming operations, requiring fallowing or reduction of operations. The potential occurrence of undesirable results will be investigated and assessed if 33 percent or more RMSs for water levels within the Basin display exceedances of the minimum threshold groundwater elevation values for three consecutive fall measurements (bracketing 2 calendar years).

5.6.1.1 Criteria for Establishing Undesirable Results §354.2(b)(2)

The criteria for defining undesirable results were established after discussion and consultations with GSA staff, the TCC, the GSPAC, and public stakeholders. Significant and unreasonable reduction of groundwater storage in the Basin is reflected in conditions that:

- Reduce the ability of the CVWD to deliver adequate water supplies for all beneficial users and uses in their service area.
- Cause significant financial burden to those who rely on the resources of the groundwater basin for their economic livelihood.
- Interfere with other SGMA sustainability indicators.

5.6.1.2 Potential Causes of Undesirable Results

Conditions that could potentially lead to an undesirable result include the following:

- **Increased Rates of Pumping in the Basin Aquifer.** If the amount of pumping in the Basin were to increase to the point where it significantly exceeds the long-term rate of recharge, then groundwater levels and storage may decline, which could affect basin well production and result in depletion of supply for beneficial uses,
- **Extended Drought.** Minimum thresholds are established based on reasonable anticipated future climatic conditions, based on the best available science and climatological models being used to characterize climate change currently in use. Extensive, unanticipated droughts more severe than those on record 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.

5.6.1.3 Effects of Undesirable Results on Beneficial Users and Land Uses §354.2(b)(3)

The effects of these undesirable results on the beneficial users and uses are the same effects as those discussed for the chronic lowering of groundwater levels sustainability indicator.

The primary effects of undesirable results on the beneficial users in the Basin will be a reduction of supply available for municipal and agricultural uses. Undesirable results may occur from allowing three consecutive exceedances of the minimum thresholds in a small geographic area. The occurrence of three exceedances (bracketing a period of 2 years) in a network of nine RMS wells will result in an assessment of the occurrence of undesirable effects in the Basin.

The practical effect of protecting against undesirable results arising from a reduction of groundwater storage is that it encourages the maintenance of long-term stability in groundwater levels and storage during average hydrologic conditions during multiple years and decades. Maintaining long-term stability in groundwater levels also maintains long-term stability in groundwater storage and prevents chronic declines, thereby providing beneficial uses and users with continued access to groundwater on a long-term basis and preventing undesirable results associated with groundwater withdrawals. Pumping above 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 SGMA and 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.

5.6.2 Minimum Thresholds for Reduction of Groundwater Storage [§354.28(a),(b)(1),(c)(2),(d), and (e)]

§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.

(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)(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.”

In accordance with the SGMA regulation cited above, GSAs have the option of defining the minimum threshold metric as a calculated volume of groundwater in storage. Management of the Basin as established in this Plan will monitor changes in groundwater levels in the RMS well network as a proxy for the change in the reduction of groundwater storage sustainability indicator. As allowed by §354.36(b)(1) of the SGMA regulations, groundwater elevation data at the RMS 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 additional depletion of groundwater from storage. Therefore, using groundwater elevation levels as a proxy, the minimum threshold for chronic reduction of groundwater storage at each RMS is defined to be equivalent to the minimum threshold for chronic lowering of groundwater levels (see **Table 5-1**).

As additional hydrogeologic data are collected during the 20-year SGMA implementation period, and as these data are used to update the water budget analysis in the Basin, these minimum thresholds may be revisited by the Carpinteria GSA.

5.6.2.1 Information and Methods Used for Establishing Reduction of Groundwater Storage Minimum Thresholds [§354.28(b)(1)]

As detailed in Section 5.5, the primary source of data used to establish the minimum thresholds for the reduction of groundwater storage sustainability indicator is well construction data and groundwater elevation data historically maintained by the CVWD. The information used for defining the minimum thresholds and measurable objectives for the reduction of groundwater storage sustainability indicator includes:

- Historical groundwater elevation data from wells monitored by the CVWD and predecessor agencies.
- Depths, locations, and construction details of existing wells.
- Maps of current and historical groundwater elevation data.
- Input from stakeholders regarding significant and unreasonable conditions and desired current and future groundwater elevations communicated during public meetings and solicitation of public comment on various options of minimum thresholds and measurable objectives presented in the public forum.
- Results of modeling various project scenarios of future groundwater level conditions.

Reduction of groundwater storage minimum thresholds will be assessed by collecting water level measurements at the RMS well sites in the monitoring network presented in Section 4 (see **Figure 4-3**). These data will be used to monitor groundwater elevations and assess changes in groundwater in storage.

5.6.2.2 Relationships Between 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.

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

- **Chronic Lowering of Groundwater Levels.** Because groundwater levels will be used as a proxy for estimating changes of groundwater in storage, the reduction of groundwater storage SMC will not impact this sustainability indicator.

- **Seawater Intrusion.** Seawater intrusion may be induced if groundwater storage in the Basin is depleted, as expressed by groundwater levels in the Basin along the coast at depressed elevations for significant periods of time. As a result of the density difference between seawater and native groundwater, seawater intrusion may be induced when groundwater elevations are above sea level. Pumping demands for municipal and agricultural beneficial uses during the past decades have resulted in a reduction of storage in the central portion of the Basin, evidenced by a depression in the groundwater elevation surface over the center of the Basin (see **Figures 3-19 through 3-23**). The Sentinel monitoring well in the C-zone of the aquifer recently installed along the coast has begun to detect increasing levels of chloride during the past few years. If water levels along the coast are maintained at low elevations for significant periods of time without any offsetting projects or management actions, this could lead to conditions that could induce seawater intrusion. Minimum thresholds for seawater intrusion are defined as chloride concentrations in currently active wells (see Section 5.7). However, projects are being planned that will mitigate this potential risk (see Section 6).
- **Water Quality Degradation.** 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 COCs in supply wells by maintain water levels equal to or higher than those recently observed in the Basin.
- **Land Subsidence.** Subsidence has not historically been a significant issue in the Basin. Future groundwater levels would likely have to be substantially lower than are predicted to occur in the future to result in significant subsidence. Should significant and unreasonable subsidence be observed as a result of groundwater management in the Basin, the minimum thresholds for the reduction of groundwater storage sustainability indicator may be revisited by the Carpinteria GSA to avoid this circumstance.
- **Interconnected Surface Water Depletions.** As discussed in Sections 3.2.6 and 5.10, available data indicate that there are no interconnected surface water systems in the Basin.

5.6.2.3 Effects of Minimum Thresholds on Adjacent 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 Montecito Basin lies to the west of the Carpinteria Basin. The minimum thresholds for the reduction of groundwater storage sustainability indicator are not anticipated to significantly affect conditions in the Montecito Basin. Additionally, the Carpinteria GSA has developed and maintained a cooperative working relationship with the Montecito GSA based on previous and ongoing communications between the GSAs and water districts. Hydrogeologic conditions near the basin boundary will be monitored, and any issues observed that may potentially affect the Montecito Basin will be communicated to the Montecito GSA.

5.6.2.4 Impact of Minimum Thresholds on Beneficial Uses and Users [§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 storage and lowering of groundwater levels have been established to be protective of beneficial uses in the Basin while providing a reliable and sustainable groundwater supply. This section briefly addresses the effects of the minimum thresholds on the beneficial uses and users in the Basin.

Municipal Supply Uses and Users. Municipal supply is a primary beneficial use in the Basin. Representatives of the CVWD maintained a leading role in the development of this Plan through assuming lead roles in the GSA and the GSPAC. Additionally, the CVWD and the GSA are the primary sponsors and administrators of any projects and management actions that are to be incorporated into basin management during the 20-year SGMA implementation period. The reduction of groundwater storage minimum thresholds establish a practical limit on the potential future increase of groundwater pumping in the Basin. The minimum thresholds have been selected not to exceed conditions that were observed during the recent drought, during which time the CVWD was able to supply all customers in its service area. However, additional water supply projects are likely to be required to achieve sustainability within the 20-year implementation time frame. As the primary sponsor of any such projects, the impact of the minimum thresholds on the municipal supply beneficial users could be the necessity of assuming financial sponsorship and implementation of projects, which could result in assumption of debt and the potential for rate increases for the paying customers in their service base.

Agricultural Uses and Users. The agricultural stakeholders in the Basin have maintained an active role during the development of this Plan. The groundwater elevation minimum thresholds place a practical limit on the acceptable lowering of groundwater levels in the Basin, thus conceptually not allowing increased agricultural production beyond the current level of agriculture in the region without projects to supplement water supply to the Basin. In the absence of other mitigating measures, this has the practical effect of potentially limiting the amount of groundwater pumping in the Basin. Limiting the amount of groundwater pumping could limit the additional amount and type of crops that can be grown in the Basin, which could result in capping the economic viability for some properties. The groundwater elevation minimum thresholds could therefore create an upper limit for the Basin's agricultural economy. This could have various effects on beneficial users and land uses, such as the following:

- There could be an economic impact on agricultural employees and suppliers of agricultural production products and materials. Many parts of the local economy rely on a vibrant agricultural industry, and they too may be impacted if irrigated agriculture is not expanded beyond current levels.
- Growth of city, county, and state tax rolls could be slowed or reduced because of the limitations imposed on agricultural growth and associated activities.

However, it should be noted that the projects and management actions discussed in Section 6 will be pursued to allow for continued agricultural pumping at recent levels and alternatives to reductions in agriculture pumping.

Domestic Uses and Users. As has been discussed previously, the CVWD supplies water to nearly 100 percent of residential and domestic users in the Basin. A CVWD records search identified only a single well being used for domestic supply in the Basin (that location is capable of connecting to the CVWD distribution network, if desired). Therefore, the minimum thresholds are not expected to have any impact on domestic use in the Basin beyond those applicable to the municipal supply of residential and domestic users beneficial use previously discussed.

Ecological Uses and Users. Groundwater elevation minimum thresholds protect the groundwater resource and the existing ecological habitats that rely upon it at current conditions because they are set to avoid long-term declines in groundwater levels. As noted previously, groundwater level minimum thresholds may limit increases in municipal and agricultural groundwater uses. Ecological land uses and users may benefit from this reduction in non-de minimis and agricultural groundwater uses.

5.6.2.5 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 reduction of groundwater storage.

5.6.2.6 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 reduction of groundwater storage will rely on the groundwater elevation monitoring program described previously for chronic lowering of groundwater levels (see Section 5.5). Groundwater levels (as a surrogate for change of groundwater in storage) that drop below the minimum threshold values for three consecutive fall measurements may indicate the presence of undesirable results.

5.6.3 Measurable Objectives for Reduction of Groundwater Storage Sustainability Indicator [§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 reduction of groundwater storage utilize groundwater levels as a proxy for direct measurement of groundwater storage. The same minimum thresholds and measurable objectives that protect against significant and unreasonable reduction in groundwater storage are used as SMCs to protect against chronic lowering of groundwater levels (see **Table 5-1**). These levels were selected using available groundwater elevation monitoring data and climatic data during the period of record. Measurable objectives may change after plan adoption during the 20-year SGMA implementation period, as new information and hydrologic data become available.

5.6.3.1 Information and Methods Used for Establishing Reduction of Groundwater Storage Measurable Objectives §354.30(b)

Measurable objectives for the reduction of groundwater storage sustainability indicator were established to meet the sustainability goal and were based on trends in historical groundwater level data, historical precipitation data, and input from the GSPAC, other public stakeholders, and the GSA Committee. The measurable objective levels were set so that: (1) natural variations in groundwater levels as were observed in the past during wet and dry periods are considered, and (2) there is enough groundwater in storage to get through a multi-year drought as was observed in water years 2012 to 2021 with 2 wet years in water years 2017 and 2019 without undesirable results, and (3) water levels typical of pre-drought conditions are used to establish measurable objectives (i.e., measurable objectives are not reflective of drought conditions). **Table 5-1** includes the estimated elevations for the measurable objectives established for the basin aquifer.

5.6.3.2 Measurable Objectives for the Principal Aquifer

The measurable objectives for the Basin RMS wells were selected using available groundwater elevation monitoring data and climatic data. The measurable objectives are selected to represent average conditions before the recent drought, and conditions observed during non-drought periods in the hydrographs of each

RMS well. The measurable objectives for this sustainability indicator are the same as those established for the chronic lowering of groundwater levels sustainability indicator. **Table 5-1** includes the measurable objectives for the reduction of groundwater storage sustainability indicator.

5.6.4 Interim Milestones for Reduction of Groundwater Storage Sustainability Indicator [§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 are required to be included in the Plan. Interim milestones demonstrate how the Basin would move from current conditions to meeting the measurable objectives during the 20-year Plan implementation horizon. While no undesirable effects on groundwater in storage have been observed in the Basin as a result of lowering of groundwater levels to date, interim milestones are being proposed to ensure that the GSA is on track for eliminating the storage deficit going forward. The GSA intends to move forward with selected projects and management actions (see Section 6) soon after plan submittal to ensure that groundwater levels recover to levels above the established minimum thresholds when non-drought rainfall conditions return. **Table 5-1** includes interim milestones at 5-year intervals toward the established measurable objectives.

The interim milestones were established by calculating equal intervals between the minimum threshold and the measurable objective, and assigning proportional increases in groundwater levels during this time period. This approach assumes a relatively uniform change in water level conditions during the 20-year period, but hydrologic conditions and project implementation may be significantly variable.

Regular updates to the water budget analysis during the 20-year SGMA implementation period will be evaluated to confirm that groundwater storage in the Basin is being maintained, and not declining to undesirable levels.

5.7 Seawater Intrusion Sustainable Management Criterion

Per Section 354.22 of the SGMA regulations, this section of the Plan describes the SMC for the seawater intrusion sustainability indicator. The definition of undesirable results is presented (Section 5.7.1), minimum thresholds (Section 5.7.2) and measurable objectives (Section 5.7.3) are presented for each RMS in the monitoring network, and interim milestones are presented (Section 5.7.4).

Unlike other SGMA basins that have documented conditions of seawater intrusion dating back decades (i.e., Santa Cruz Mid-County, Oxnard Plain, Salinas), evidence of seawater intrusion in the Basin is quite recent and is to date confined to data from a single monitoring well installed in 2019. No lengthy period of record of seawater intrusion exists in the Basin. However, the recent data are significant, and the GSA understands this sustainability indicator to be an important consideration for future groundwater management in the Basin, and a likely driver for future projects and management actions designed to avoid undesirable effects associated with seawater intrusion.

5.7.1 Undesirable Results for Seawater Intrusion [§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.

The GSA has established the definition of significant and unreasonable seawater intrusion into the Basin as:

Seawater moving inland to the point where groundwater produced from currently active wells exhibits increased concentrations of chloride above the established secondary maximum contaminant level (MCL) for drinking water of 250 ppm.

To date, seawater intrusion is not known to have impacted any active wells in the Basin. It is one of the goals of this GSP to maintain this condition, and to avoid impacts to beneficial users from seawater intrusion. As discussed previously, to date, elevated chlorides have only been detected in the C-zone Sentinel well. Increased groundwater monitoring will be implemented along the coast in the western portion of the Basin to manage the potential occurrence of seawater intrusion in the Basin.

5.7.1.1 Criteria for Establishing Undesirable Results §354.2(b)(2)

The criteria for defining undesirable results were established after discussion and consultations with GSA staff, the TCC, the GSPAC, and public stakeholders. Significant and unreasonable seawater intrusion in the Basin is reflected in conditions allowing inland migration of brackish or saline groundwater to the geographic extent where it is expressed as increased chloride concentrations in currently active production wells in the Basin. A chloride isocontour along a line defined by currently active production wells nearest to the coast will be defined as the minimum threshold conditions. To monitor the isocontour, chloride concentrations in monitoring wells and production wells on both sides of the isocontour line must be monitored. Protective groundwater elevations at monitoring wells along the coast will be maintained via projects to prevent seawater intrusion from impacting active production wells.

Undesirable results would be conditions that:

- Reduce the ability of the CVWD to deliver adequate water supplies for all beneficial users and uses in their service area.
- Reduce the ability of agricultural stakeholders to maintain crops at recent levels as a result of increased salinity of irrigation water.
- Interfere with other SGMA sustainability indicators.

The practical effect of protecting against undesirable results arising from seawater intrusion is that it maintains groundwater quality along the coast at conditions comparable to current conditions, mitigating against the loss of economic productivity of agriculture in that area.

5.7.1.2 Potential Causes of Undesirable Results

Conditions that could potentially lead to an undesirable result include the following:

- **Increased Rates of Pumping in the Basin Aquifer.** If the amount of net pumping in the Basin were to increase significantly, it could lead to groundwater elevations inland from the coast that may exacerbate long-term conditions that allow inland migration of brackish and saline groundwater, if no offsetting projects or management actions are implemented to mitigate against migration of brackish or saline groundwater. If protective groundwater elevations are not maintained along the coast, this could potentially result in conditions leading to seawater intrusion.
- **Extended Drought.** Minimum thresholds are established based on reasonable anticipated future climatic conditions, based on the best available science and climatological models being used to characterize climate change currently in use. Extensive, unanticipated droughts more severe than those on record may lead to excessively low groundwater levels, that could allow seawater intrusion if no offsetting projects or management actions are implemented.

5.7.1.3 Effects of Undesirable Results on Beneficial Users and Land Uses §354.2(b)(3)

The primary negative effect on beneficial uses and users of seawater intrusion is that the Basin groundwater supply along the coast could exhibit increased salinity, impacting the use of groundwater for both municipal and agricultural purposes. The secondary maximum contaminant level (SMCL) for chloride is 250 milligrams per liter (mg/L); a SMCL indicates a taste and odor issue. Water with this chloride concentration is still drinkable. However, municipal supply could require higher levels of treatment, with the associated increased cost for supplying potable water to its customer base. Many of the agricultural operations in the western part of the Basin along the coast are greenhouse operations that either augment well water with District water to attain desired water quality or route their well water through a treatment unit to attain the desired quality. However, undesirable effects could force an increase in these practices, affecting the economics of the agriculture in the area.

Increased salinity of irrigation water could result in agricultural stakeholders experiencing reduced crop yields, or necessitating the purchase of additional CVWD water for blending with groundwater or for direct irrigation, depending on individual crop-specific tolerances of different plants.

5.7.2 Minimum Thresholds for Seawater Intrusion [§354.28(a),(b)(1),(c)(3),(d), and (e)]

§ 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:

(3) Seawater Intrusion. The minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results. Minimum thresholds for seawater intrusion shall be supported by the following:

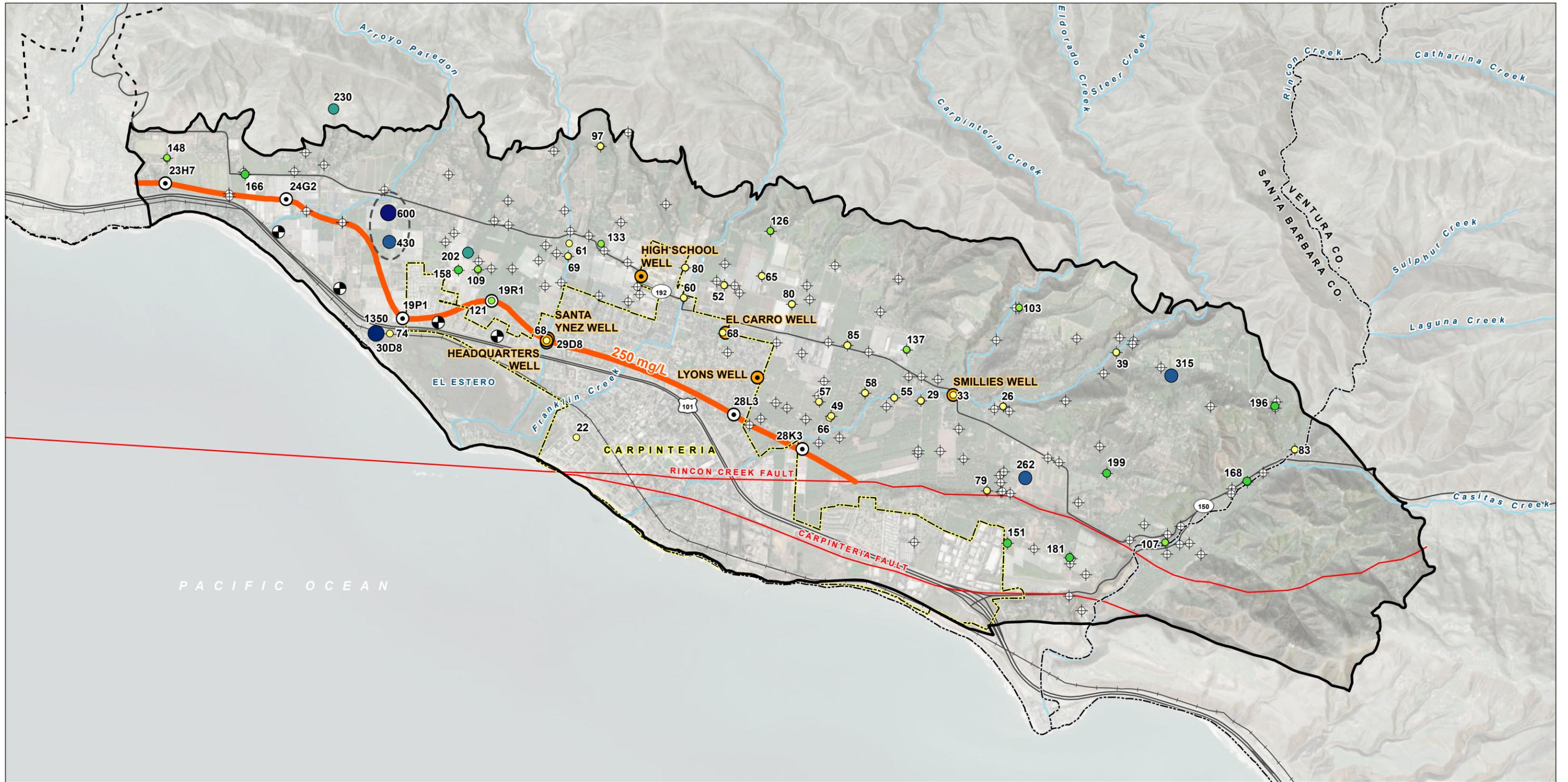
(A) Maps and cross-sections of the chloride concentration isocontour that defines the minimum threshold and measurable objective for each principal aquifer.

(B) A description of how the seawater intrusion minimum threshold considers the effects of current and projected sea levels.

(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.

Seawater intrusion minimum thresholds for the Basin are defined as a chloride isocontour of 250 mg/L sub-parallel to the coast along a line defined by currently active wells in the Basin (see **Figure 5-10**). The isocontour stops at the intersection with the Rincon Creek Fault, because uplifted fault blocks of bedrock along this fault truncate the productive sedimentary zones of the basin aquifer; therefore, seawater intrusion is not expected southeast of the Rincon Creek Fault. Construction of additional coastal monitoring wells similar to the Sentinel wells (A-, B-, and C-zone wells) are planned as part of the 5-year implementation plan to more definitively characterize water quality conditions in the aquifer along the coast. As of 2022, only the C-zone Sentinel well – perforated at 1020 to 1120 ft BGS- has indicated rising concentrations of chloride in the Basin. Additionally, the GSA recognizes that a seawater barrier project may need to be considered for longer term implementation, after additional hydrogeologic data are gathered from the expanded Sentinel well monitoring effort (see Section 6).



LEGEND

Maximum Chloride Concentration in mg/L (2015 - 2021)

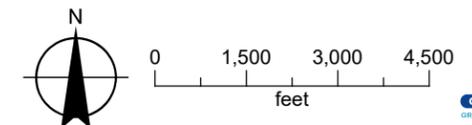
- < 100
- 101 - 150
- 151 - 200
- 201 - 250
- 251 - 500
- > 500

- MT Isocontour at 250 mg/L
- CVWD District Well
- Proposed RMS Well (Active)
- ◐ Proposed Monitoring Well
- ◑ Existing Monitoring Well
- ⊕ Active Well
- CVWD Database Well

All Other Features

- Carpinteria Groundwater Basin
- Montecito Groundwater Basin
- County Boundary
- City Boundary
- Fault
- Railroad
- Major Road
- Watercourse

FIGURE 5-10
Seawater Intrusion Isocontour SMC
 Carpinteria Basin Groundwater Sustainability Plan



5.7.2.1 Information and Methods Used for Establishing Seawater Intrusion Minimum Thresholds [§354.28(b)(1)]

The primary source of data used to establish the minimum thresholds for the seawater intrusion sustainability indicator is well construction data, groundwater elevation data, and water quality data historically maintained by the CVWD. The information used for defining the minimum thresholds and measurable objectives for the seawater intrusion sustainability indicator includes:

- Review of water quality data from wells monitored by the CVWD.
- Locations of currently active wells in the Basin.
- Review of data from the recently installed Sentinel wells.
- Regulatory criteria for chlorides.
- Historical coastal and basin-wide groundwater elevation data from wells monitored by the CVWD and predecessor agencies.
- Depths and locations of existing wells.
- Input from stakeholders regarding significant and unreasonable conditions communicated during public meetings and solicitation of public comment on various options of minimum thresholds and measurable objectives presented in the public forum.
- Information regarding potential future beneficial uses of groundwater between the coast and identified currently active wells.
- Estimates of potential inland groundwater velocities along the coast.

Figure 5-10 presents the maximum observed chloride concentrations from 2015 through 2021 at wells that have been monitored by the CVWD. Inspection of this figure indicates that chloride concentrations across the Basin are predominantly lower than the SMCL for chloride of 250 mg/L. One of the two notable exceptions includes the area in the western part of the Basin in the vicinity of Arroyo Paredon, which exhibits significantly elevated chloride concentrations in comparison to the rest of the Basin. However, this trend has been observed as part of the basin characterization of ambient groundwater quality (likely associated with surface water quality in Arroyo Paredon Creek) and is not understood to be a result of seawater intrusion. Agricultural operations in this area have continued through the recent drought for greenhouse crops, row crops, and orchards in this area, using both groundwater and District water to provide irrigation. Second, some wells in the eastern portion of the Basin in the vicinity of Shepherd Mesa have existing data in excess of 250 mg/L. This area is located north of the fault blocks that truncate the extension of the aquifer strata out beneath the ocean; therefore, it is not understood to be at risk of seawater intrusion. These data are understood to be part of the naturally variable water quality conditions in the Basin.

The Sentinel well cluster installed in 2019 has provided real-time data on conductivity, and quarterly sampling of chloride and total dissolved solids (TDS) (see **Figure 3-32 through 3-34**). These wells have provided the only chloride data to date that indicate elevated concentrations of chloride along the coast in the aquifer sediments. It is anticipated that among the first activities undertaken during the 5-year implementation will be installation of additional monitoring wells along the coast, to more robustly characterize chloride concentrations and associated water quality indicators in the area of concern along the coast.

SGMA allows for the utilization of groundwater elevations as a proxy criterion for minimum thresholds for seawater intrusion. This Plan does not choose to use this approach, opting to define the minimum thresholds as a chloride isocontour. However, the successful achievement of this minimum threshold will

depend on the maintenance of protective groundwater elevations along the coast to prevent inland migration of brackish groundwater.

Initial model runs were performed to demonstrate the feasibility of the barrier concept. As a result of the lack of data regarding aquifer parameters along the coast, these efforts were not carried through to the point of conceptual design, where the number of wells or necessary injection rates were calculated. After additional data are collected in the first 5-year SGMA implementation period, future modeling evaluations of projected conditions with respect to seawater intrusion will reference protective groundwater elevations using the Ghyben-Herzberg principle to calculate freshwater equivalent heads necessary to maintain the minimum thresholds against seawater intrusion while simulating projects and management actions to achieve this minimum threshold.

Seawater intrusion minimum thresholds will be assessed by collecting water samples at current and future coastal monitoring wells and at the RMS well sites in the monitoring network presented in **Figure 4-4**. This data and observed water levels from the wells will be used to monitor aquifer conditions and assess changes in conditions that could lead to seawater intrusion.

As an initial attempt to estimate groundwater flow velocities along the coast, a simple calculation was performed using available data for hydraulic conductivity, groundwater gradient, and velocity. Groundwater velocity can be estimated using the equation:

$$V = Ki/n \text{ where}$$

$$V = \text{velocity (feet per day [ft/day])}$$

$$K = \text{Hydraulic Conductivity (ft/day)}$$

$$i = \text{Hydraulic gradient (unitless), and}$$

$$n = \text{effective porosity}$$

Little data with respect to hydraulic conductivity or other physical characteristics of the productive strata of the basin aquifer are available. Estimates for hydraulic conductivity used in the groundwater model for the productive strata range from approximately 10 ft/day to about 50 feet per day, so this range of values is used in this analysis. The groundwater elevation contour map for fall 2020 was examined, and a hydraulic gradient of about 0.003 was calculated from the contours. An estimate of 0.15 is used as a typical estimate of effective porosity for sand. Using these values, calculated groundwater velocities ranging from 73 to 365 feet per year are obtained. These groundwater velocities indicate that there is likely time available in the initial 5-year SGMA implementation period to gather additional data to better characterize the water quality and aquifer conditions required to assess seawater intrusion conditions, and to properly design a barrier project, should the decision be taken to implement such a project. It is recognized that this is a simple calculation based on idealized assumptions. However, the equation is based on long-standing and commonly accepted hydrogeologic principles, and represents a reasonable first estimate of groundwater velocity along the coast.

There are several significant data gaps with respect to the understanding of the seawater intrusion sustainability indicator along the coast. Data density characterizing important details of the stratigraphic geometry of the productive zones of the aquifer will need to be improved. Data describing aquifer parameters such as transmissivity, storativity, and porosity for the A-zone, B-zone, and C-zone along the coast are not well characterized. The lack of this physical data results in significant uncertainty with respect to anticipated flow rates of potential injection wells, and the resulting chloride concentrations related to these projects and management actions. However, minimum thresholds have been established using the

best available data and understanding of the aquifer. The minimum thresholds may be revised as additional data are gathered during the 20 -year SGMA implementation period.

5.7.2.2 Relationships Between 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.

The minimum thresholds for seawater intrusion are defined in terms of chloride concentrations along an isocontour line classified by currently active wells in the Basin. These minimum thresholds could theoretically influence or be influenced by other sustainability indicators, as outlined below:

- **Chronic Lowering of Groundwater Levels.** Additional lowering of groundwater levels beyond current levels along the coast between the Rincon Creek fault and the boundary with the Montecito Basin could lead to conditions conducive to seawater intrusion if no offsetting projects or management were undertaken. Planning is underway for projects and management actions that will improve conditions to maintain groundwater elevations at protective levels along the coast (see the Carpinteria Advanced Purification Project and the Seawater Barrier Project, both discussed in Section 6).
- **Reduction of Groundwater Storage.** Minimum thresholds for reduction of groundwater storage are equivalent to those identified for chronic lowering of groundwater levels. Additional lowering of groundwater levels beyond current levels along the coast between the Rincon Creek fault and the boundary with the Montecito Basin could lead to conditions conducive to seawater intrusion. Planning has been initiated for projects and management actions that will improve conditions to maintain groundwater elevations at protective levels along the coast.
- **Water Quality Degradation.** The minimum thresholds for degraded water quality for nitrate, arsenic, and boron are not anticipated to have any relational impact with the seawater intrusion minimum thresholds. Unintruded RMS wells in the inland portion of the Basin are assigned a lower minimum threshold chloride concentration (142 mg/L) based on agricultural thresholds published in the Basin Plan (RWQCB et al., 2019) and observed recent chloride concentrations in those wells. If the seawater intrusion minimum thresholds are sustained through projects and management actions, this would indicate no significant landward migration of poorer quality groundwater. Regular monitoring of coastal and inland basin wells will be maintained to monitor this relationship.
- **Land Subsidence.** Subsidence has not historically been a significant issue in the Basin. Achieving seawater intrusion minimum thresholds will require similar or increased groundwater elevations along the coast, which would not be expected to result in subsidence in the Basin.
- **Interconnected Surface Water Depletions.** As discussed in Section 5.10, available data indicate that there are no interconnected surface water systems in the Basin.

5.7.2.3 Effects of Minimum Thresholds on Adjacent 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 Montecito Basin borders the Carpinteria Basin to the west. If seawater intrusion minimum thresholds are successfully achieved, this implies groundwater elevations along the coast similar to current conditions or increased groundwater elevations above current conditions along the coast. This could theoretically have a small effect by reducing groundwater inflow from the Montecito Basin because of increased groundwater elevations in the Carpinteria Basin.

The minimum threshold isocontour is set slightly inland, so it is possible that water quality conditions between the coast and the isocontour could change. The Carpinteria GSA has developed and maintained a cooperative working relationship with the Montecito GSA based on previous and ongoing communications between the GSAs and water districts. Hydrogeologic conditions near the basin boundary will be monitored during the initial 5-year SGMA implementation period, and any issues observed that may potentially affect the Montecito Basin will be communicated.

5.7.2.4 Impact of Minimum Thresholds on Beneficial Uses and Users [§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 area between the chloride concentration isocontour and the ocean (see **Figure 5-10**) is characterized by three areas with differing land uses (see **Figure 2-2**). The effects on beneficial uses and users for each of these are addressed separately.

In the southeastern portion of this area between Franklin Creek and the Rincon Creek fault, the area is primarily residential. There are no water supply wells in this area, and all residences are served potable water by the CVWD. Additionally, much of this area is likely protected from seawater intrusion by the geologic offset along the Rincon Creek fault, as discussed in Section 3. As a result of these circumstances, the seawater intrusion minimum threshold is not anticipated to have any impact on beneficial uses in the area.

The Carpinteria Salt Marsh Preserve estuary (El Estero estuary) is an ecological reserve and has no active wells. The seawater intrusion minimum threshold is not anticipated to have any impact on beneficial uses in this area. The area between the estuary and the isocontour is predominantly commercial/residential and is served by CVWD. As a result, the seawater intrusion minimum threshold is not anticipated to have any impact on beneficial uses in this area.

The area between the estuary and the Montecito Basin boundary and the isocontour is predominantly occupied by agricultural operations, most of which are greenhouse operations. (This includes the Arroyo

Paredon watershed, which is known to have poorer groundwater quality than the rest of the Basin.) As documented during the agricultural interviews conducted for this Plan, many of the greenhouse agricultural operations either use CVWD water to blend, or run their pumped groundwater through reverse osmosis treatment units to maintain the desired water quality necessary for their individual crops. Because the isocontour line locations are defined by currently active wells based on CVWD records, the seawater intrusion minimum threshold is not anticipated to have any negative impact on beneficial uses in this area. Successful attainment of the minimum threshold will have a positive impact on beneficial users by maintaining water quality along the coast.

5.7.2.5 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 currently exist for seawater intrusion.

5.7.2.6 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 for seawater intrusion will be measured through biannual groundwater sampling for chlorides and general chemistry in the seawater intrusion RMS well network (see **Figure 4-4**), and through quarterly sampling of the existing Sentinel well cluster. In addition, all new monitoring wells installed along the coast (conceptual locations presented in **Figure 5-10**, with specific locations to be determined according to access and land availability) will be sampled quarterly and outfitted with transducers for continuous monitoring of groundwater elevations. Laboratory results from these samples will be used to determine chloride concentrations along the coast and the isocontour in relation to the minimum threshold isocontour. Groundwater sampling will be conducted in accordance with the sampling protocols outlined in **Appendix G**.

5.7.3 Measurable Objectives for Seawater Intrusion Sustainability Indicator [§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 measurable objective chloride isocontour has the same physical location as the minimum threshold isocontour displayed on **Figure 5-10**. Many of the wells defined as RMS wells along the isocontour line do not have any historical chloride data at the time of the development of this Plan. The maximum recent chloride data for a well along this line is 121 mg/L at well 19R1. Two wells north of the isocontour line along the extreme western portion of the line, north of 23H7 and 24G2, show recent chloride concentrations of 148 and 166 mg/L. Given these data, the GSA decided to establish the measurable objective for chloride along the isocontour line at 150 mg/L. This implies that it will be acceptable for chloride concentrations along the isocontour line to fluctuate between 150 and 250 mg/L during the 20-year SGMA implementation period.

However, a significant data gap exists with respect to the established minimum thresholds and measurable objectives along the isocontour line location. Of the eight wells identified as RMS wells for seawater intrusion, only two wells (19R1 and 29D8) have recent chloride data. At the time of this Plan development, the GSA has commenced outreach to the individual well owners to obtain permission to access and sample the wells to establish a baseline of data for chloride along the isocontour line.

5.7.4 Interim Milestones for Seawater Intrusion Sustainability Indicator [§354.30(e)]

§ 354.30 Measurable Objectives.

(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.

The measurable objective chloride isocontour of 150 mg/L is partially defined by RMS wells that currently have chloride concentrations below that threshold. Contrary to other coastal basins with seawater intrusion, the detection of elevated chlorides in groundwater in the Basin resulting from seawater intrusion are confined to a single location. There is a significant data gap with respect to geographic and lateral distribution of chlorides in groundwater along the coast. Additionally, projects and management actions included in this Plan are designed with the objective of preventing any current seawater intrusion from advancing inland. The strategy for defining measurable objectives for seawater intrusion is to maintain chloride concentrations at their current levels. With that approach, interim milestones for seawater intrusion are established equivalent to the measurable objective of 150 mg/L for each 5-year increment. These interim milestones may be revised as additional data on chloride in the coastal area is collected during the SGMA implementation period.

5.8 Water Quality Degradation Sustainable Management Criterion

This section describes the SMC for the water quality degradation sustainability indicator. It defines undesirable results (Section 5.8.1), presents minimum thresholds (Section 5.8.2) and measurable objectives for each RMS in the monitoring network (Section 5.8.3), and provides interim milestones (Section 5.8.4).

The purpose of the water quality degradation sustainability indicator in SGMA is to protect against any degradation of groundwater quality as a result of groundwater management under the Plan. SGMA is not intended to serve as a mandate to improve water quality within the Basin beyond conditions indicated by historical water quality data. This sustainability indicator takes into consideration protection of municipal drinking water supplies and agricultural uses of groundwater in the Basin. For municipal supply wells, federal and state regulatory standards (MCL and SMCL) established by the State Water Resources Control Board Division of Drinking Water and U.S. Environmental Protection Agency were used to establish thresholds. For agricultural uses, thresholds were established after evaluating water quality objectives presented in the Basin Plan (RWQCB et al., 2019), and evaluating historical water quality data for Basin wells during the period of record. The Carpinteria GSA is not charged with managing groundwater quality unless it is indicated that water quality degradation is caused by groundwater pumping in the Basin, or the Carpinteria GSA implements a project that degrades water quality. **Figure 4-5** displays the RMS well network established for degraded water quality.

5.8.1 Undesirable Results for Water Quality Degradation [§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 criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.

(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.

SGMA regulations § 354.28(c)(2) 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.”

Per SGMA regulations, the degraded groundwater quality undesirable result is a quantitative combination of groundwater quality minimum threshold exceedances. The undesirable results for the water quality degradation sustainability indicator as defined for the purposes of this Plan are as follows:

The Basin will be considered to have undesirable results if, for any 5-year period during SGMA implementation, an increase in groundwater quality minimum threshold exceedances as a result of groundwater management is observed at 33 percent or more of the representative monitoring sites in the Basin, in relation to 2015 basin conditions.

The undesirable conditions for water quality degradation in the Basin are based on the goal of fewer than 33 percent of the RMSs for water quality exceedances that can occur as a result of Plan-related groundwater management activities during the next 5-year management period.

Specifics regarding the definition of the minimum thresholds used in defining the undesirable results are detailed in the following sections. **Table 5-2** presents a summary of the minimum thresholds defined for the water quality degradation sustainability indicator.

The following conditions may lead to an undesirable result for groundwater quality in the Basin:

- Concentrations of regulated contaminants in untreated groundwater pumped from private domestic wells, agricultural wells, or municipal wells exceed regulatory thresholds as a result of pumping or Carpinteria GSA activities.
- Groundwater pumping or Carpinteria GSA activities cause concentrations of nitrate, TDS, chloride, or boron to increase and exceed minimum thresholds and in greater than concentrations since SGMA was enacted in January 2015.

5.8.1.1 Criteria for Establishing Undesirable Results

Criteria used to establish the undesirable results for water quality degradation sustainability indicator are observed water quality data and trends that:

- Reduce capacity of public water supply systems or unreasonably increase costs for public or private water supply.
- Result in constituent concentrations above regulatory primary drinking water standards at supply wells.
- Reduce crop production.

5.8.1.2 Potential Causes of Undesirable Results

Conditions that could potentially lead to an undesirable result include the following:

- **Changes to Basin Pumping Patterns or Quantities.** If the rates or locations of groundwater pumping change as a result of projects or management actions implemented under this Plan, these changes could induce movement of groundwater toward supply wells with concentrations of COCs at concentrations above historical background concentrations at supply wells.
- **Groundwater Recharge.** Active recharge with imported water or captured runoff could alter groundwater flow patterns, potentially resulting in movement of COCs toward supply wells at concentrations above historical background at supply wells. Recharge of poorer water quality water than native groundwater could lead to an undesirable result (note that permitting requirements generally preclude this circumstance).

5.8.1.3 Effects of Undesirable Results on Beneficial Users and Uses

As defined in this Plan, undesirable results are established to prevent water quality degradation within the Basin because of the implementation of any projects or management action conducted for the management of groundwater in the Basin under this Plan. This limits the potential impacts of undesirable water quality on beneficial users in the Basin. However, potential effects of undesirable results include:

- Increased water treatment costs for public or private supply wells
- Reduced agricultural production

5.8.2 Minimum Thresholds for Water Quality Degradation [§354.28(b)(1)]

§ 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)(4) 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 COCs in the Basin is to avoid increased degradation of groundwater quality from baseline concentrations since enactment of SGMA in January 2015. Minimum thresholds established for contaminants and for salts and nutrients are presented in the following subsections and summarized in **Table 5-2**.

Table 5-2. Minimum Thresholds for the Water Quality Degradation Sustainability Indicator

Constituent	MT	RMS Locations	Rationale
Arsenic	10 µg/L	5 CVWD supply wells	MCL is the federal regulation for drinking water CVWD is the only potable water supplier in Basin
Nitrate (as N)	10 mg/L	5 CVWD supply wells	MCL is the federal regulation for drinking water CVWD is the only potable water supplier in Basin
TDS	1,000 mg/L	5 CVWD supply wells and 6 monitoring wells	MT set at SMCL
Chloride	142 mg/L	5 CVWD supply wells and 6 monitoring wells	MT set at the Basin Plan’s “no problem” agricultural threshold
Boron	0.75 mg/L	5 CVWD supply wells and 6 monitoring wells	MT set at Basin Plan agricultural threshold for other coastal basins

Notes

µg/L = micrograms per liter

CVWD = Carpinteria Valley Water District

MCL = maximum contaminant level

mg/L = milligrams per liter

MT = minimum threshold

N = nitrogen

RMS = representative monitoring site

SMCL = secondary maximum contaminant level

TDS = total dissolved solids

5.8.2.1 Information and Methods Used for Establishing Water Quality Degradation Minimum Thresholds §354.28(b)(1)

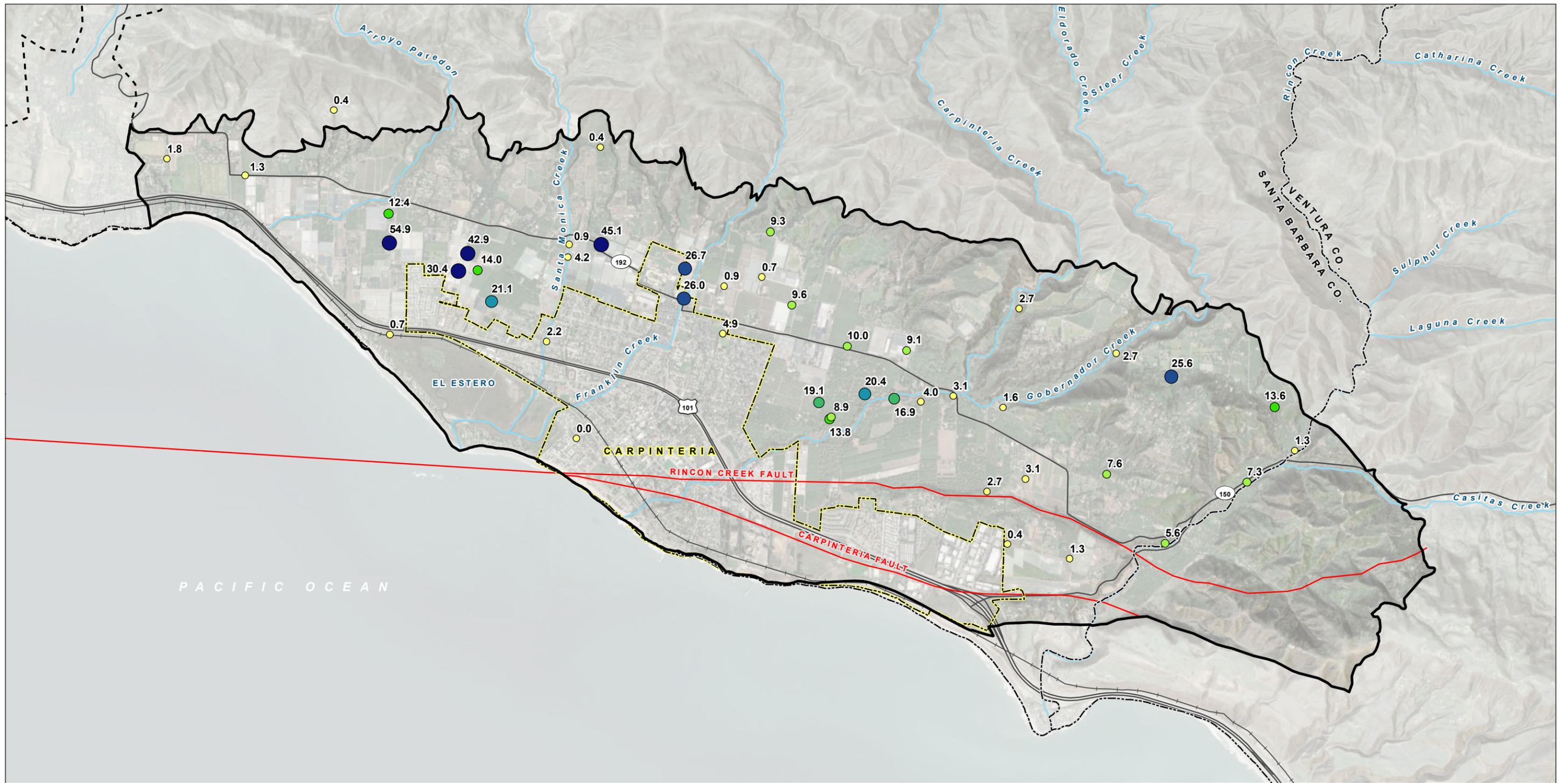
The information used for establishing the water quality degradation minimum thresholds included:

- Historical groundwater quality data from production and agricultural wells in the Basin
- Federal and state primary and secondary drinking water quality standards (SWRCB, 2019)
- RWQCB Basin objectives for groundwater quality (2019) for TDS
- Feedback about significant and unreasonable conditions from GSPAC members, GSA staff members, and public stakeholders

Based on the review of groundwater quality in Section 3, water quality in the basin is generally good. There is a recognized area of the Basin in the west near Arroyo Paredon where the groundwater is observably more highly mineralized and of poorer quality than in other parts of the Basin (see **Figures 5-11 through 5-14**). Water quality objectives established under SGMA are not intended to improve ambient water quality conditions in this area. The primary COCs that exist for agricultural wells and public supply wells are:

- Nitrate
- Arsenic
- TDS
- Chloride
- Boron

Figures 5-11 through 5-14 display the maximum concentration of each nitrate, TDS, chloride, and boron in sampled groundwater from 2015 through 2021. (No data for arsenic is presented because it was not detected in basin groundwater samples during this period.) These data are considered as representative of recent ambient groundwater quality conditions in the Basin. These data were considered when establishing minimum thresholds for the water quality degradation sustainability indicator. For the COCs that have established primary MCLs (nitrate and arsenic), the minimum threshold is set equivalent to the primary MCL. For TDS, the minimum threshold is established at the SMCL of 1,000 mg/L. For boron, the minimum threshold is established at 0.75 mg/L, based on review of historical data and RWQCB Basin Plan Median Groundwater objectives for the Central and Southern Coast. **Table 5-2** presents the minimum thresholds for the COCs.



LEGEND

Maximum Nitrate* Concentrations in mg/L (2015 - 2021)

- < 5
- >5 - 10
- >10 - 15
- >15 - 20
- >20 - 25
- >25 - 30
- >30

All Other Features

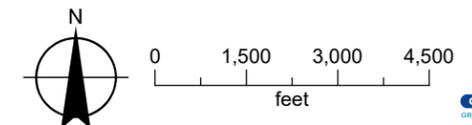
- Carpinteria Groundwater Basin
- Montecito Groundwater Basin
- County Boundary
- City Boundary
- ∕ Fault
- Railroad
- Major Road
- ~ Watercourse

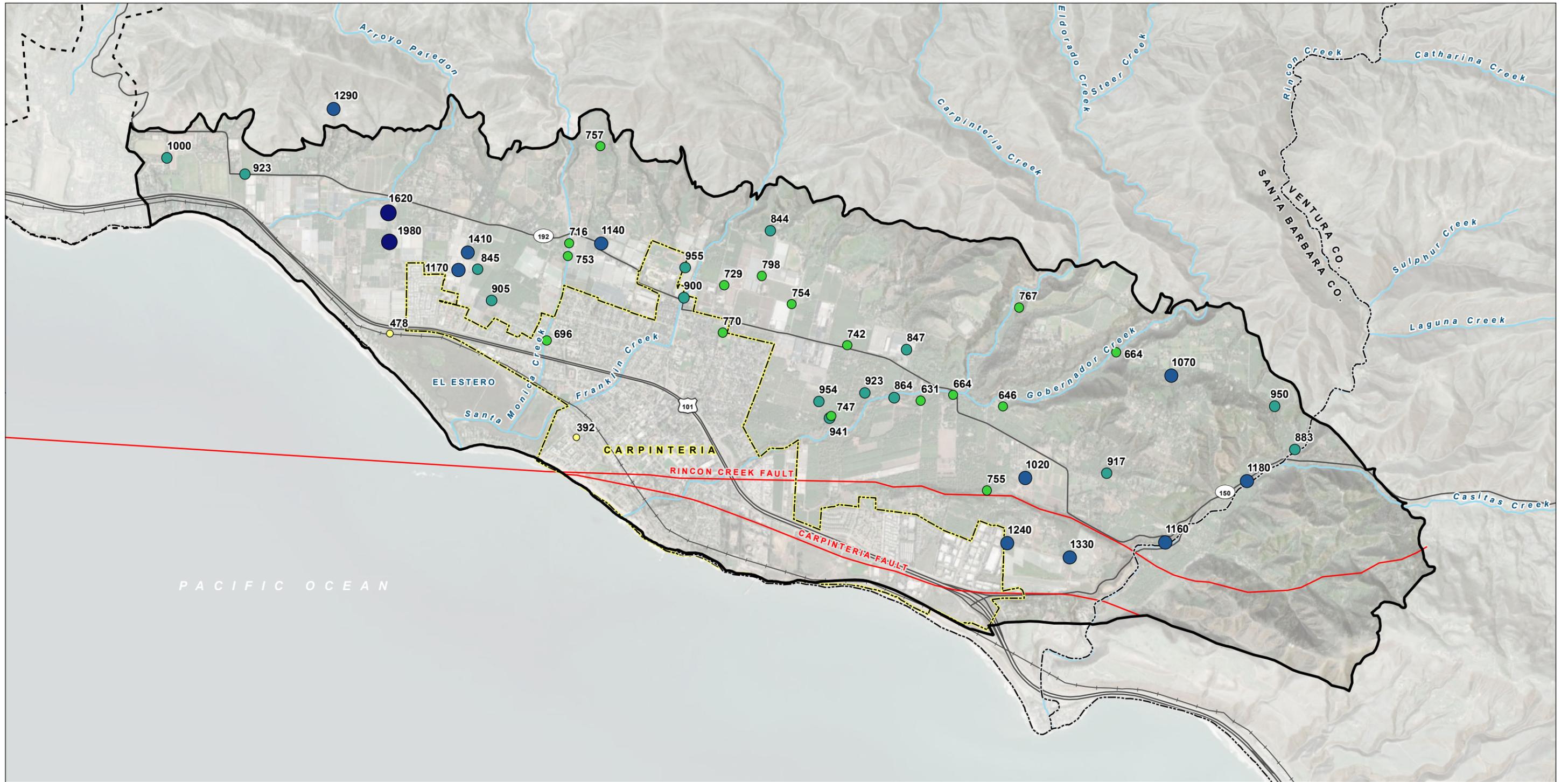
NOTE

*Data represents NO₃ (as N) values.

FIGURE 5-11

Maximum Nitrate Concentrations (2015 - 2021)
Carpinteria Basin Groundwater Sustainability Plan





LEGEND

Maximum TDS Concentrations in mg/L (2015 - 2021)

- < 500
- 501 - 600
- 601 - 800
- 801 - 1000
- 1001 - 1500
- > 1500

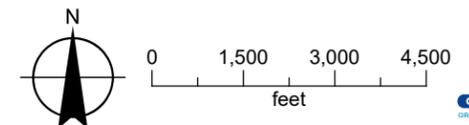
All Other Features

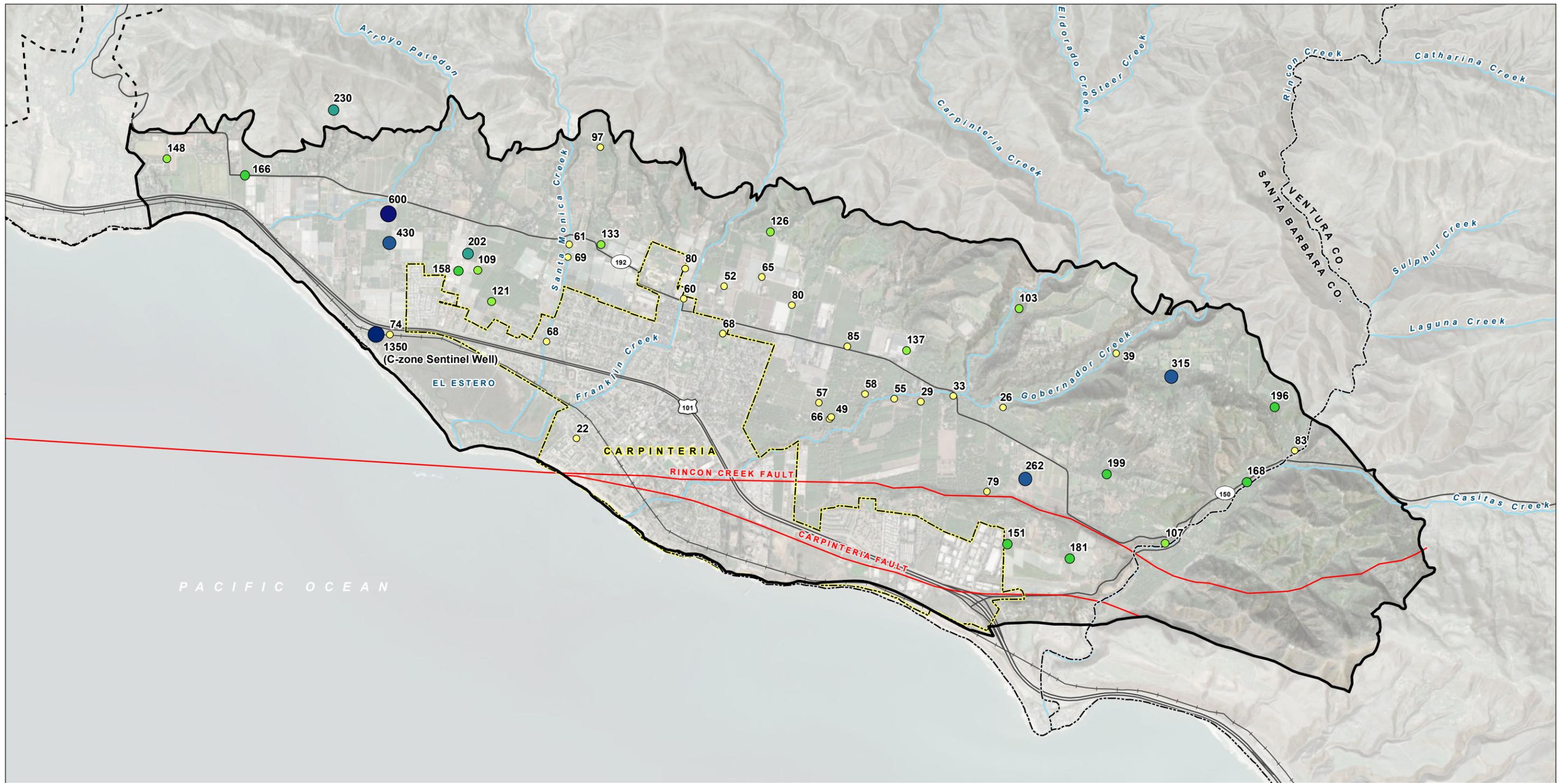
- Carpinteria Groundwater Basin
- Montecito Groundwater Basin
- County Boundary
- City Boundary
- ↘ Fault

- +— Railroad
- V— Major Road
- ~ Watercourse

FIGURE 5-12

Maximum TDS Concentrations (2015 - 2021)
Carpinteria Basin Groundwater Sustainability Plan





LEGEND

Maximum Chloride Concentration in mg/L (2015 - 2021)

- < 100
- 101 - 150
- 151 - 200
- 201 - 250
- 251 - 500
- > 500

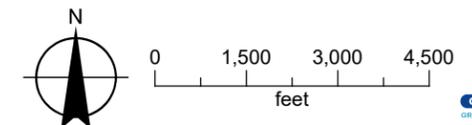
All Other Features

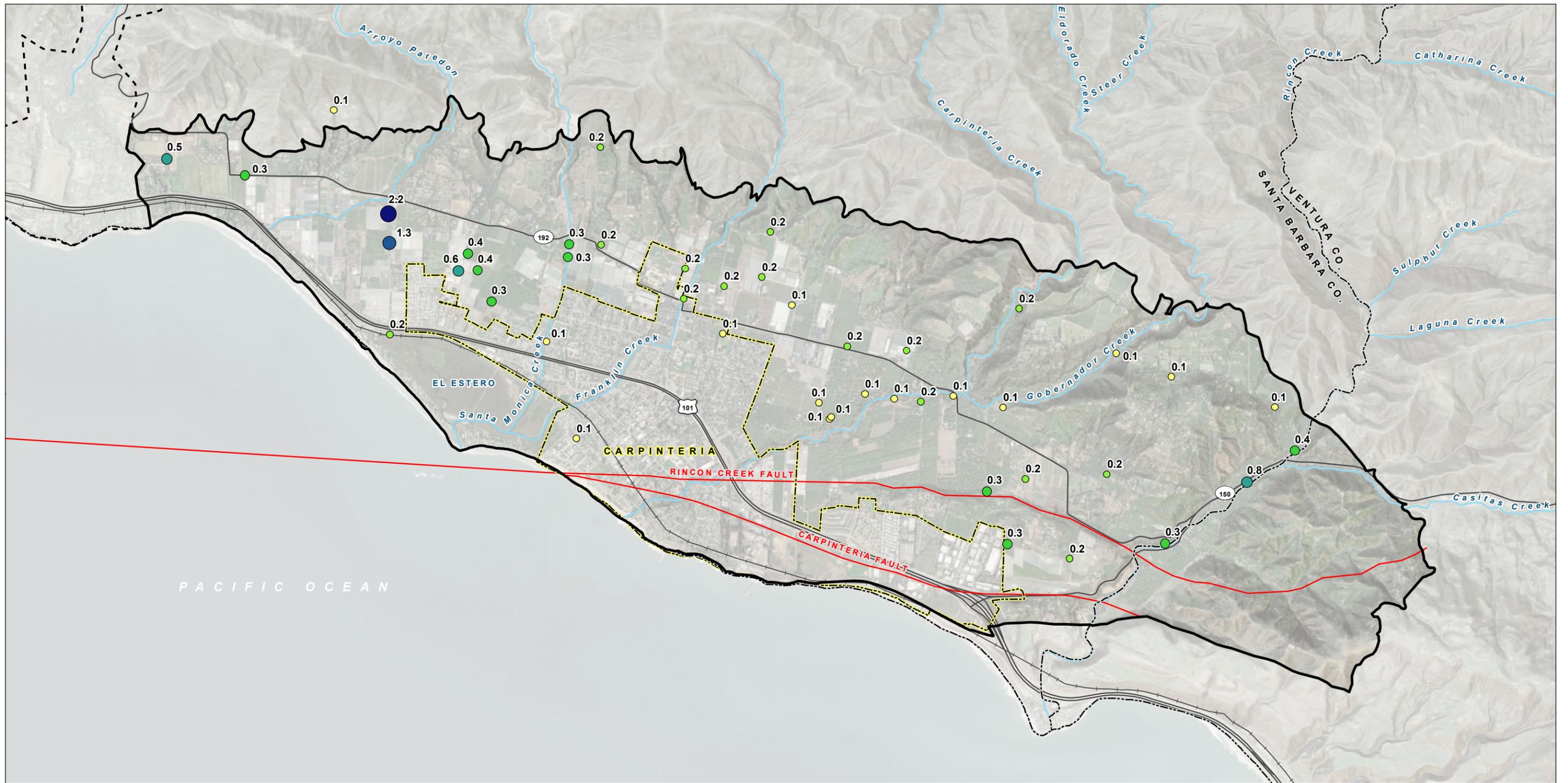
- Carpinteria Groundwater Basin
- Montecito Groundwater Basin
- County Boundary
- City Boundary
- Fault

- + Railroad
- Major Road
- ~ Watercourse

FIGURE 5-13

Maximum Chloride Concentrations (2015 - 2021)
Carpinteria Basin Groundwater Sustainability Plan





LEGEND

Maximum Boron Concentration in mg/L (2015 - 2021)

- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.5 - 0.8
- 0.9 - 1.5
- 1.6 - 2.2

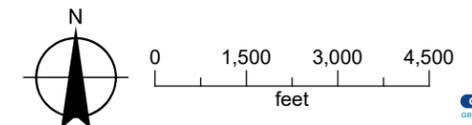
All Other Features

- ▭ Carpinteria Groundwater Basin
- ▭ Montecito Groundwater Basin
- ▭ County Boundary
- ▭ City Boundary
- ▬ Fault

- +— Railroad
- Major Road
- Watercourse

FIGURE 5-14

Maximum Boron Concentrations (2015 - 2021)
Carpinteria Basin Groundwater Sustainability Plan



5.8.2.2 Relation of Minimum Thresholds to Other Sustainability Indicators §354.28(b)(2)

The groundwater quality minimum thresholds were set for each of the five constituents in **Table 5-2**. These minimum thresholds were derived from analysis of existing ambient water quality data measured in the Basin and applicable regulatory criteria.

No actions regarding the minimum thresholds for water quality will impact other sustainability indicators. However, preventing migration of poor-quality groundwater (for example, actions required to prevent additional migration of contaminant plumes) could theoretically limit activities needed to achieve minimum thresholds for other sustainability indicators, as discussed below:

- **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 or locations where it could be recharged. Water used for recharge cannot exceed any of the groundwater quality minimum thresholds.
- **Reduction of Groundwater Storage.** Nothing in the groundwater quality minimum thresholds promotes pumping in excess of the sustainable yield. The groundwater quality minimum thresholds will not result in impact on the groundwater storage minimum threshold.
- **Seawater Intrusion.** The seawater intrusion sustainability indicator is defined by water quality data (chloride concentrations). However, this is limited to the coast, along the front of potential seawater intrusion between the western basin boundary and the Rincon Creek Fault (see **Figure 4-4**). The water quality monitoring network (see **Figure 4-4**) is distributed throughout the Basin as a whole (see **Figure 4-5**). The minimum thresholds established for the water quality degradation sustainability indicator throughout the Basin will not specifically impact the seawater intrusion SMCs.
- **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 impact the land subsidence sustainability indicator.
- **Interconnected Surface Water Depletions.** As discussed in Sections 3.2.6 and 5.10, available data indicate that there are no interconnected surface water systems in the Basin.

5.8.2.3 Effects of Minimum Thresholds on Neighboring Basin

The minimum thresholds established for water quality in the Carpinteria Basin will have no impact on hydraulic conditions at the Montecito Basin boundary. Therefore, there is no anticipated effect from the water quality minimum thresholds on conditions in the Montecito Basin.

5.8.2.4 Effects of Minimum Thresholds on Beneficial Users and Uses

§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 practical effect of the minimum thresholds for the water quality degradation sustainability indicator is that they collectively deter any significant long-term changes to groundwater quality in the Basin due to groundwater management. Therefore, basin management that prevents the undesirable results from

occurring will not constrain the use of groundwater, nor have a negative effect on the beneficial users and uses of groundwater.

Municipal Uses and Users. The water quality degradation minimum thresholds generally benefit the urban water users in the Basin. Limiting the number of additional wells where COCs could exceed MCLs or SMCLs ensures an adequate supply of quality groundwater for municipal use. Management of the Basin to prevent occurrences of these minimum thresholds may also result in lowered costs for water treatment. Existing federal, state, public health, or municipal regulations may require that a well not be used if MCLs are exceeded and may supersede any actions related to SGMA-related minimum threshold exceedances. Wells in violation of federal, state, and local water quality regulations will have to comply with the specific regulations.

Agricultural Land Uses and Users. The groundwater quality minimum thresholds generally benefit the agricultural water users in the Basin by maintaining groundwater quality suitable for use in agriculture. For example, limiting the number of additional agricultural supply wells that may exceed COC concentrations (for example, TDS) that could reduce crop production ensures that a supply of usable groundwater will exist for beneficial agricultural use.

Domestic Land Uses and Users. The water quality degradation minimum thresholds generally benefit the single domestic water user in the Basin by maintaining current and acceptable water quality.

Ecological Land Uses and Users. Although the water quality degradation minimum thresholds do not directly benefit ecological uses, it can be inferred that the water quality degradation minimum thresholds will indirectly benefit ecological water uses in the Basin because these thresholds limit future increases in concentrations of COCs from what they are now, or prior to what they were when SGMA was enacted in January 2015.

5.8.2.5 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 water quality degradation minimum thresholds for salts and nutrients specifically incorporate federal and state drinking water standards. State regulatory agencies have responsibility and authority for responding to detections of contaminants that may impair drinking water quality.

5.8.2.6 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 data will be directly measured from analytical laboratory results for samples collected from RMS wells. Exceedances of regulatory standards and minimum thresholds will be assessed on an annual basis in accordance with the monitoring program (see Section 4). Groundwater quality sampling will be monitored under existing CVWD/GSA programs.

5.8.3 Measurable Objectives for Water Quality Degradation Sustainability Indicator [§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 quality should not be degraded as a result of actions taken under this Plan. Groundwater quality for COCs across the Basin should be maintained within the ranges indicated by historical data. Therefore, the measurable objectives for the water quality degradation sustainability indicator are the same as the minimum thresholds.

5.8.3.1 Information and Methods Used for Establishing Water Quality Degradation Measurable Objectives [§354.30(b)]

Available historical water quality collected by the CVWD were used in establishing both the minimum thresholds and the measurable objectives for the five water quality COCs discussed in the Plan. Regulatory criteria and water quality objectives were also considered when defining these SMCs.

Because protecting groundwater quality is important to the beneficial users and uses of the groundwater resource, the measurable objective for the water quality degradation sustainability indicator is the same as the minimum thresholds. The GSA will review any exceedance to determine its significance to groundwater management in the Basin, and any potential responses.

5.8.4 Interim Milestones for Water Quality Degradation Sustainability Indicator § 354.28(a)(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 Carpinteria GSA anticipates moving from current conditions to meeting the measurable objectives. No significant and unreasonable results have been observed in the Basin in association with degraded groundwater quality. For water quality, measurable objectives are set at the minimum thresholds. Interim milestones are set for each 5-year interval following Plan adoption. The interim milestones for water quality degradation are the same as the minimum threshold for each COC for 5, 10, and 15 years after plan adoption.

5.9 Land Subsidence Sustainable Management Criterion

This section describes the SMC for the land subsidence sustainability indicator. It defines undesirable results (Section 5.9.1), presents minimum thresholds (Section 5.9.2) and measurable objectives for each RMS in the monitoring network (Section 5.9.3), and provides interim milestones (Section 5.9.4).

5.9.1 Undesirable Results for Land Subsidence [§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.

(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 criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.

(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.

Land subsidence is the phenomenon of the land surface elevation in a given area declining from previous elevations. This phenomenon may be caused by several factors, including declines of groundwater elevations and subsequent compaction of sediments. Land subsidence has not historically been an issue in the Basin. No instances of damage to property or infrastructure in the area are known.

Locally defined significant and unreasonable undesirable results for the land subsidence sustainability indicator are land surface elevation change rates that cause impacts to infrastructure, groundwater supply, land use, or property interests.

Monitoring of this sustainability indicator will not be based on groundwater data. Conditions will be monitored using satellite-measured subsidence data (Interferometric Synthetic Aperture Radar [InSAR] data) collected and maintained by DWR.

For clarity, this SMC references the combination of two related component concepts of subsidence to define significant and unreasonable conditions:

- **Land Subsidence.** Land subsidence is a gradual settling of the land surface caused by, among other processes, compaction of subsurface materials because of 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 Elevation Fluctuation.** Land surface may rise or fall, elastically, in any one year. Land surface elevation fluctuation may or may not indicate long-term permanent subsidence. This can be caused by tectonic activity in the earth, or by local activity such as grading activities, particularly in agricultural areas or housing developments.

By regulation, the land subsidence undesirable result is a quantitative combination of these two components. For the Basin, no long-term subsidence impacts on infrastructure (i.e., commercial buildings, homes, and utility infrastructure) because of groundwater management is considered acceptable. The undesirable results for the land subsidence sustainability indicator as defined for the purposes of this Plan are as follows:

The Basin will be considered to have undesirable results if measured subsidence using InSAR data, between June of one year and June of the subsequent year, is greater than 0.1 foot in any one year, or a cumulative 0.5 foot in any 5-year period, as a result of groundwater management under the Plan, or any long-term permanent subsidence that is attributable to groundwater management.

Therefore, the ground surface subsidence undesirable results include the following:

- Significant and unreasonable land subsidence caused by groundwater management or extraction exceeds the minimum threshold and causes damage to structures and infrastructure and substantially interferes with surface land uses.

5.9.1.1 Criteria for Establishing Undesirable Results § 354.26(b)(2)

The criteria used to establish the undesirable results for land subsidence sustainability indicator are based on the satellite-measured subsidence data (InSAR data) collected by DWR.

5.9.1.2 Potential Causes of Undesirable Results § 354.26(b)(1)

Conditions that may lead to an undesirable result include:

- A shift in pumping locations, which could lead to a substantial decline in groundwater levels.
- Shifting a significant amount of pumping and causing groundwater levels to fall in an area that is susceptible to subsidence, such as certain areas underlying the City of Carpinteria, could trigger subsidence in excess of the minimum threshold.

5.9.1.3 Effects of Undesirable Results on Beneficial Users and Land Uses § 354.26(b)(3)

The effects of these undesirable results on the beneficial users and uses include damage to critical infrastructure, and damage to private or commercial structures that would adversely affect their uses. Staying above the minimum threshold will avoid the subsidence undesirable conditions.

5.9.2 Minimum Thresholds for Land Subsidence § 354.28(c)(5)

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.”

Based on an analysis of potential errors in the InSAR data, as discussed in the following section, the subsidence minimum threshold is:

The InSAR-measured subsidence between June of one year and June of the subsequent year shall be no more than 0.1 foot in any single year and a cumulative 0.5 foot in any 5-year period at any location in the Basin, resulting in no measurable permanent subsidence.

5.9.2.1 Information and Methods Used for Establishing Land Subsidence Minimum Thresholds § 354.28(b)(1)

Minimum thresholds were established to protect groundwater supply, land uses, and property interests from substantial subsidence that may lead to undesirable results. Changes in surface elevation are measured using InSAR data available from DWR. The general minimum threshold is the absence of measurable long-term land subsidence as a result of pumping in the Basin. The InSAR data provided by DWR, however, are subject to measurement error. The statewide level errors for the total vertical displacement measurements between June 2015 and June 2021 are as follows:

1. The error between InSAR data and continuous GPS data is 16 mm (0.052 feet) with a 95 percent confidence level.
2. The measurement accuracy when converting from the raw InSAR data to the maps provided by DWR is 0.048 feet with 95 percent confidence level. (TRE Altamira, Inc., 2023)

For the purposes of this Plan, the errors for InSAR data are considered the sum of errors 1 and 2, for a combined total error of 0.1 foot. Thus, measured land surface change of greater than 0.1 foot will be assessed as potential subsidence. As discussed previously, land surface elevations can fluctuate naturally. Therefore, subsidence will be monitored at the same time each year to reduce the effect of general fluctuations of elevation on observed data.

5.9.2.2 Relation of Minimum Thresholds to Other Sustainability Indicators § 354.28(b)(2)

Land subsidence minimum thresholds have little or no impact on other minimum thresholds, as described below:

- **Chronic Lowering of Groundwater Levels.** The land subsidence minimum thresholds are not expected to result in significant or unreasonable lowering of groundwater elevations. Continued decline of water levels beyond historically observed conditions could potentially lead to subsidence. However, it has not been an issue in the Basin to date.
- **Reduction of Groundwater Storage.** The land subsidence minimum thresholds will not affect the amount of pumping and will not result in a significant or unreasonable change in groundwater storage. Continued decline of groundwater in storage beyond historically observed conditions could potentially lead to subsidence. However, it has not been observed to be an issue in the Basin to date.
- **Seawater Intrusion.** The land subsidence sustainability indicator is not expected to have any effect on the seawater intrusion sustainability indicator, which is measured by chloride concentrations, and which relies on maintaining or increasing current water levels.
- **Water Quality Degradation.** The land subsidence minimum thresholds will not change the groundwater flow directions or rates and, therefore, will not result in a significant or unreasonable change in groundwater quality.
- **Interconnected Surface Water Depletions.** As discussed in Sections 3.2.6 and 5.10, available data indicate that there are no interconnected surface water systems in the Basin.

5.9.2.3 Effect of Minimum Thresholds on Neighboring Basins § 354.28(b)(3)

The land subsidence minimum thresholds are set to prevent any long-term subsidence that could harm infrastructure. Therefore, the subsidence minimum thresholds will not prevent the Montecito Basin from achieving sustainability.

5.9.2.4 Effects of Minimum Thresholds on Beneficial Users and Land Uses § 354.28(b)(4)

The land subsidence minimum thresholds are set to prevent subsidence that could harm infrastructure, so it is defined to protect beneficial users and uses in the Basin. Available data indicate that there is currently no subsidence occurring in the Basin that affects infrastructure. Staying above the minimum threshold will avoid the land subsidence undesirable result and protect the beneficial uses and users from impacts to infrastructure and interference with surface land uses.

5.9.2.5 Relevant Federal, State, or Local Standard § 354.28(b)(5)

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

5.9.2.6 Method for Quantitative Measurement of Minimum Thresholds § 354.28(b)(6)

Minimum thresholds will be assessed using DWR-supplied InSAR data.

5.9.3 Measurable Objectives for Land Subsidence § 354.30(a)-(g)

The measurable objective for subsidence is the same as the minimum threshold because land subsidence cannot be detected via InSAR at rates less than selected for the minimum threshold.

5.9.3.1 Information and Methods Used for Establishing Land Subsidence Measurable Objectives § 354.3(b)

The measurable objectives are set based on maintaining current conditions and changes are measured by DWR-supplied InSAR data.

5.9.4 Interim Milestones for Land Subsidence Sustainability Indicator § 354.28(a)(e)

Interim milestones show how the GSAs anticipate moving from current conditions to meeting the measurable objectives. Interim milestones are set for each 5-year interval following Plan adoption. Land subsidence measurable objectives are set at current conditions of no long-term subsidence. There is no change between current conditions and sustainable conditions. Therefore, the interim milestones are identical to the minimum thresholds and measurable objectives.

5.10 Interconnected Surface Water Depletions Sustainable Management Criterion

Natural hydraulic connections can exist between shallow groundwater systems and overlying streams. These surface water bodies can be gaining (receiving discharge from the alluvial aquifer) or losing (discharging water to the alluvial aquifer). These relationships change in magnitude and direction across wet and dry cycles, and may change in response to changes in surface water operations or groundwater management practices. Interconnected surface water depletions occur when there are decreased gains or increased losses in volumes of streamflow caused by lowered groundwater elevations associated with groundwater use. At certain levels, depletions may have adverse impacts on beneficial uses of the surface water and may lead to undesirable results.

The HCM of the Basin present an analysis and discussion of interconnected surface water (see Section 3.2.6). Under normal surface water hydrologic conditions, the surface water flow regime is typical of uncontrolled streams along the southern coast, with flashy flows resulting from winter storm events emanating from the contributing watershed in the bedrock mountains upstream and flowing across the Basin toward the ocean. Data are presented in **Figures 3-19 through 3-23** documenting that groundwater elevations in the principal aquifer are below the stream channels in the unconfined area of the Basin under all water year types. In the confined portion of the Basin, the principal aquifer is separated from the stream channel by the fine-grained sediments of the confining layer. Thus, it is concluded that there are no interconnected surface water systems in the Basin.

Because available data indicate that there are no interconnected surface water systems in the Basin, no SMCs are established for the depletion of interconnected surface water depletions sustainability indicator.

5.11 Management Areas

The GSA has no plans at this time to separate the Basin into different management areas.

5.12 References

DWR. 2017. *Best Management Practices for the Sustainable Management of Groundwater: DRAFT Sustainable Management Criteria*. Prepared by the California Department of Water Resources Sustainable Groundwater Management Program.

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