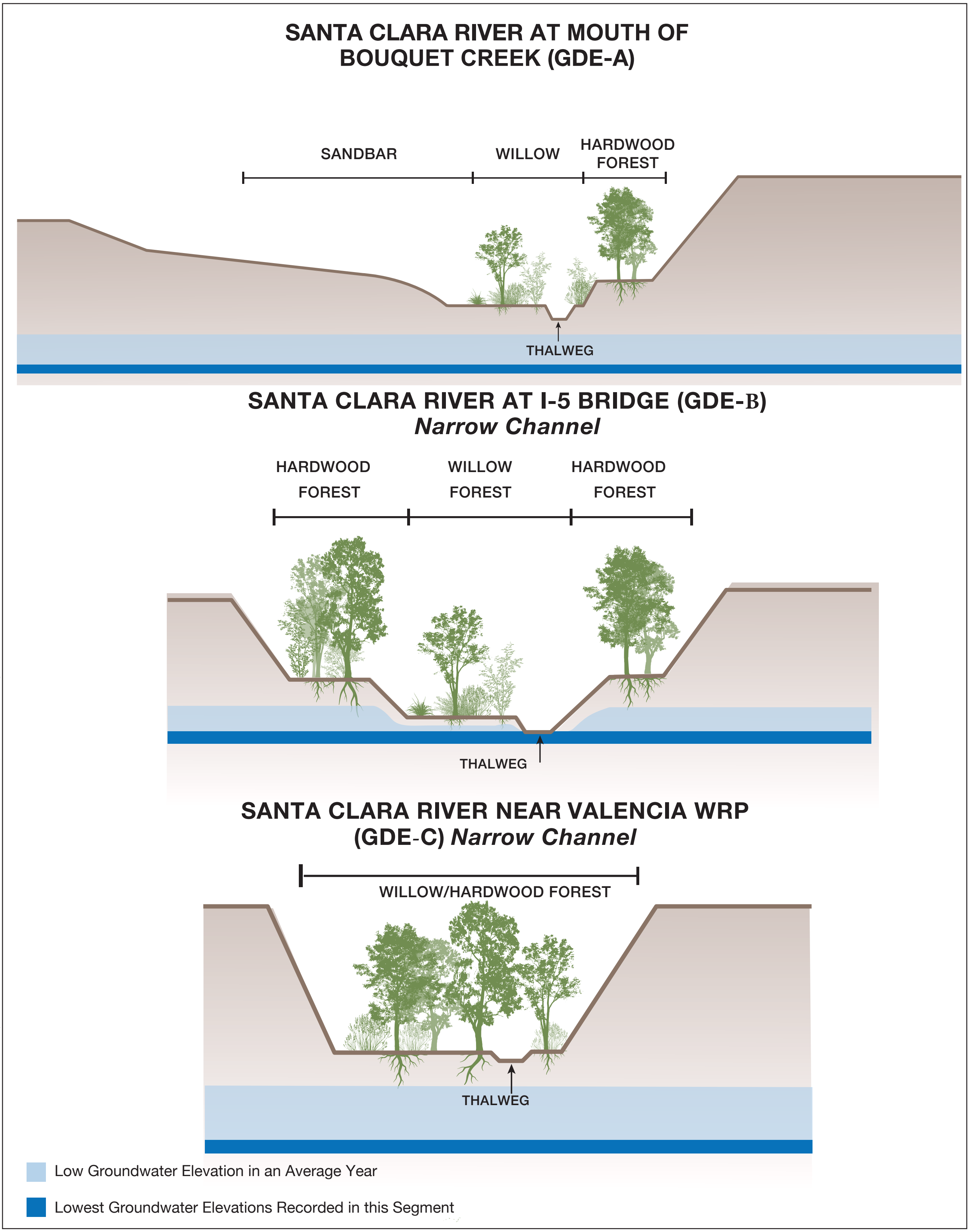


LAX/19xxx/D201900670.00 - SCVA Future Recycled Water Environmental Considerations Assessment/05 Graphics-GIS-Modeling/Illustrator

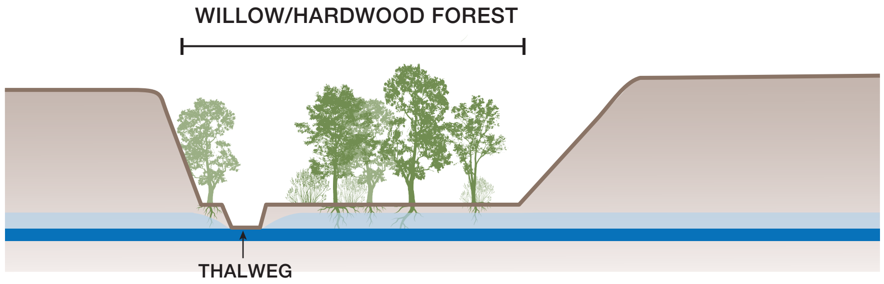
SOURCE: ESA, 2020

GDE Considerations Assessment

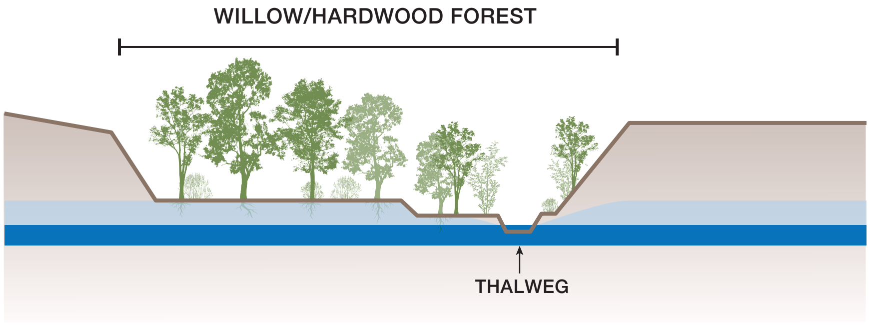
Figure 5-63
Schematic Cross Sections at Sites GDE-A, GDE-B, and GDE-C

ESA

SANTA CLARA RIVER BELOW MOUTH OF CASTAIC CREEK (GDE-D)
Narrow Channel



SANTA CLARA RIVER AT MOUTH OF POTRERO CANYON (GDE-E)
Narrow Channel

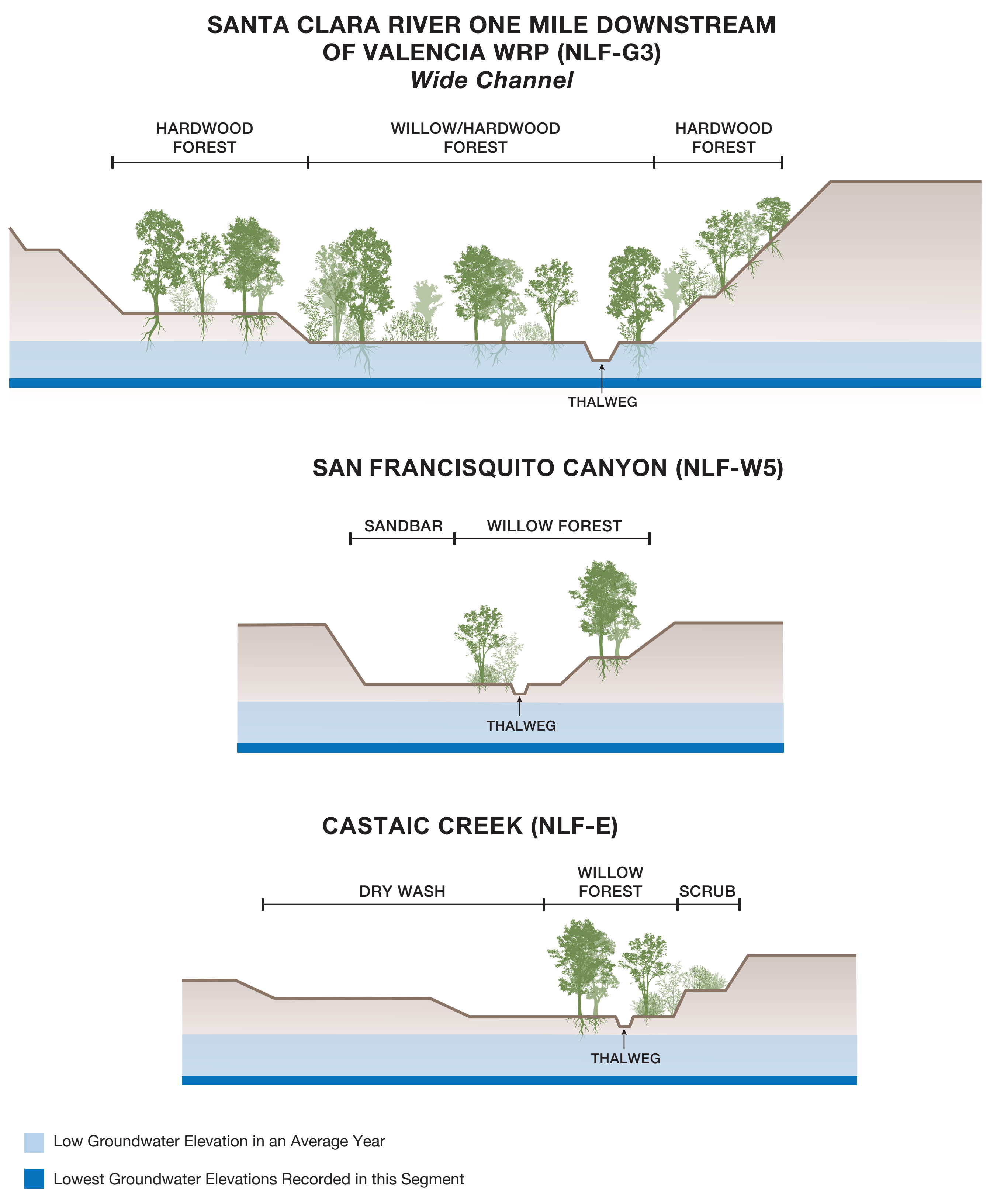


▨ Low Groundwater Elevation in an Average Year

■ Lowest Groundwater Elevations Recorded in this Segment

SOURCE: ESA, 2020

Figure 5-64
Schematic Cross Sections
at Sites GDE-D and GDE-E


SANTA CLARA RIVER ONE MILE DOWNSTREAM OF VALENCIA WRP (NLF-G3)
Wide Channel

SAN FRANCISQUITO CANYON (NLF-W5)

CASTAIC CREEK (NLF-E)

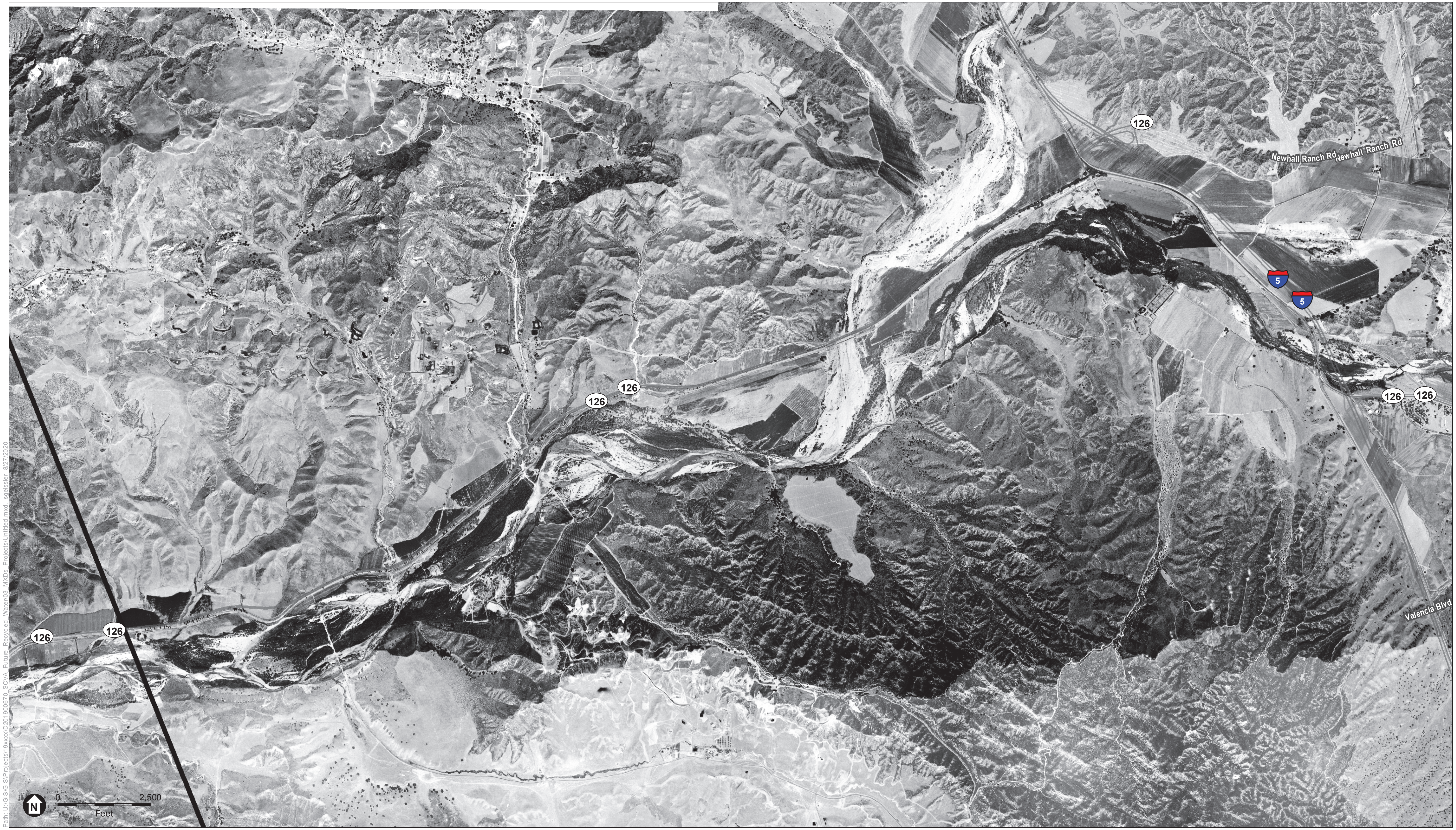
🟦 Low Groundwater Elevation in an Average Year

🟦 Lowest Groundwater Elevations Recorded in this Segment

LAX/19xxx/D201900670.00 - SCVA Future Recycled Water Environmental Considerations Assessment/05 Graphics-GIS-Modeling/Illustrator

SOURCE: ESA, 2020

Figure 5-65
Schematic Cross Sections at Sites NLF-G3, NLF-W5, and NLF-E



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SOURCE: HistoricAerials.com (1947-2016).

GDE Considerations Assessment

Figure 5-66
Historical Aerial
1947

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6. Water Budgets

6.1 Summary of Basin Conditions and Water Budget

This section describes the historical, current, and projected water budgets for the groundwater basin that is located in the Santa Clarita Valley (the valley), in the northwestern part of the County of Los Angeles (LA County). The local groundwater basin is designated by the California Department of Water Resources (DWR) as the Santa Clara River Valley East Groundwater Subbasin, which is herein referred to in this section as the Basin. The water budgets have been developed as part of the ongoing process of developing a Groundwater Sustainability Plan (GSP) for the groundwater basin under the requirements of California's Sustainable Groundwater Management Act (SGMA).

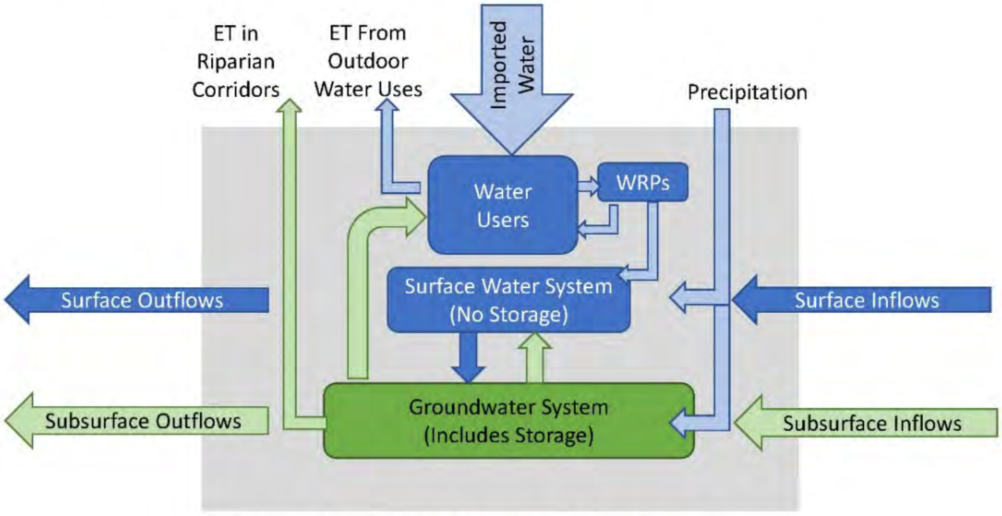
6.1.1 Background

6.1.1.1 Introduction

A water budget defines the sources and uses of water in an area. The budget, like a financial budget, is intended to quantify the sources and uses of water and ensure they are in long-term balance. With variable water supplies, groundwater storage can be used to balance water supply and demand in the short term, while ensuring that supplies meet or exceed demand to provide a balanced water budget over the longer term. The water budget is thus closely related to the water balance, which tracks water supplies, human and environmental demands for water, and changes in water storage within the Basin (primarily in groundwater).

The water budget for the groundwater basin is a regional basinwide water budget that accounts not just for groundwater, but also for surface water and imported water supplies and uses. The regional water budget provides an accounting of all surface water and groundwater flowing into and out of the Basin over a specified period. A generalized depiction of the water budget processes (inflows and outflows) for surface water and groundwater in the local groundwater basin is shown below.

Water Balance Components in the East Subbasin



WRPs (Wastewater Treatment Plants) ET = Evapotranspiration

Note: This diagram presents a basic water budget.
Certain surface water budget processes are not shown.

In the groundwater budget, basin inflows include imported water recharge, surface water, and subsurface flows into the groundwater system; basin outflows include groundwater extraction (pumping), plant uptake of groundwater, groundwater flows to surface waters, and subsurface outflows. The difference between inflows and outflows results in a change in the volume of water stored within the basin.

In the Basin, imported water primarily enters the groundwater system through percolation of applied water and leachate from septic systems. However, imported water is occasionally released to the river system from Castaic Lake, and a portion of these releases percolates into the groundwater basin from the river system. Outputs from the Basin include subsurface and surface flows at the western boundary of the groundwater basin (located near the LA/Ventura County line); evapotranspiration from plants along the river and its tributaries; and consumptive uses including agricultural, municipal, institutional, and industrial uses of pumped groundwater. Changes in regional storage occur almost exclusively in the groundwater basin because surface storage in the area is dedicated to storage in Castaic Lake of imported water, not local water.

Recharge of the Basin from surface waters occurs from percolation of stormflows from the Santa Clara River and its tributaries and from precipitation percolating into the groundwater system. Subsurface groundwater originating from outside of the Basin is a fairly minor source of inflow.

The interactions between surface water and groundwater can be quite complex and subtle and are discussed in greater detail below. This section prepares surface water and groundwater budgets that incorporate these interactions. This assessment, or water budget analysis, provides an understanding of historical conditions, current conditions, and how future changes to supply, demand, hydrology, population, land use, and climatic conditions may affect the water budget in the Basin.

6.1.1.2 Basin Definition

The Basin is the eastern-most and furthest upstream subbasin in the group of six subbasins that comprise the Santa Clara River Valley Groundwater Basin (Figure 6.1-1). Located in the Santa Clarita Valley in northwestern LA County, California, this local groundwater subbasin is identified in DWR Bulletin 118 as the Santa Clara River Valley East Subbasin (DWR Basin 4-4.07). The Basin sits in the Eastern Hydrologic Subarea of the Upper Santa Clara River Hydrologic Area (Figure 6.1-2). Some tributaries to the Santa Clara River are outside of the Bulletin 118 Basin boundary (e.g., Towsley, East, and Rice creeks) because they were mapped by DWR as either non-water bearing or containing geologic materials that are not recognized as part of the Basin. Because they are outside of the Bulletin 118 Basin boundary, they are not subject to groundwater management activities pursuant to this GSP. They are, however, included in the overall Basin water budget because the surface water flow originating in these tributaries that recharges the Basin must be accounted for.

6.1.1.3 Development of Imported Supplies and the Basin Operating Plan

Analysis of the current and future management of the local groundwater basin depends upon a number of parameters, including the criteria used to manage water demands, imported supplies, recycled water, and groundwater pumping. Further, future management of the local groundwater basin must consider the influences of future growth and possible climate change. In particular, the current and future uses of groundwater in this water budget are based on the existing Basin Operating Plan for the Basin, which was incorporated into the Groundwater Monitoring Plan required by the Groundwater Management Act (AB 3030)[25] and adopted in 2003 by Castaic Lake Water Agency (CLWA), the predecessor agency to today's Santa Clarita Valley Water Agency (SCV Water). The Basin Operating Plan was updated in 2009 and is based

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[25] The Groundwater Management Act (California Assembly Bill [AB] 3030), which took effect in 1993, permitted certain local agencies to develop groundwater management plans.

upon the principle of ensuring that the Basin is operated without causing an overdraft condition (LSCE and GSI, 2009). By design, the Basin Operating Plan draws upon the groundwater storage reserves of the Basin (primarily in the Saugus Formation) to augment imported supplies during drought years in the State Water Project (SWP) system, then reduces pumping at other times to facilitate the natural replenishment of those reserves. This operating plan and the water budget described herein are consistent with the water resources plan for SCV described in its Urban Water Management Plans (UWMPs).[26]

Imported Water

In 1963, the Upper Santa Clara River Valley Water Agency, the predecessor and legacy agency to CLWA and now SCV Water, entered into a contract with DWR for SWP supply. Of the 79,000 acres then encompassed by the legacy agency boundary, 10,600 acres were in agricultural production and 3,700 acres were residential, with 12,400 residents. Also, the Wayside Honor Rancho (now the Pitchess Detention Center) and other LA County correctional facilities housed an additional population of 3,200 inmates. At that time, planners estimated that, by 1990, agricultural activities would end and developable land covering 51,500 acres would be urbanized and support a population of 180,000. Accordingly, the legacy agency contracted for SWP water supply of 23,000 acre-feet per year (AFY) to keep the Basin in balance. Annexations and new land development practices made more land developable. In response, the legacy agency increased its contract amount to 41,500 AFY by 1966. Once the importation of SWP water began, the local population rapidly increased along with the volume of water being imported from year to year. The legacy agency purchased SWP contract rights from other water purveyors in 1991 and 1992, which increased the legacy agency's current contract amount to 95,200 AFY. These purchases were made because of the need for additional imported water supplies to meet growth projections, as well as with the recognition that the percentage of contracted water that could be delivered to SWP contractors might decrease over time because of increasingly stringent regulatory constraints on the SWP system.

In addition, CLWA acquired a firm 11,000 AFY of groundwater from the Buena Vista and Rosedale Rio-Bravo Water Storage Districts (BVRRB). Further, CLWA/SCV Water placed 140,000 acre-feet of water into long-term groundwater banks in Kern County to provide imported water when SWP supplies are curtailed because of dry conditions. The operation of these water banks during wet/normal year and dry years is illustrated in the diagram on page 6-6.

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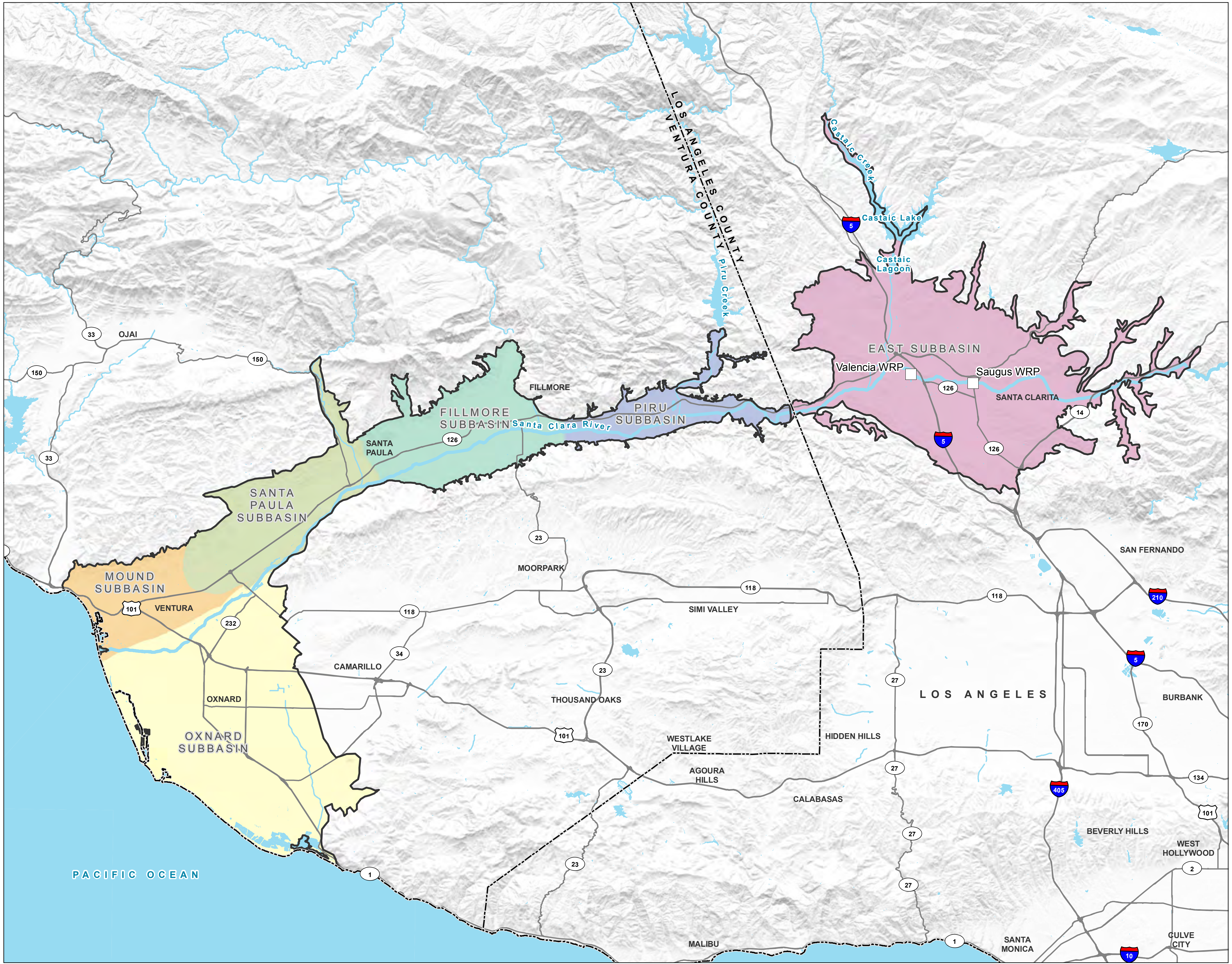
[26] The *Santa Clarita Valley Water Agency 2020 Urban Water Management Plan*, dated June 28, 2021, is the current version of the UWMP (KJ, 2021).

FIGURE 6.1-1

Santa Clara River Valley Groundwater Basin and Subbasins

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan



LEGEND

- ☐ Water Reclamation Plant (WRP)
- Santa Clara River Valley Groundwater Basin

Santa Clara River Valley Subbasins

- Santa Clara River Valley East
- Piru
- Fillmore
- Santa Paula
- Mound
- Oxnard

All Other Features

- County Boundary
- Major Road
- Watercourse
- Waterbody

N

0 12,500 25,000 37,500
Feet

Date: December 9, 2021
Data Sources: USGS, DWR Bulletin 118

GSI Water Solutions, Inc.

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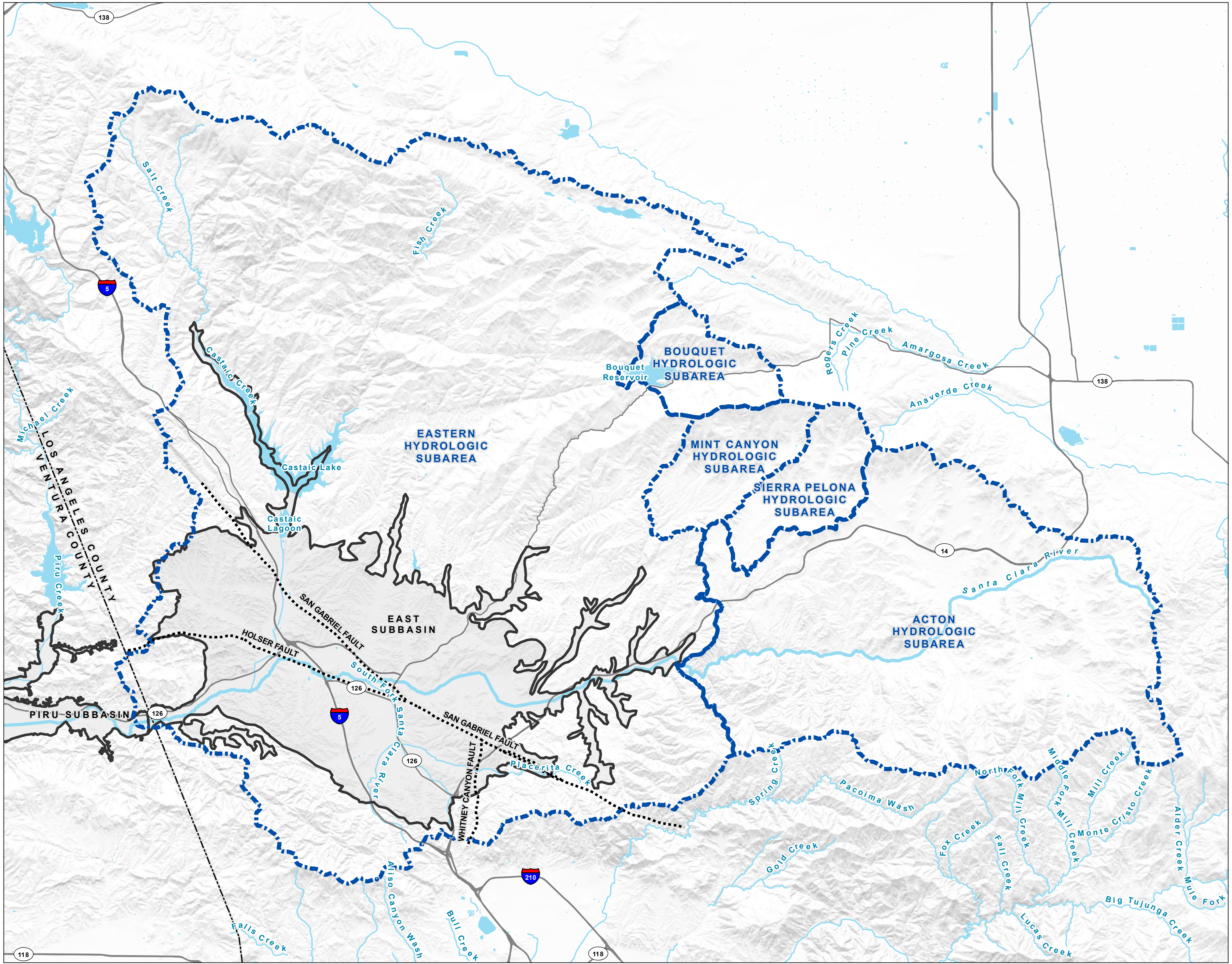

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FIGURE 6.1-2

Watershed Boundaries for Upper Santa Clara River Hydrologic Area and Subareas

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

Fault

Santa Clara River Valley Groundwater Basin

Upper Santa Clara River Hydrologic Subbarea

All Other Features

Major Road

Watercourse

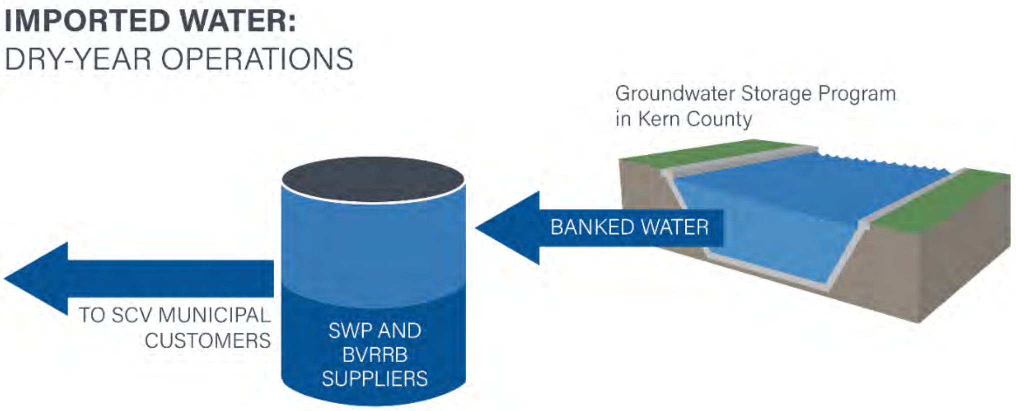
Waterbody

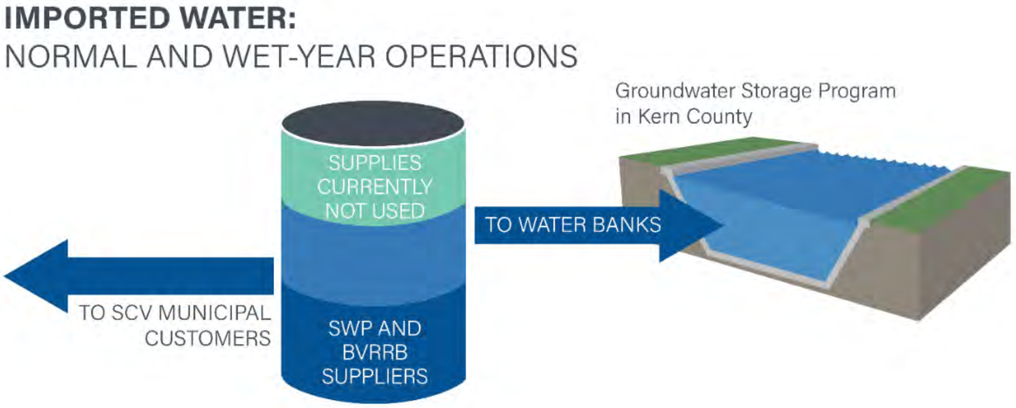
N

0 9,000 18,000 27,000
Feet

Date: December 9, 2021
Data Sources: USGS, DWR Bulletin 118

GSI Water Solutions, Inc.





BVRRB: Buena Vista and Rosedale Rio-Bravo Water Storage Districts
SCV: Santa Clarita Valley Water Agency
SWP: State Water Project

The cylinders in these diagrams show the total imported supplies available to the Basin. In normal and wet years, water in excess of annual need within the SCV Water service area is delivered to one of SCV's banking partners and stored in a groundwater basin through spreading or by in lieu replenishment. Under wetter circumstances, excess water may exceed the ability to bank supplies, in which case, excess water may be turned back to the SWP system. Conversely, during dry years, water is taken out of the bank (physically delivered to the California Aqueduct or exchanged for the banking partners' SWP water supplies) to make up for SWP shortfalls.

Basin Operating Plan

As described above, prior to the formation of SCV Water, the retail water purveyors and CLWA undertook preparation of an AB 3030 Groundwater Management Plan (AB 3030 plan) that was adopted in 2003 (LCSE, 2003). That plan was updated in 2009 and built upon extensive work already conducted in the Basin, including introducing the application of a three-dimensional numerical groundwater model to ensure that the proposed operations under this plan would not result in overdraft. The AB 3030 plan and later updates describe a Basin Operating Plan with the following annual groundwater production schedule:[27]

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[27] See the discussion of Primary Element 4 of the AB 3030 Plan (on page 30 of LSCE, 2003).

	Groundwater Production (AFY)			
	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
Alluvial Aquifer	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus Formation	7,500 to 15,000	15,000 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	**37,500 to 55,000**	**45,000 to 60,000**	**51,000 to 60,000**	**51,000 to 70,000**

AFY: acre-feet per year

Although a number of factors have prevented full use of the Saugus Formation as described in the Basin Operating Plan, the Basin Operating Plan remains the best available description of future operation of the Basin and thus is used to estimate water balances under the future land use and water use conditions described in this section. The Basin Operating Plan is similarly used to describe groundwater operations in the 2020 Urban Water Management Plan (KJ, 2021) and the 2021 *Draft Water Supply Reliability Plan Update* (Geosyntec, 2021).[28] The Basin Operating Plan has similarly been used in the 2010 and 2015 Urban Water Management Plans (KJC et al., 2011 and 2016), and the 2017 Water Supply Reliability Plan Update (Clemm and KJC, 2017). The combination of imported water management in conjunction with the Basin Operating Plan forms the basis for current and future water planning in the Santa Clarita Valley. These plans consistently demonstrate that operation of the basin under the existing Basin Operating Plan (and in combination with the imported water resources portfolio) allows SCV Water to reliably meet water demands within its service area under current conditions and through 2050 build-out of land and water uses under varying hydrologic conditions consistent with those that have been recorded for nearly a century in the region. The recent 2021 *Draft Water Supply Reliability Plan Update* (Geosyntec, 2021) has reached the same conclusions—specifically, that there would be a supply surplus that would greatly exceed any projected shortfalls, as long as the remaining supply capacity in the Saugus Formation and/or in specific water banks is fully developed.

6.1.2 Water Budget Analysis and Presentation of Data

The water budgets presented in this section have been developed using a three-dimensional numerical computer model that simulates the natural interactions that take place between surface and groundwater components. This numerical computer model conducts its calculations three times a month over multiple decades to estimate these interactions.

Figure 6.1-3 depicts the general characteristics of the surface and groundwater processes occurring in the Basin, along with its geologic structure.

6.1.2.1 The Role of Imported Water in the Water Budget Analysis

Imported water is an important part of the regional water budget. The adequacy of imported water is essential to meeting the needs of the region and its water balance. Imported water comes from various water supply sources that are transported through the SWP system to Castaic Lake, where SCV Water takes

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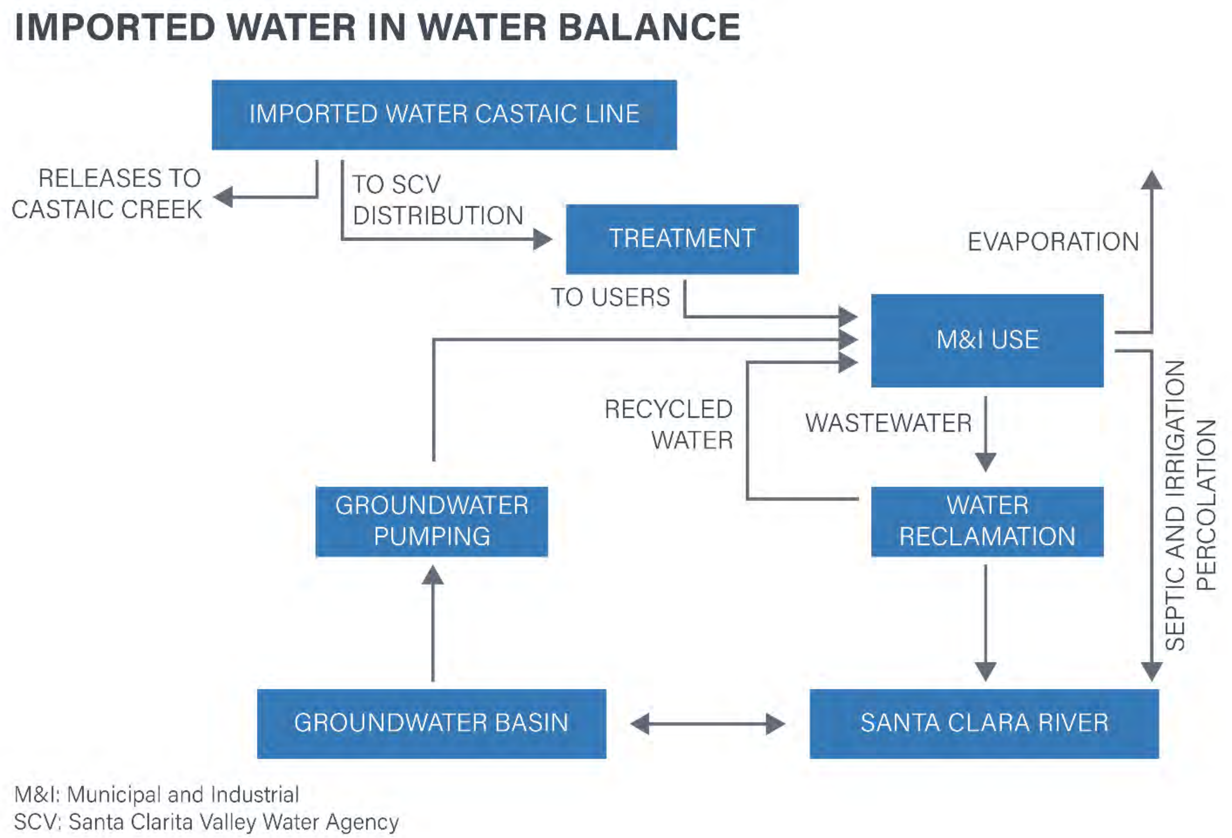
[28] It is conceivable that SCV Water may find it more feasible to operate the Saugus Formation differently in certain circumstances. In particular, if the first year of increased Saugus pumping during a dry period is a year of an especially significant curtailment in SWP water deliveries (as occurred in 1977), then SCV Water may elect to pump as much as 33,825 AFY from the Saugus Formation during the first year of SWP curtailments (resulting in 35,000 AFY of total pumping from the Saugus Formation) and reduce its Saugus Formation pumping below 33,825 AFY in one or more subsequent years, if the curtailment persists.

delivery of these supplies then pumps the water via pipeline for treatment at either the Earl Schmitt Filtration Plant or the Rio Vista Water Treatment Plant. Water is then distributed to municipal water users. Imported water enters the natural surface water system as return flow from municipal sewerage system discharges and releases from Castaic Lake to downstream agencies in Ventura County (a portion of which recharges the groundwater system in the Basin). Imported water also recharges the groundwater system as percolation from land-applied water (outdoor irrigation) and from septic systems. The use of imported water in the regional water balance is depicted in the graphic below.



In this section, imported water releases to Castaic Creek are included in the historical water budget analysis, but are not included in the current or projected water budget analyses. Future releases of imported water to Castaic Creek are presumed to be for the benefit of downstream parties only, and therefore any incidental recharge is excluded from the projected water budget for the upstream area.

In the water budget analyses, the return flows of imported water (from deep percolation of applied irrigation water, septic tank percolation, and water reclamation plant [WRP] discharges to the Santa Clara River) are not tracked separately from the return flows from local groundwater supplies because these two supply sources are blended in the distribution system. Accordingly, imported water is reported only in tables showing the sources of water for delivery to customers in any year. In these tables, imported water is shown as an amount of water delivered by SCV Water from Castaic Lake through its municipal delivery system to its customers.

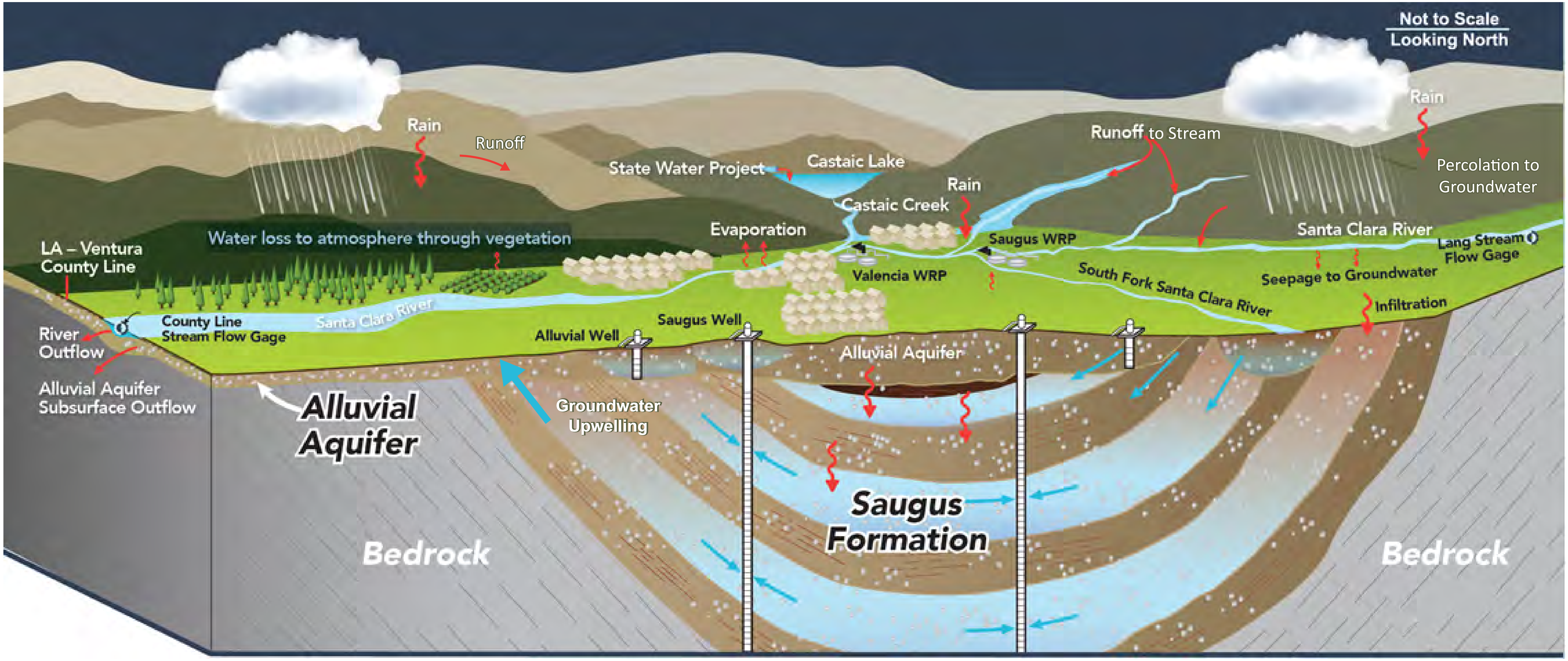


FIGURE 6.1-3

Conceptual Groundwater and Surface Water Flow Diagram
Santa Clara River Valley Groundwater Basin

Santa Clara River Valley East Groundwater Subbasin Groundwater Sustainability Plan

GSI Water Solutions, Inc.

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6.1.2.2 Terms Used in Water Budget Tables and Graphics

In this section, tabular data present the water budgets for the surface water system (generally the Santa Clara River and its tributaries), and the groundwater system (the Basin, which is the local groundwater system in the valley). Because of the interconnections between these systems, the tables may show that an interconnected process that exchanges water between the surface and groundwater systems has a negative numerical value in one system and an equal but positive numerical value in the other system, to provide balancing of the water budgets in both systems. For example, streamflow losses that represent an outflow term for surface water also represent inflow (recharge) values for groundwater, while upwelling of groundwater into a stream represents an outflow (loss) of water from the groundwater system and an inflow (gain) of water in the surface water system.

In order to discern important watershed components such as surface water flows compared with groundwater flows leaving the Basin and groundwater storage changes over time, separate surface water and groundwater budgets were developed. These budgets reflect the results of using the three-dimensional numerical groundwater flow model of the Basin to simulate the interaction between the surface water and groundwater systems. These exchanges of water and the complete group of processes that are components of the surface water and groundwater budgets (and that are used in the graphics and tables) are summarized below.

- **Precipitation**, primarily in the form of rainfall, typically occurs from fall through spring. While averaging slightly over 17 inches per year (in/yr), it is highly variable as shown below in Figure 6.1-4. The general pattern is a period of below-normal precipitation followed by shorter periods of higher precipitation. Rainfall provides surface flows in the form of runoff and directly recharges the groundwater basin through percolation through the soil column. Quantities of precipitation are impacted by climate change as discussed in the projected water budget discussion (Section 5).
- **Surface Water Recharge to the Groundwater Basin** constitutes an addition to the groundwater system in the groundwater budget and is a surface water loss in surface water budget. Surface water flow originates from precipitation in canyons and tributaries of the upper Santa Clara River watershed, which drain into the Santa Clara River. Conversely, groundwater upwelling that flows into the surface water systems is depicted as an outflow from the groundwater system but a source of water to the surface water system. The watersheds that are tributary to the Basin are shown on Figure 6.1-5. Surface water inflows also include controlled releases of local water and (infrequently) SWP water impounded in Castaic Lake. The impounded local water consists of precipitation runoff from the watershed areas upstream of the reservoir. These releases into Castaic Creek occur near the northern boundary of the Basin. Controlled releases of local water also occur from Bouquet Reservoir, which is located at the boundary between the Eastern and Bouquet Hydrologic Subareas (Figure 6.1-2). A large portion of these releases infiltrates the alluvial material underlying each creek, while the remainder continues as streamflow out of the Basin.
- **Evapotranspiration** (ET) is the uptake of groundwater by phreatophyte plant communities. These include the riparian mixed hardwood forests and coast live oak woodlands shown in Figure 6.1-6.

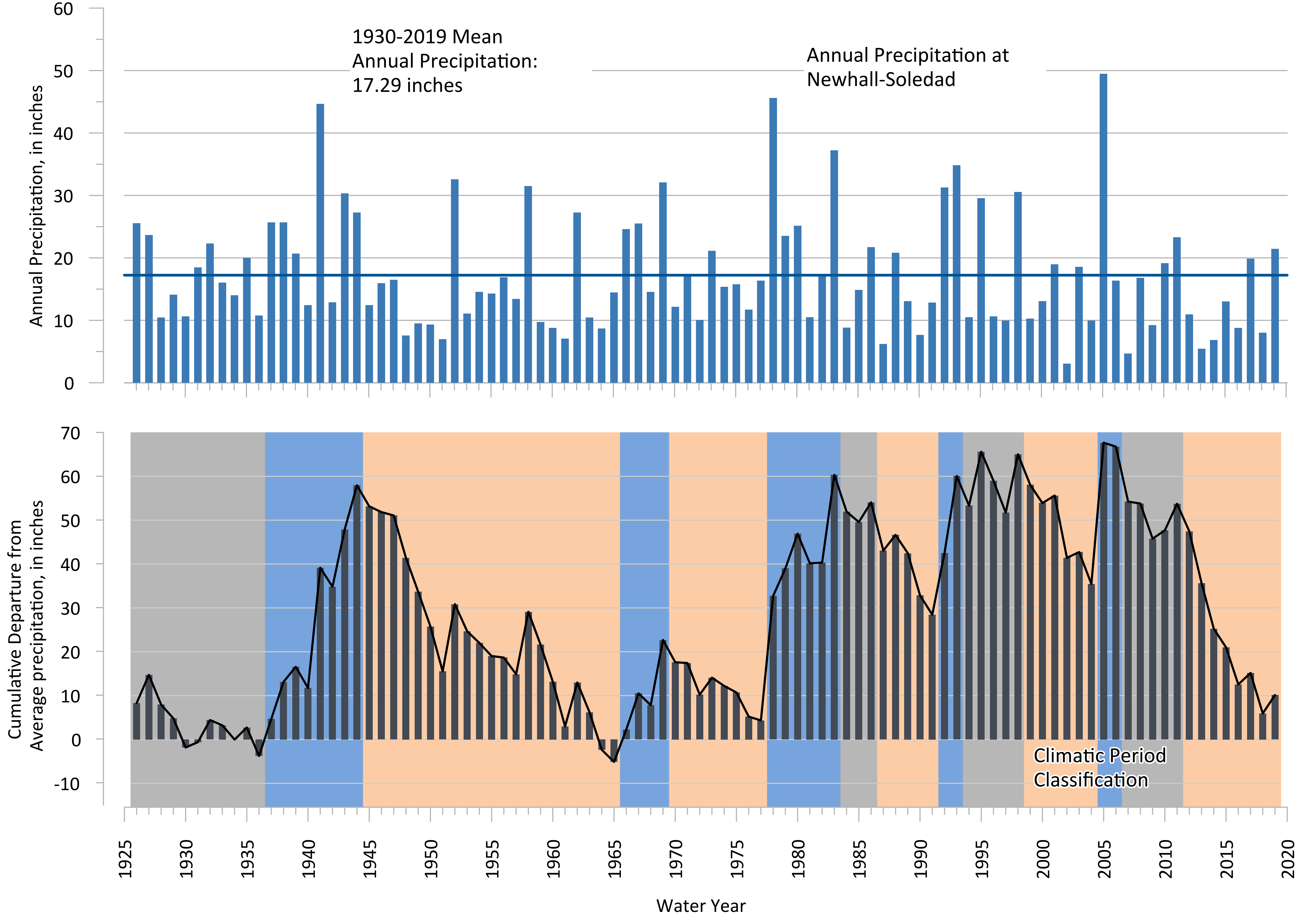


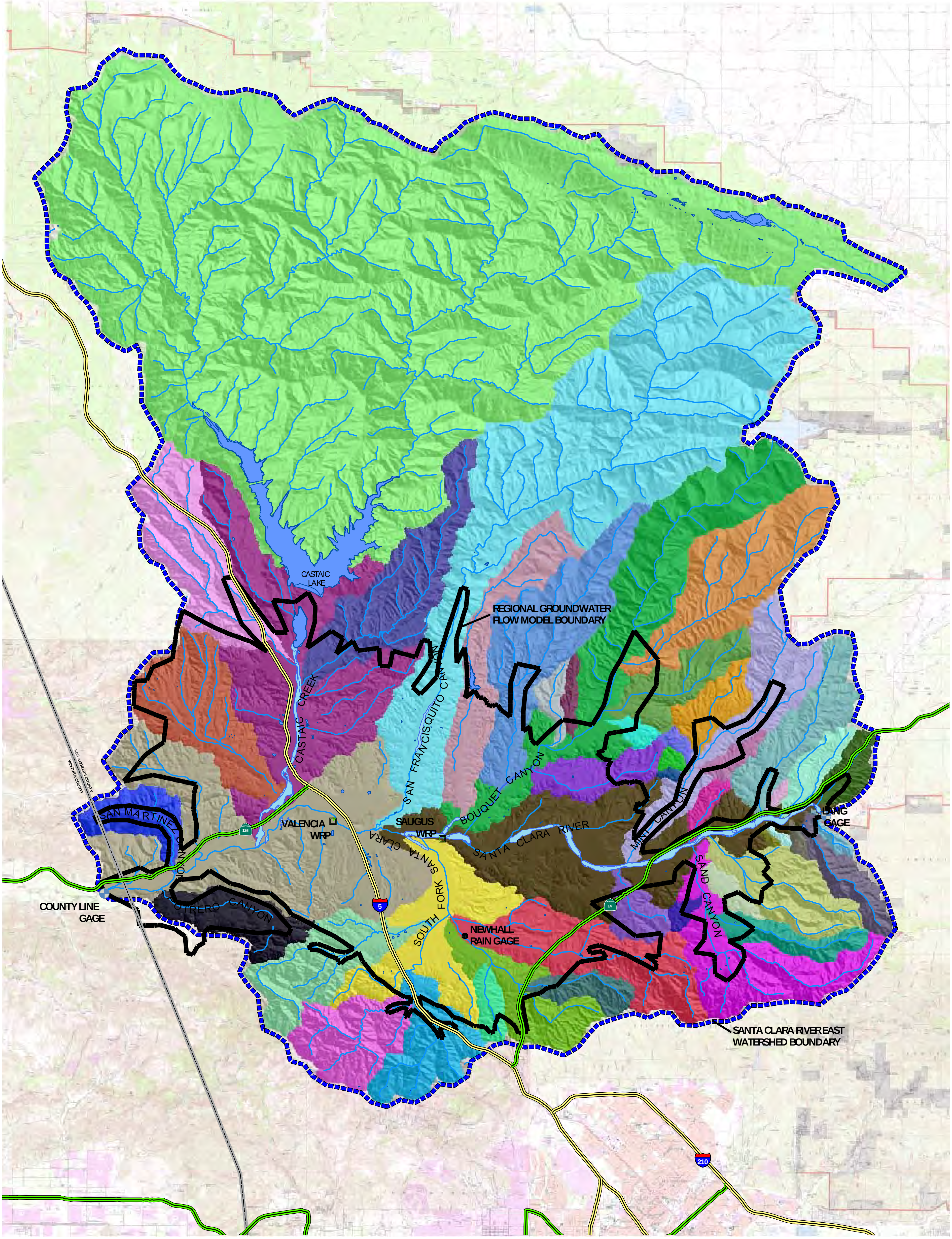
FIGURE 6.1-4

Annual Precipitation at the Newhall-Soledad (Newhall Fire Station #73) Rain Gage and Water Year Types for the Santa Clara River Valley East Groundwater Subbasin

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟦 Wet
- 🟧 Dry
- ◼ Normal
- — Cumulative Departure From Mean
- — Mean Precipitation



LEGEND

Hydrography

- 🟦 Lake
- 🟦 Stream
- ◐ Stream Gage
- ☐ Water Reclamation Plant (WRP)

Major Road

- ═ Interstate
- ═ State Highway

Data Sources: CH2MHILL, 2004

FIGURE 6.1-5

Contributing Watersheds to the Santa Clara River Valley East Groundwater Subbasin

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

N

0 2.5 5
Miles

GSI Water Solutions, Inc.

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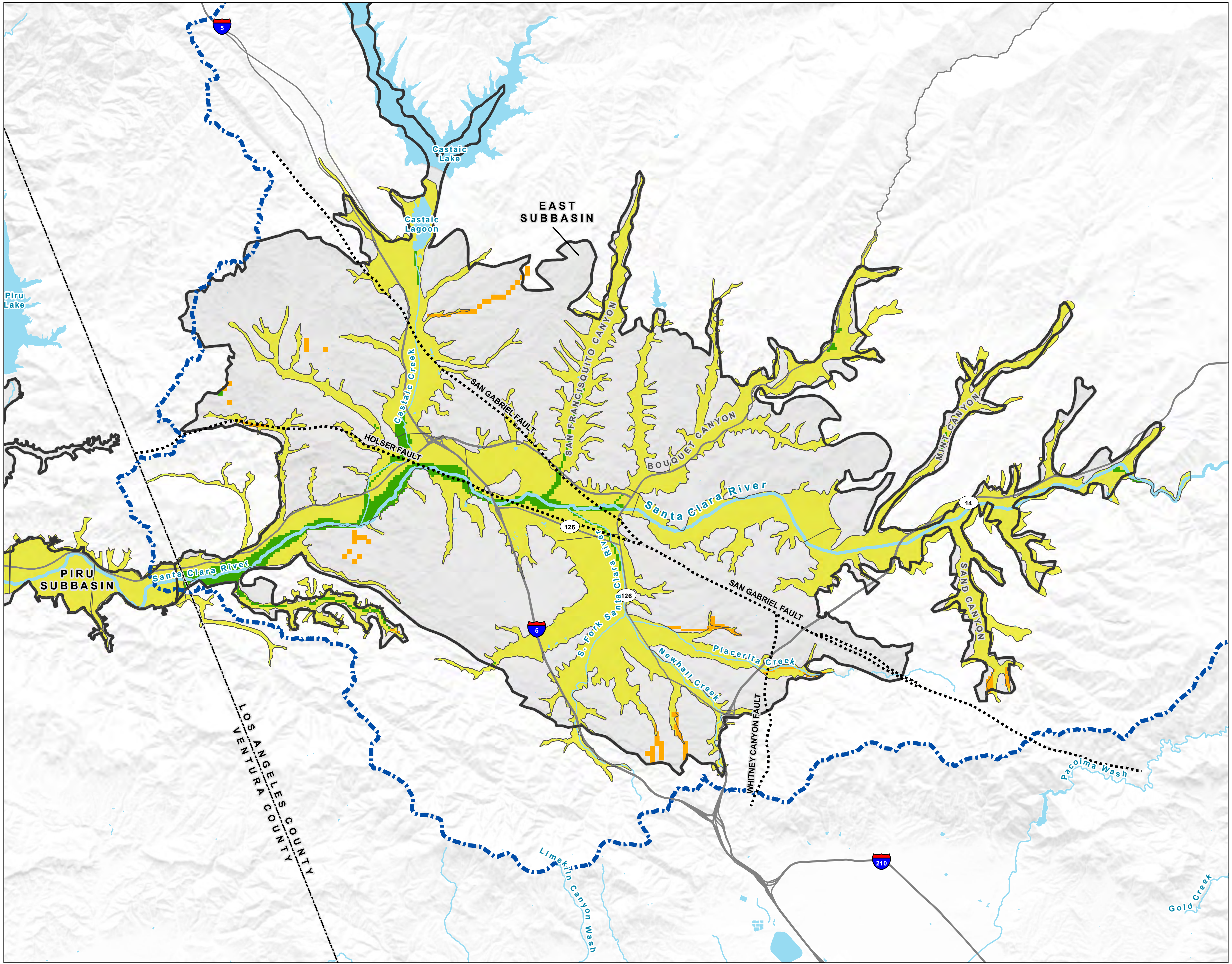


FIGURE 6.1-6

Phreatophyte Locations in the Model Grid

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- Alluvial Aquifer
- Santa Clara River Valley Groundwater Basin
- Watershed Boundary

Phreatophyte Locations

- 🟩 Riparian Mixed Hardwood
- 🟧 Coast Live Oak Woodland

All Other Features

- Major Road
- Watercourse
- Waterbody

Date: December 9, 2021
Data Sources: USGS, DWR Bulletin 118, ESA (2020)

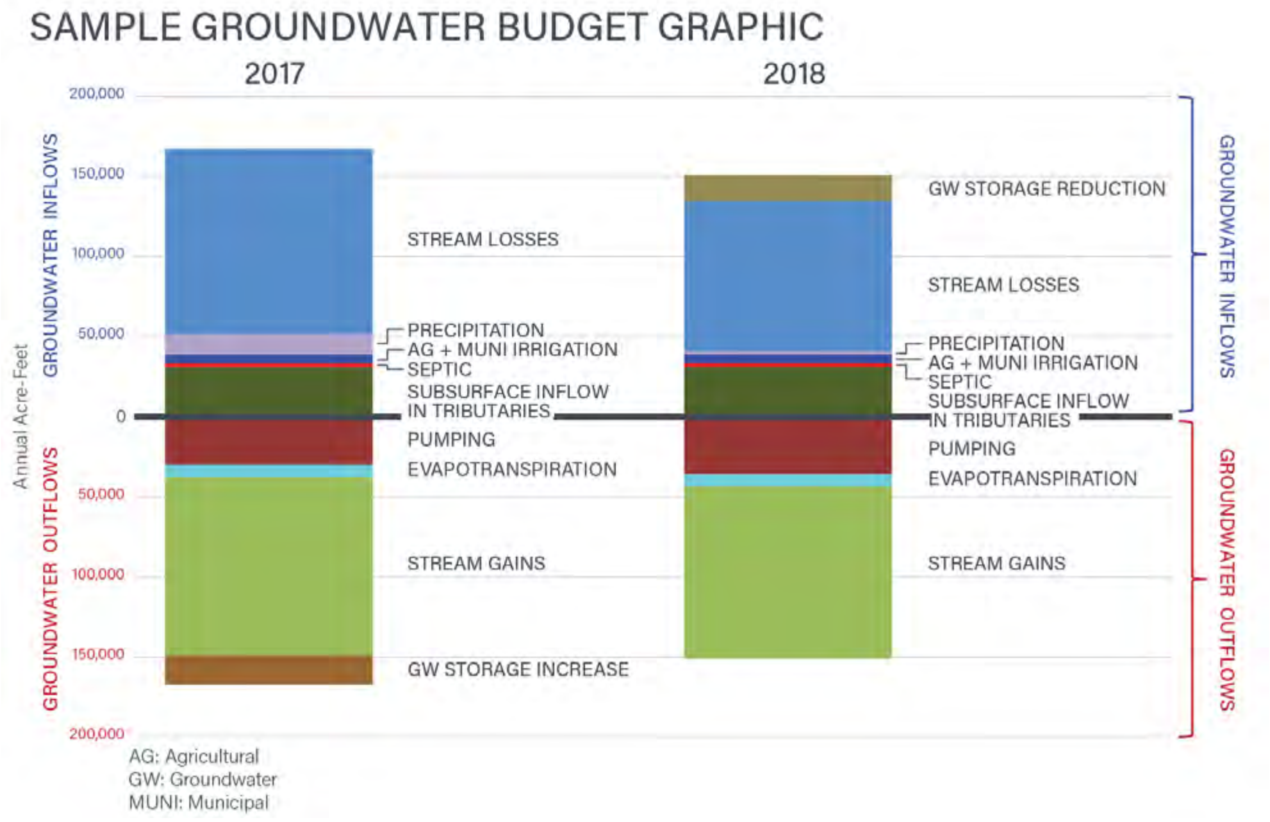
GSI Water Solutions, Inc.

Document Path: Y:\0420_CLWA\Source_Figures\019_EastSubbasinGSP\GSP\Section6\Figure6_1_6_Phreatophyte_Locations_in_the_Model_Grid.mxd, abarry

- **Other Consumptive Uses** represent the portion of agricultural and urban water uses that are not returned to the surface or groundwater systems and hence are "consumptive" uses of water. This is almost exclusively in the form of ET of land-applied water (water that is used for irrigation of agricultural crops and urban landscapes). Consumptive use does not include water that percolates into the ground when irrigation of agricultural lands and municipal lawns and gardens occur; this percolation of irrigation water is accounted for as inflows into the groundwater system. Indoor water use is a very small consumptive use. Most of the water used inside homes and nonresidential facilities is returned to the system via wastewater systems that consist of WRPs discharging treated water into the Santa Clara River and septic systems that percolate treated water into the groundwater system.
- **Surface and Subsurface Outflows** represent surface or groundwater flowing out of the Basin at its western boundary (near the LA/Ventura county line).
- **Point Discharges to the Santa Clara River** also occur from local WRPs and from groundwater treatment systems that pump groundwater to contain and treat perchlorate contamination on and near the former Whittaker-Bermite Corporation (Whittaker-Bermite) property.
- **Stream Losses** are surface water outflows that occur when streamflows seep into the underlying groundwater system (see Surface Water Inflows above) and when surface water in the Santa Clara River flows out of the Basin at the western basin boundary.
- **Stream Gains** occur when groundwater upwells into surface streams. These flows, beginning at the mouth of the San Francisquito Canyon and continuing beyond the western basin boundary, contribute to the perennial streamflow that occurs in most periods in the Santa Clara River.
- **Agricultural and Municipal and Industrial Irrigation** water that is not taken up by plants (through ET) percolates into the groundwater basin. This is also referred to as irrigation return flow.
- **Septic Systems** also provide a small amount of groundwater recharge to the groundwater basin.
- **Pumping** from the groundwater basin removes water from the groundwater system. The largest pumper in the Basin is SCV Water, which accesses groundwater from both the Alluvial Aquifer and the Saugus Formation. SCV Water and the Los Angeles County Waterworks District No. 36, Val Verde (LACWD) are the sole municipal water providers in the Santa Clarita Valley. Other pumpers include FivePoint Holdings, LLC (FivePoint), which is the successor of interest to The Newhall Land and Farming Company and extracts water for agricultural uses; the Pitchess Detention Center, which extracts water for municipal purposes; the Disney Corporation, which pumps localized Saugus Formation groundwater along the basin boundary for irrigation purposes; golf courses; and small domestic pumpers. Historical pumping levels are documented in annual reports, including the *2019 Santa Clarita Valley Water Report* (LSCE, 2020).

The water budget analyses for the Basin combine these hydrologic and water use components to arrive at annual surface water and groundwater budgets. These budgets are presented in graphical form and in tables. A sample of the terms used in the groundwater budget is shown in the diagram below for two years.

In the Sample Groundwater Budget graphic, the area below the zero line of the graphic shows pumping, ET, and stream gains are all leaving the groundwater system (as groundwater outflows), while stream losses, precipitation, irrigation return flows, septic systems, and subsurface tributary inflows, are all recharging the groundwater basin (i.e., as groundwater inflows), as shown above the zero line. Using DWR's guidance for displaying storage changes, the net impact of stored groundwater on the water budget and the balancing of the water budget terms is shown in a brown or tan color each year.



For the second year, the positive value of this storage change (as represented by the tan bar) is called a groundwater storage reduction because the aquifer naturally releases stored water that is then available as a source of water to support the various groundwater discharge mechanisms that are operating in the Basin. This occurs when the volumes of those groundwater outflow terms are higher than the amount of recharge into the aquifer system. Conversely, for the first year, the negative value of this storage change (as represented by the black bar) is called a groundwater storage increase because the aquifer naturally stores water during high precipitation/recharge periods (when the groundwater discharge mechanisms do not need to withdraw stored water because of the high amount of groundwater recharge). This method of representing the storage terms is based on the principle of conservation of mass, which states that the difference between inflows and outflows must equal the change in storage at any given time. Accordingly, under this principle, in any given year, the size of the group of bars lying above the zero line is the same as the size of the group of bars lying below the zero line.

6.1.3 The Process for Building the Projected Water Budget

The water budget analyses that are described and developed in this section provide the basis for identifying the projected water budget that are used in subsequent steps of GSP development to evaluate basin sustainability, develop sustainable management criteria under SGMA, and identify and evaluate implementation measures for obtaining and/or maintaining long-term sustainability of the Basin's groundwater resources in the next 20 years (the time frame required by SGMA for achieving sustainability). In the sections below, the estimated future water budget (which is described by DWR as the "projected" water budget) for the Basin is derived. The projected basin water budget is fundamental to evaluating the sustainability of the Basin because it depicts how the basin operates in highly variable hydrologic conditions, how the basin interacts with the surface water system, and how the Basin Operating Plan for the groundwater resources in the Basin interrelates to the overall water resources supply plan for the region.

The development of the projected water budget is presented in several parts.

- First, the historical water budget for the groundwater system is presented. The historical water budget shows how water use has grown over time as the area developed and how the groundwater basin water interacted with the surface water system and imported water system over time (from 1925 through 2019), including during periods of abundant precipitation and periods of drought conditions.
- Next, the current water budget is presented. In this water budget, the performance of the Basin is simulated over a repeat of the historical hydrologic record (1925 through 2019), but with a static level of pumping and overlying human water demands that are representative of recent land uses and water uses in the Basin. This differs from the historical water budget in that it takes out the factors associated with continual changes in the overlying land and water uses during the historical record, thereby allowing an analysis of how the basin would perform under a repeat of historical droughts and wet cycles at the current level of overlying development and human water demand. The current water budget depicts how the groundwater basin currently interacts with the surface water system and how the region depends upon imported water to maintain a long-term balance between supplies and human demands for water.
- Finally, the projected water budget is presented, with a preceding discussion of how the Basin Operating Plan was developed and how this plan interrelates to the region's dependence upon imported water supplies (based on the conjunctive-use management approach for the Basin). The projected water budget also accounts for the effects of climate change on the local groundwater system.

6.1.4 Historical Water Budget

This section provides a look back at the Basin's historical water budget from 1925 through 2019. This historical water budget includes historical wet and dry periods, which are later used to represent water supply variability in current and projected water budget evaluations. The historical water budget also depicts the actual history of past changes in regional water use over time.

6.1.4.1 Historical Water Supplies and Demands

Water use changes were dramatic during this period. The table below shows the overlying human water demands and the sources of water used to meet those demands.

		Municipal Users				Other Users	Total	
Years	**Statistic**	**Local Groundwater**	**Imported Water**	**Recycled Water**	**Total**	**Local Groundwater**	**Local Groundwater**	**Demand**
1936–1949	Min	0	0	0	0	5,000	5,000	5,000
	Average	0	0	0	0	33,500	33,500	33,500
	Max	0	0	0	0	50,000	50,000	50,000
1950–1959	Min	500	0	0	500	50,000	50,500	50,500
	Average	1,000	0	0	1,000	51,000	51,000	51,000
	Max	1,000	0	0	1,000	51,000	51,000	51,000
1960–1979	Min	500	0	0	500	14,000	29,000	29,000
	Average	11,500	0	0	11,500	23,500	35,000	35,000
	Max	20,000	7	0	20,000	50,000	50,500	50,500
1980–2019	Min	12,201	1,126	0	21,386	9,975	24,138	33,323
	Average	25,820	26,486	167	52,473	13,990	39,810	66,463
	Max	34,612	47,205	507	77,311	17,312	50,373	92,079

Notes

All units are in acre-feet. Values prior to 1980 are estimates and are rounded to the nearest 500 or 1,000 acre-feet due to limited records. Totals do not equal the sum of the individual uses because the minimum, average, and maximum values occur in different years for each water use and water source.

Min = minimum

Max = maximum

Water use during the region's history can be logically divided into four periods: predevelopment (before 1936), agricultural (1936 through 1959), transition to urbanization (1960 through 1979), and the modern period of record (1980 through 2019).

- **Predevelopment Period (Before 1936).** During the 1800s and early 1900s, the Basin was largely rural, with ranches, rural populations, and small villages present. This early development included an outpost of Mission San Fernando that was established at Castaic Junction in 1802. See Lopez, 1974 for an ethnographic and archaeological study of these early years, including discussions of precipitation and temperature patterns during this period. Shallow hand-dug wells and direct diversions of water from perennial reaches of the Santa Clara River are thought to be the primary sources of the low-volume water needs in those days.[29]
- **Agricultural Development Period (1936 through 1959).** The first large-scale use of groundwater is thought to have occurred with the construction of agricultural supply wells along the Santa Clara River in the western and central portions of the Basin beginning in the mid-1930s. Inspection of aerial photos from 1947 and a U.S. Geological Survey (USGS) study of the Basin's agricultural and early urban years (Robson, 1972) indicate that groundwater pumping for agricultural uses supported irrigated crop cultivation on as much as 6,100 acres (approximately) of land lying along the alluvial corridors that contain the Santa Clara River and certain tributaries. See Appendix I, Water Budget Details, for the

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[29] See https://scvhistory.com/scvhistory/lopezrobert1974rainfall.htm for details.

locations of these lands and the wells that are estimated (based on construction dates) to have provided the irrigation water supply. Calculations by Robson (1972), CH2M HILL (2004), and GSI (2020) for the mixture of crops farmed in those days and more recently indicate that (1) crop irrigation demands range from about 4 to 10 acre-feet (AF) per acre per year, and (2) crops consume approximately 50 to 70 percent of the land-applied irrigation water pumped from the Alluvial Aquifer, with the remainder lost to evaporation from soils and seepage back to the underlying water table. Accordingly, annual groundwater pumping to support agricultural irrigation is thought to have averaged approximately 50,000 AFY by the mid-1940s and continuing through much, if not all, of the 1950s. The Saugus Formation was not a source of groundwater supply until the early 1950s, when the newly formed Newhall County Water District drilled wells along the South Fork Santa Clara River in the town of Newhall.

- **Transition Period (1960 through 1979).** Beginning in the 1960s, certain parcels of agricultural land, located primarily east of the modern-day Interstate 5 (I-5) freeway, were retired and gradually urbanized. As this transition began, the region began planning water importation to meet future growth. In 1963, the Upper Santa Clara River Valley Water Agency, the predecessor to CLWA, and now SCV Water, contracted with DWR for SWP supply. Urbanization continued during the 1960s and 1970s, with the first deliveries of SWP water occurring in 1979.
- **Modern Record (1980 through 2019).** Over these years, the Basin has continued to urbanize. By 2019 the region's population was approximately 286,000. During this period, the region invested in increased supplies of imported water and began operating the local groundwater basin in conjunction with imported water. This was formalized in a Basin Operating Plan near the turn of this century (LSCE, 2003; LSCE and GSI, 2009).

6.1.4.2 Historical Groundwater Budget Analysis Results

Figure 6.1-7, shown below, depicts the historical water budget. The figure presents a histogram plot showing the multiple groundwater inflows and outflows, with the inflows stacked as bars above the zero line and the outflows stacked as bars below the zero line. A yellow line shows the cumulative change over time in the volume of groundwater in storage in the Basin. Like the cumulative departure curve for precipitation, the cumulative change curve for groundwater storage indicates whether the basin is experiencing long-term changes in groundwater storage, and, in particular, whether an overdraft condition might exist (as would be shown by a curve that is declining over a long period—i.e., sloping down and to the right over multiple decades). As shown in this plot, the historical water budget shows the effects of periodic low precipitation periods but does not show long-term sustained downward trends in the cumulative change curve over the entire period. The absence of long-term sustained downward trends in the cumulative change curve indicates that the Basin has not been in an overdraft condition. This observation is corroborated by observed groundwater levels.

As a companion to Figure 6.1-7, the table that follows it shows the sources of water delivered to end users in the historical water budget, beginning with the first delivery of imported water in 1979. Prior to 1979, all water use in the area was derived from groundwater pumping.

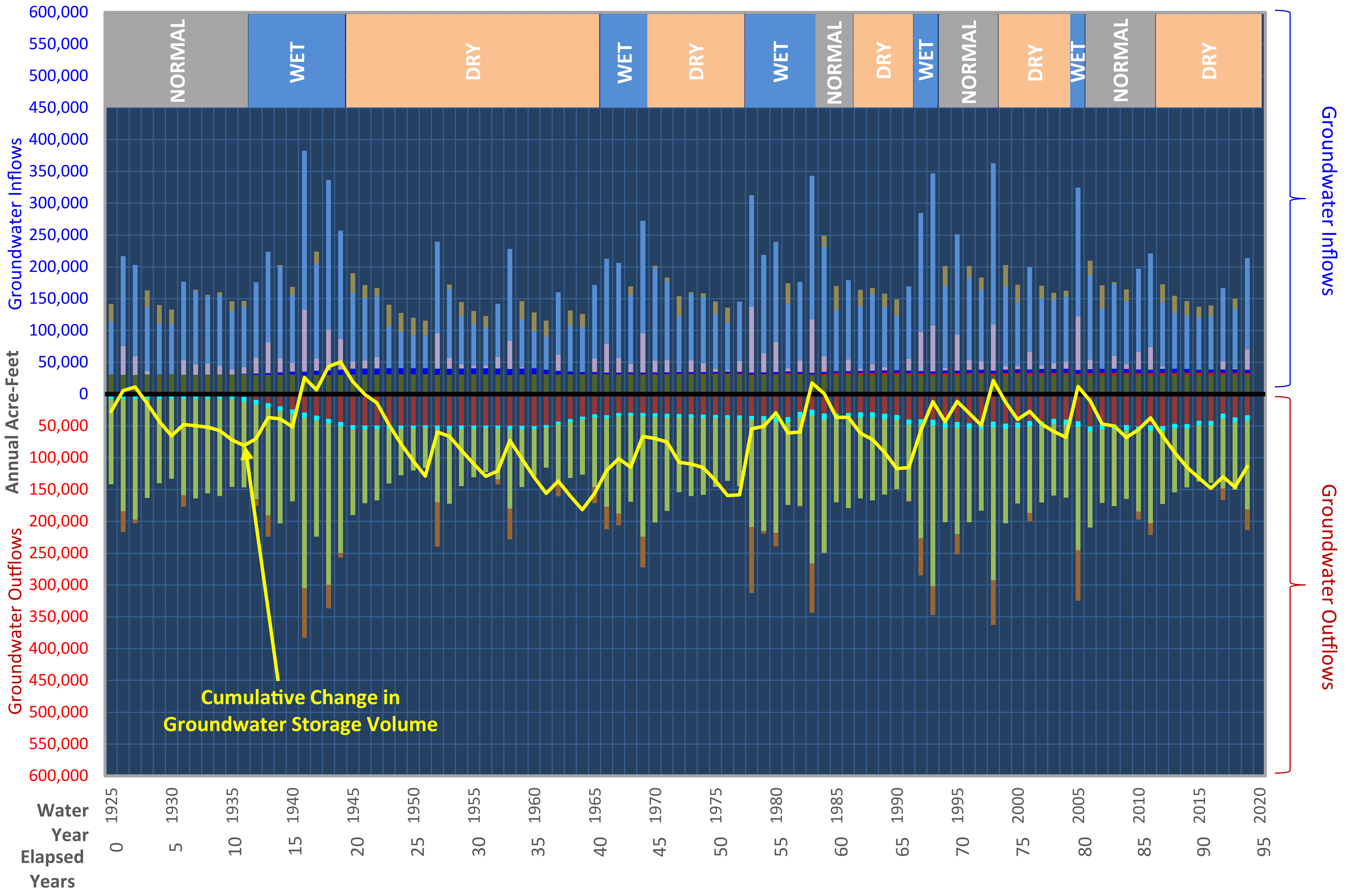

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FIGURE 6.1-7

Historical Groundwater Budget (Water Years 1925-2019)

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

	Municipal Users				Other Users	Total	
Calendar Year	**Local Groundwater**	**Imported Water**	**Recycled Water**	**Total**	**Local Groundwater**	**Local Groundwater**	**Demand**
1979	19,500	7	0	19,507	15,223	34,723	34,730
1980	20,639	1,126	0	21,765	15,413	36,052	37,178
1981	18,482	5,817	0	24,299	17,278	35,760	41,577
1982	12,253	9,659	0	21,912	13,705	25,958	35,617
1983	12,201	9,185	0	21,386	11,937	24,138	33,323
1984	16,390	10,996	0	27,386	15,377	31,767	42,763
1985	16,659	11,823	0	28,482	13,403	30,062	41,885
1986	17,393	13,759	0	31,152	12,297	29,690	43,449
1987	17,592	16,285	0	33,877	10,611	28,203	44,488
1988	18,601	19,033	0	37,634	9,975	28,576	47,609
1989	21,195	21,618	0	42,813	10,285	31,480	53,098
1990	21,453	21,613	0	43,066	11,284	32,737	54,350
1991	31,825	7,968	0	39,793	10,279	42,104	50,072
1992	27,355	13,911	0	41,266	11,160	38,515	52,426
1993	29,959	13,393	0	43,352	10,777	40,736	54,129
1994	31,599	14,389	0	45,988	13,559	45,158	59,547
1995	28,677	16,996	0	45,673	14,347	43,024	60,020
1996	32,054	18,093	0	50,147	14,570	46,624	64,717
1997	32,025	22,148	0	54,173	15,319	47,344	69,492
1998	28,604	20,254	0	48,858	13,599	42,203	62,457
1999	29,968	27,282	0	57,250	17,154	47,122	74,404
2000	28,409	32,579	0	60,988	15,608	44,017	76,596
2001	25,367	35,369	0	60,736	16,362	41,729	77,098
2002	26,457	41,763	0	68,220	16,979	43,436	85,199
2003	22,978	44,416	50	67,444	14,829	37,807	82,273
2004	24,671	47,205	420	72,296	15,590	40,261	87,886
2005	32,316	37,997	418	70,731	12,785	45,101	83,516
2006	33,061	40,048	419	73,528	17,312	50,373	90,840
2007	31,690	45,151	470	77,311	14,768	46,458	92,079
2008	33,884	41,705	311	75,900	14,750	48,634	90,650
2009	31,100	38,546	328	69,974	16,564	47,664	86,538
2010	33,152	30,578	336	64,066	16,098	49,250	80,164
2011	33,624	30,808	373	64,805	15,439	49,063	80,244
2012	33,726	35,558	428	69,712	15,694	49,420	85,406
2013	29,779	43,281	400	73,460	16,151	45,930	89,611
2014	34,612	33,092	474	68,178	12,885	47,497	81,063
2015	29,893	24,148	450	54,491	12,079	41,972	66,570
2016	26,329	31,130	507	57,966	14,360	40,689	72,326
2017	16,403	46,651	501	63,555	13,438	29,841	76,993
2018	22,869	41,999	352	65,220	13,071	35,940	78,291
2019	17,547	42,072	458	60,077	12,510	30,057	72,587

Notes

All values are in units of acre-feet. Data are for calendar years, to be consistent with water usage information presented in annual reports. See Table I-2 in Appendix I for water-year values of groundwater usage. Other users are FivePoint (The Newhall Land and Farming Company), the Pitchess Detention Center, Sand Canyon Country Club, Valencia Country Club, Vista Valencia Golf Course, small private domestic well owners, and the groundwater pumping/treatment system on the Whittaker-Bermite property.

6.1.5 Current Water Budget

The approach that was used to develop the current water budget involved taking the historical pattern of natural hydrologic conditions (i.e., precipitation, basin inflows, ET, etc.) from 1925 through 2019 and using current pumping and development patterns to demonstrate how the current operation of the groundwater basin interacts with the surface water system under historical droughts and wet periods. Analysis of the current water budget allows for evaluating whether overdraft conditions would possibly occur if the current levels of groundwater pumping and overlying water uses were to continue for many decades.

6.1.5.1 Water Supplies and Demands for the Current Water Budget

While the historical water budget extends through 2019, the pumping patterns that have occurred beginning in 2015 have been abnormally depressed during these years—well below the annual volumes specified in the AB 3030 Groundwater Management Plan (LSCE, 2003). To avoid this anomaly, this current water budget uses SCV Water's actual 2014 pumping distribution and the overlying land uses that were present that year. The 2014 land uses are believed to be within 1 percent of those found in 2019, based on the number of water accounts served by SCV Water. For other pumpers (i.e., non-municipal pumpers), the current water balance uses those well owners' average pumping during the last 10 years, which is consistent with estimation procedures used in past Urban Water Management Plan analyses.

The table below shows how human water demands would be satisfied at the current level of development and the associated current level of water demands and groundwater pumping.

Municipal Users				Other Users	Total	
Local Groundwater	Imported Water	Recycled Water	Total	Local Groundwater	Local Groundwater	Demand
34,612	33,092	474	68,178	14,623	49,235	82,801

Notes

All values are in units of acre-feet and are for 365-day years. Values will be higher in leap years.
Groundwater pumping consists of actual 2014 municipal water use, 2010–2019 average pumping for other pumpers, and 500 AFY for the groundwater pumping/treatment system on the Whittaker-Bermite property.
Other users are FivePoint (The Newhall Land and Farming Company), the Pitchess Detention Center, Sand Canyon Country Club, Valencia Country Club, Vista Valencia Golf Course, small private domestic well owners, and the groundwater pumping/treatment system on the Whittaker-Bermite property.

6.1.5.2 Current Groundwater Budget Analysis Results

The current groundwater budget is depicted in Figure 6.1-8, below. This plot shows the effects of periodic low precipitation periods but does not show long-term sustained downward trends in the cumulative change curve for groundwater storage over the entire period. The absence of long-term sustained downward trends in the cumulative change curve indicates that the Basin would not be in an overdraft condition if current land use and water use conditions persisted over multiple decades of fluctuating precipitation in the basin.

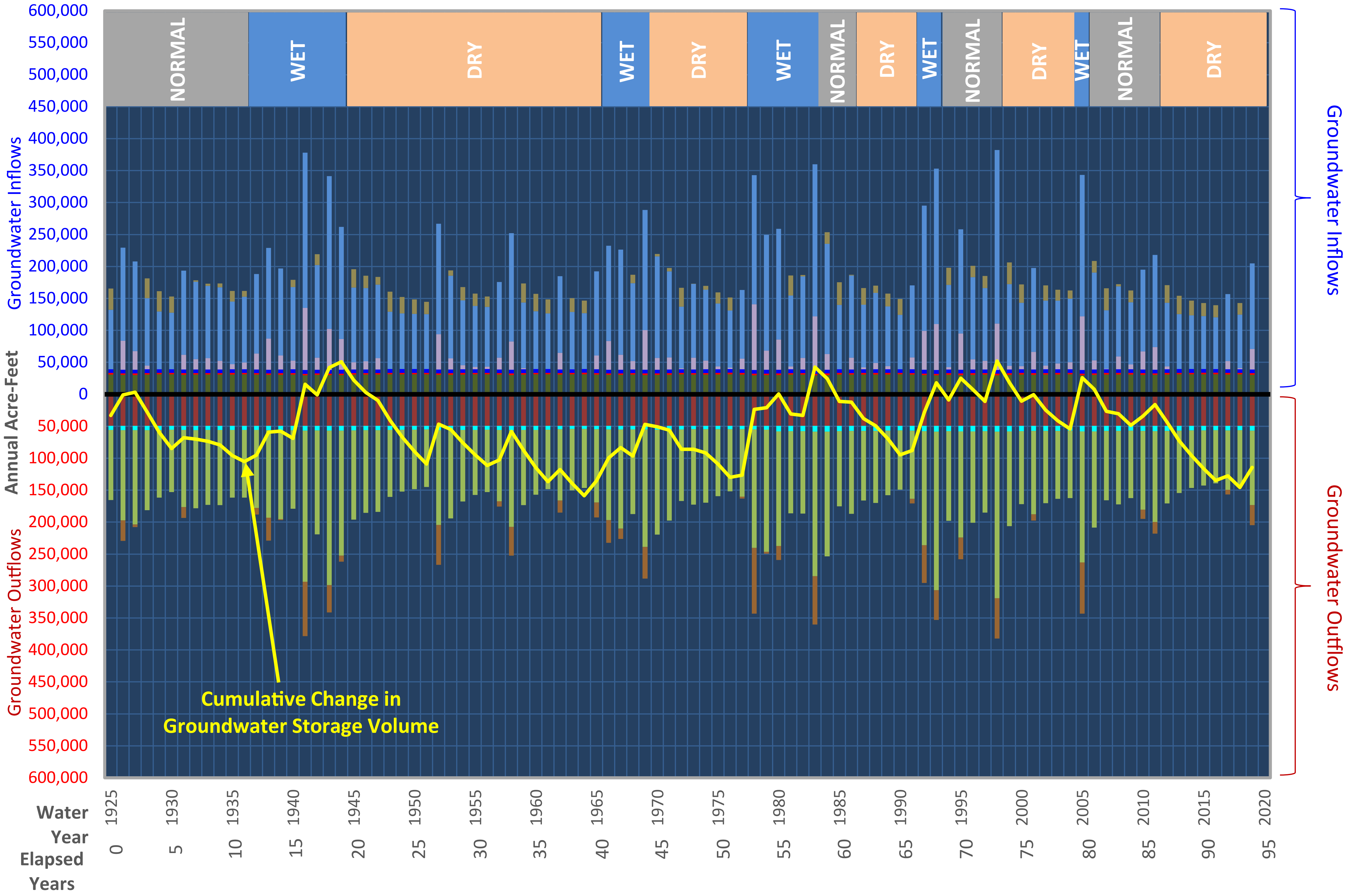

FIGURE 6.1-8

Current Groundwater Budget Under the 2014 Level of Development

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

6.1.6 Projected Water Budget

This section presents the projected water budget under three alternative sets of climate assumptions and derives the future water budget that will be carried forward into later evaluations of basin sustainability.

6.1.6.1 Water Supplies and Demands for the Projected Water Budget

Simulations of the projected water budget under a variety of future conditions are described below. In all of those scenarios, future human demands for water are projected under full build-out of the Basin's land uses, and hence full build-out of future water demands. Full build-out is expected to occur by the year 2050 (KJ, 2021), and future basin pumping is in accordance with the Basin Operating Plan.

	Municipal Users				**Other Users**	**Total**	
Year Type	**Local Groundwater**	**Imported Water**	**Recycled Water**	**Total**	**Local Groundwater**	**Local Groundwater**	**Demand**
Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
Dry Year 1	44,915	53,224	8,961	107,100	7,585	52,500	114,685
Dry Year 2	49,915	43,994	8,961	102,870	7,585	57,500	110,455
Dry Year 3+	59,915	33,994	8,961	102,870	7,585	67,500	110,455
Average (1925–2019)	**44,649**	**48,365**	**8,966**	**101,980**	**7,588**	**52,237**	**109,568**

Notes

Normal-year and dry-year values are in units of acre-feet per year (AFY) and are for 365-day years. Values will be higher in leap years. Average values for 1925–2019 include leap years. Hence, the average values for recycled water and local groundwater are slightly higher than those shown for normal and dry years.

Other users are FivePoint (The Newhall Land and Farming Company), the Pitchess Detention Center, Sand Canyon Country Club, Valencia Country Club, Vista Valencia Golf Course, small private domestic well owners, and the groundwater pumping/treatment system on the Whittaker-Bermite property.

Total demand by municipal users in normal years (101,000 AFY), single-dry years (107,100 AFY), and multiple-dry years (102,870 AFY) is for Year 2050, as shown in Tables 7-2, 7-3, and 7-4 of the 2020 UWMP (KJ., 2021), and is the demand with the plumbing code and active conservation.

As described above, the projected water budget is based on simulating the effects of full build-out of land uses and human demands for water. Three alternative projected water budgets (no climate change, 2030 climate change, and 2070 climate change) are presented for consideration as the projected water budget to use for evaluating basin sustainability under SGMA. The projected water budget is examined to see how changes in climate could affect precipitation and ET rates locally in the Basin, as defined by DWR for the years 2030 and 2070. The analysis of the projected water budget also includes a numerical groundwater flow model simulation that uses the historical climate without climate change, to help quantify the climate-change influence separately from the changes in land and water uses. All three of these projected water budgets are developed for the same historical climatic regime (1925 through 2019) as is used in the historical and current water budgets, with DWR's local climate-change factors being applied to the historical climatic regime to describe the potential future effects of climate change on precipitation and ET in 2030 and 2070. Based on this analysis, the projected water budget that was for further SGMA sustainability evaluations and groundwater management planning reflects full build-out conditions in the Basin plus precipitation and ET changes that are estimated by DWR to occur in 2030.

6.1.6.2 Evaluating the Influences of Climate Change

One of the dominant uncertainties in water resource planning in California is climate change. Hydrology in California is highly variable, and forecasts of the effects of climate change suggest even greater variability could occur in the coming years. Moreover, the available global climate models suggest that a general warming trend is likely to occur in California, which is likely to reduce SWP water deliveries and have other profound implications for management of water supplies in the state.

When evaluating sustainable management of the Basin 50 years into the future, it is prudent to consider the potential impacts that climate change could have on the state's future management of water supplies and the change in hydrology within the local groundwater system. SGMA issues guidance to local GSAs for consideration of how to factor these forecasts and uncertainties into planning for local sustainability. Sustainable groundwater management provides a buffer against drought and climate change and contributes to reliable water supplies regardless of weather patterns. The Santa Clarita Valley depends on groundwater for a portion of its annual water supply, and sustainable groundwater management is essential to a reliable and resilient water system.

The 2020 Urban Water Management Plan (KJ, 2021) provides future water supply and human water demand values and incorporates DWR's most current estimates of future SWP delivery capability (DWR, 2020). The projected water budgets are based on the current operating plan for the Basin (the Basin Operating Plan) which is applicable to all three of the projected water budget scenarios described in this Water Budgets section (no climate change, 2030 climate change, and 2070 climate change).

DWR provides GSAs with one climate scenario for 2030 and three climate scenarios for 2070. The climate scenario for 2030 provides the best estimate of the variability in local hydrology (precipitation and ET) that the Basin might experience during the next 20 years as the GSA works to obtain and/or maintain sustainability of local groundwater resources. The three climate scenarios for 2070 demonstrate the uncertainty of climate when considering a 50-year planning horizon under SGMA. The forecasts result in a fairly minor change in local hydrology compared with the effects of climate uncertainty and future climate change on future statewide policy-making and water resource management. When considering sustainability 50 years out, SCV Water anticipates there will be a need to consider and adjust to the influences of climate change in its water demand and supply management programs. Thus, it is prudent to focus on the 2030 climate scenario for addressing sustainability within the 20-year time frame required by SGMA, while also using the results of the 2070 water budget analysis to inform water managers about conditions that may be possible afterward.

6.1.6.3 Projected Groundwater Budget Analysis Results

The projected water budgets, in Figures 6.1-9 through 6.1-11 below, show that the cumulative change curve for groundwater storage may shift slightly downward with the onset of slightly reduced precipitation and greater ET in the Basin. However, chronic declines in groundwater levels are not projected to occur over long periods, which indicates that SCV Water's operating plan for the Basin is unlikely to cause an overdraft condition in the local groundwater system (i.e., it is unlikely to exceed the basin yield) in the future under the assumed climatic conditions, as discussed in Section 6.1.7.

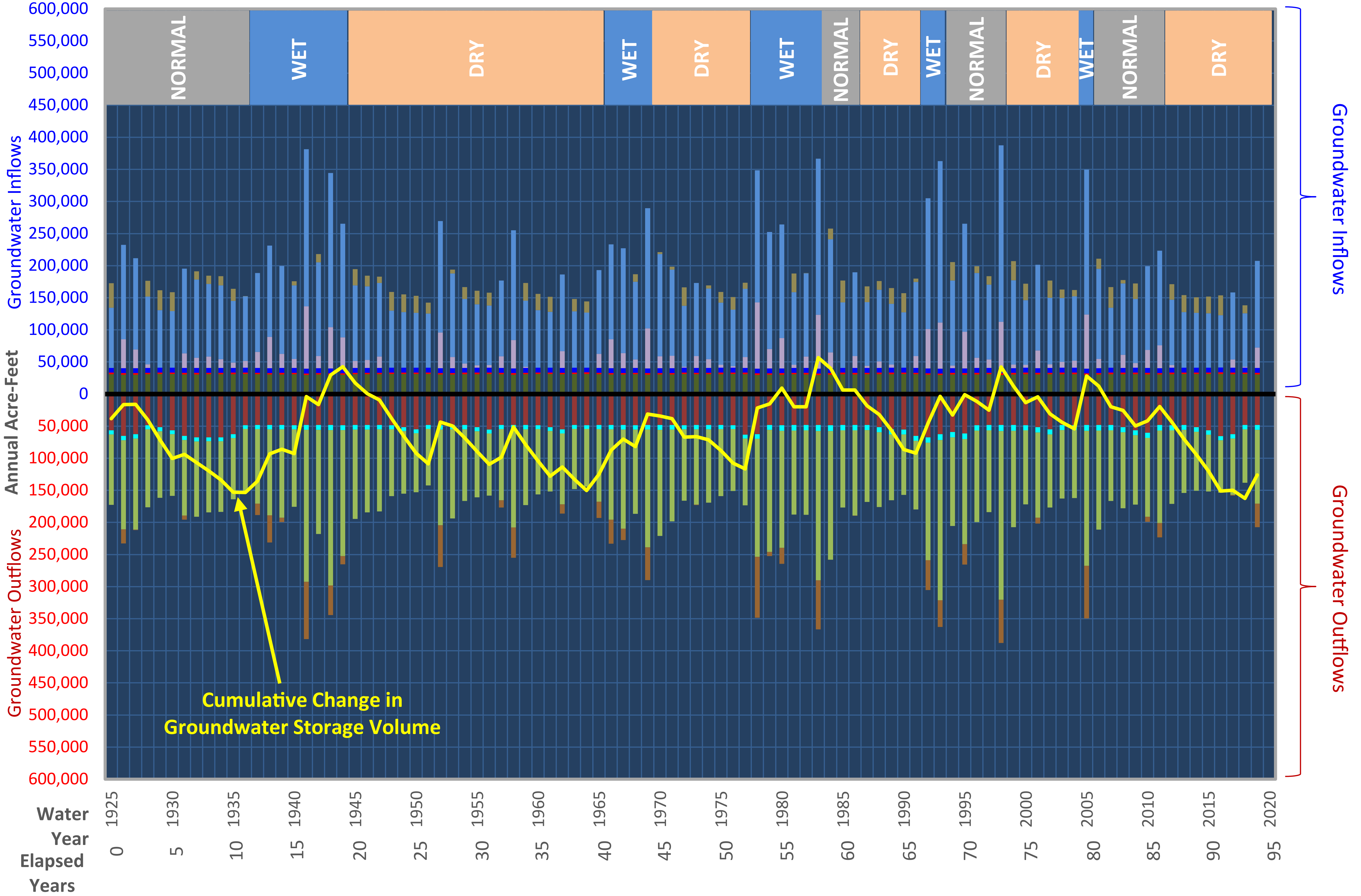

FIGURE 6.1-9

Projected Groundwater Budget Under Full Build-out Conditions Without Climate Change

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

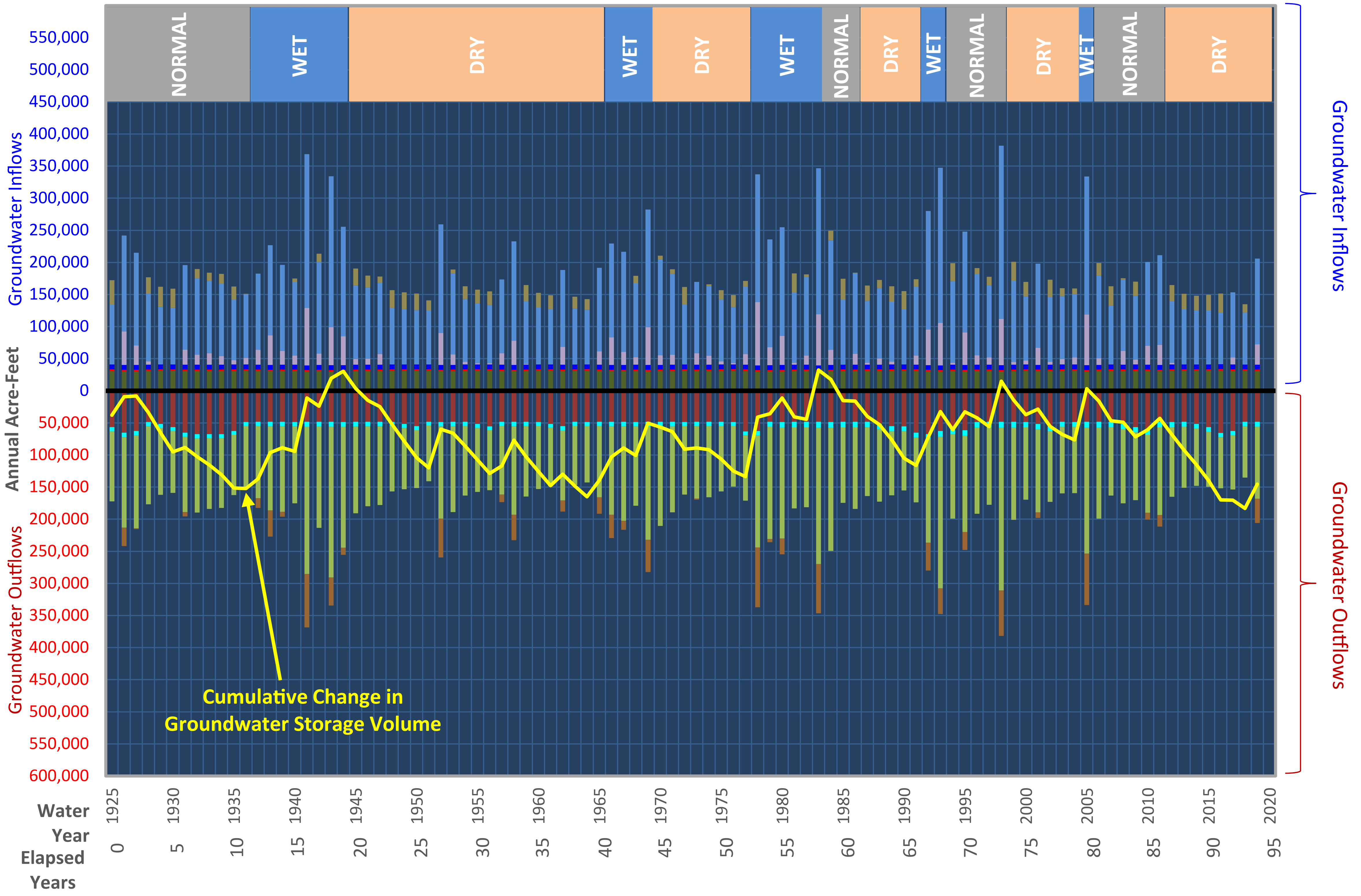

FIGURE 6.1-10

Projected Groundwater Budget For Year 2042 Conditions (Full Build-out Conditions With 2030 Average Climate Change)

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

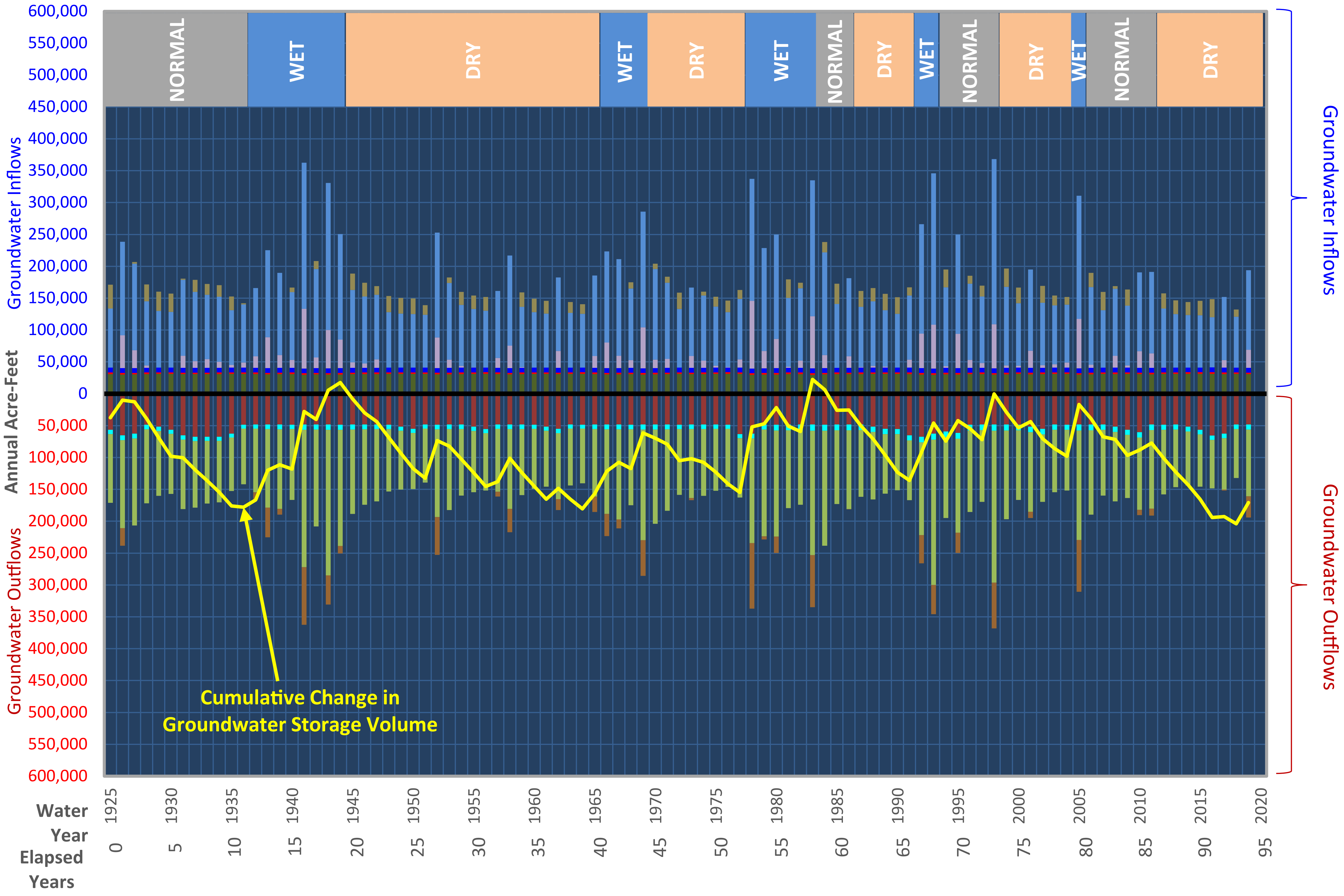

FIGURE 6.1-11

Projected Groundwater Budget For Year 2072 Conditions (Full Build-out Conditions With 2070 Average Climate Change)

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

6.1.7 Basin Yield

SGMA requires that basins be brought into balance within 20 years so as to avoid undesirable results and depletion of groundwater resources. A basin that is out of balance is characterized by a continual lowering of groundwater levels over time, a condition known as overdraft. Overdraft occurs when the average annual amount of groundwater extraction exceeds the long-term average annual supply of water to the basin. Effects of overdraft can include seawater intrusion, land subsidence, and groundwater depletion (which refers to chronic lowering of groundwater levels), eventually making a basin unusable. This is not to say that a basin must be in balance each year. It is normal for groundwater basins to experience increases and decreases in storage in response to the normal dry and wet hydrologic cycles. What is generally required is for a basin to be operated at or below its "basin yield" production volume, which is a long-term (multi-decadal) average annual production volume that does not create a long-term chronic overdraft condition.

The basin yield volume for a groundwater basin is the average amount of pumping that can occur on a long-term basis without creating a chronic (i.e., continual) lowering of groundwater levels and a chronic reduction in groundwater storage volumes. The basin yield volume is generally considered equal to the long-term average replenishment rate of the aquifer from natural and artificial recharge sources. ET and basin outflow are also factored into calculating groundwater replenishment rates. The volume of groundwater pumped in a given year can be less than, or greater than, the long-term average volume that is used to define basin yield.

The table below compares the annual groundwater pumping volumes that were modeled for the projected water budget with the annual pumping volumes specified in the operating plan for the Basin.

Year Type	Modeled Groundwater Pumping for the Projected Water Budgets	Pumping Ranges Specified in the Basin Operating Plan
Normal	48,300	37,500 to 55,000
Dry Year 1	52,500	45,000 to 60,000
Dry Year 2	57,500	51,000 to 60,000
Dry Year 3+	67,500	51,000 to 70,000
Modeled Average for Projected Water Budgets	**52,200**	

Note

Normal-year and dry-year values are in units of acre-feet per year (AFY) and are for 365-day years. Values will be higher in leap years. The modeled average of 52,200 AFY is for the 95-year time period that is simulated in the numerical groundwater flow model, and is rounded from values presented in other tables and in Appendix I.

As shown in the table, annual pumping volumes increase during dry years, which are defined as years when SWP water deliveries are significantly curtailed. The increase in groundwater pumping during these years (compared with normal years) occurs in the Saugus Formation. The projected water budgets for the Basin indicate the Basin Operating Plan does not produce chronic declines in groundwater storage volumes or groundwater levels in the aquifer system on a long-term basis, including under the two different climate change scenarios that were evaluated. This means the basin yield volume for the Basin is likely higher than the average annual production volume of 52,200 AFY that was simulated for the projected water budget under full build-out of the land and water uses in the Basin.

The results of the projected water budget also indicate that, pursuant to the Basin Operating Plan, the Basin can be pumped at an annual rate of at least 67,500 AFY for multiple dry years without causing chronic water-level declines. The number of consecutive dry years that the basin can be pumped at or above 67,500 AFY without causing chronic water level declines has not been tested or determined. Thus, it is prudent to consider the basin yield volume for the Basin to be at least 52,200 AFY, based on the long-term average amount of pumping. However, as indicated by the projected water budget analyses presented in this section, pumping at rates of 67,500 AFY (and potentially higher) can occur for multiple dry years without causing chronic groundwater level declines and hence exceeding the long-term basin yield for the Basin groundwater system.

The basin yield volume is not the same as the sustainable yield of the basin according to SGMA, because the GSP development process must consider not only chronic lowering of groundwater levels and chronic reduction in groundwater storage, but also whether there are other undesirable results with respect to other sustainability indicators (including degradation of water quality, subsidence, surface water depletion, and seawater intrusion). The GSP development process also must consider whether groundwater-dependent ecosystems (GDEs) have been, or will be, impacted. As discussed in Sections 8 and 9 of the GSP, undesirable results arising from pumping in the groundwater basin have not been identified to date and are not expected to occur under the Basin Operating Plan, given that this operating plan is expected to not create a chronic decline in groundwater levels, a reduction of groundwater in storage, or significant and unreasonable depletion of surface water. These conditions will be monitored and evaluated under the monitoring program described in Section 7 of the GSP, along with monitoring of the two other sustainability indicators that are pertinent in the Basin (degraded groundwater quality and land subsidence). If undesirable results are identified in the future, then the GSP will include projects and management actions to return the Basin to a sustainable condition. Because undesirable results are not expected to occur, the basin yield volume of at least 52,200 AFY is numerically equivalent to the sustainable yield of the Basin (though it potentially might be higher, as described above).

6.2 Data Sources, Time Periods, and Methods

The SGMA regulations (herein referred to as the GSP regulations) contain specific requirements for developing and presenting the water budgets, as described in 23 California Code of Regulations (CCR) §354.18 and listed below:

> **§ 354.18 Water Budget.**
>
> **(a) Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored. Water budget information shall be reported in tabular and graphical form.**
>
> **(b)The water budget shall quantify the following, either through direct measurements or estimates based on data:**
>
> **(1) Total surface water entering and leaving a basin by water source type.**
>
> **(2) Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.**
>
> **(3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.**
>
> **(4) The change in the annual volume of groundwater in storage between seasonal high conditions.**
>
> **(5) If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.**
>
> **(6) The water year type associated with the annual supply, demand, and change in groundwater stored.**
>
> **(7) An estimate of sustainable yield for the basin.**

In accordance with these requirements, for each of the three periods that must be evaluated (historical, current, and projected) an integrated water budget is developed for the basin's surface water and groundwater systems. Each integrated water budget describes the total inflows and outflows for surface water and the two principal aquifers (the Alluvial Aquifer and the Saugus Formation) combined. The water budgets present the magnitudes of individual inflow and outflow terms for each water year (October 1 through September 30)[30] evaluated. Additionally, for each water year, the water budget consists of distinct surface water and groundwater budgets. These water budgets quantify inflows and outflows on a basinwide basis in the Basin. Tables 6.2-1 and 6.2-2 provide inventories of the inflow and outflow terms for the surface water system and the groundwater system, respectively. Figure 6.2-1 shows the inflows and outflows from these systems, the linkages between these systems, and the sources and uses of water supplies in the Basin.

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[30] Water year 2019, for example, begins on October 1, 2018, and continues through September 30, 2019.

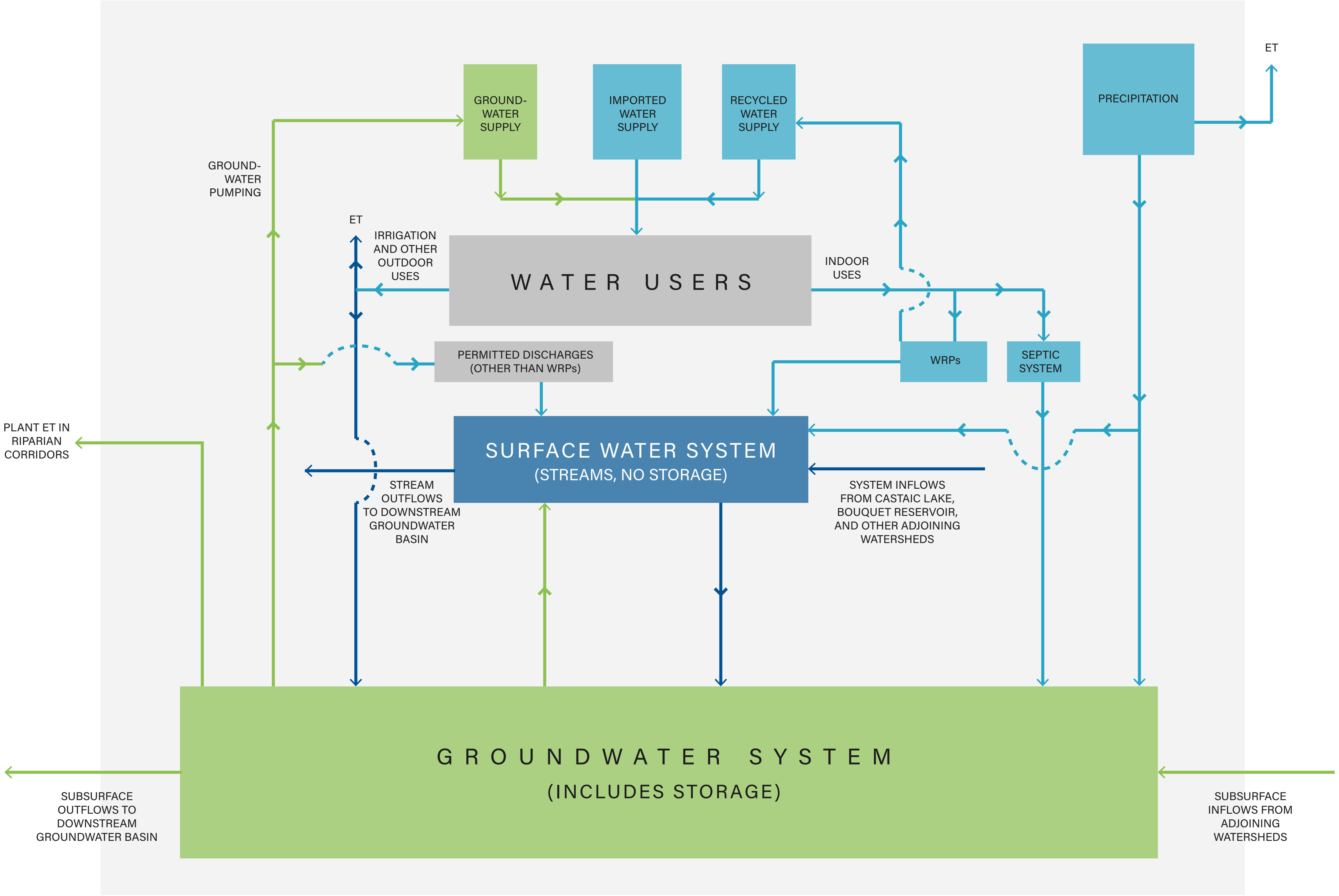

FIGURE 6.2-1

Water Budget Process Diagram for the East Subbasin

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

NOTES
ET: evapotranspiration
WRP: Water Reclamation Plant

Table 6.2-1. Inventory of Surface Water Inflows and Outflows for the Basin

Blue = Surface Water System Process
Green = Exchange with Groundwater
Purple = Internal Flow Process Within the Surface Water System

Surface Water Process	**Information Source**
INFLOWS	
In-Basin Precipitation	Rain Gage Data and Isohyetes
Stormwater Generated from In-Basin Precipitation	Rainfall Data and Modeling
Stream Inflow (Santa Clara River)	Stream Gaging Data
Stream Inflow (Releases from Castaic Lake/Lagoon)	Data and Projections
Stream Inflow (Releases from Bouquet Reservoir)	Data and Projections
Stream Inflow (Other Santa Clara River Tributaries)	Modeling
Discharges to Santa Clara River from WRPs	Data and Projections
Discharges to Santa Clara River from Groundwater Treatment Systems	Data and Projections
Groundwater Discharge to Streams	Modeling
OUTFLOWS	
Santa Clara River Non-Storm Outflow at the Western Basin Boundary	Data and Modeling
Groundwater Recharge from Precipitation	Modeling
Groundwater Recharge from Streams	Modeling
ET and Stormwater Outflow	Modeling
CHANGE IN STORAGE	
Change in Surface Water Storage (None)	—

Notes

Inflows to - and storage in - Castaic Lake and Bouquet Reservoir are not included in the surface water budgets because these water bodies lie at or upstream of the margins of the groundwater basin.

Subsurface outflow through the thin alluvial material beneath the Santa Clara River at the western boundary of the Basin is accounted for in the "Santa Clara River Non-Storm Outflow at the Western Basin Boundary" term because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

Table 6.2-2. Inventory of Groundwater Inflows and Outflows for the Basin

Blue = Exchange with Surface Water
Green = Groundwater System Process
Purple = Internal Flow Process Within the Groundwater System

Groundwater Process	**Information Source**
INFLOWS	
Recharge from Precipitation	Rainfall Data and Modeling
Recharge from Streams	Rainfall Data and Modeling
Subsurface Inflow	Modeling
Septic System Percolation	Data and Modeling
Recharge of Applied Water	Data and Modeling
OUTFLOWS	
Groundwater Pumping	Data and Projections
Riparian Evapotranspiration	Modeling
Groundwater Discharge to Streams	Modeling
CHANGE IN STORAGE	
Change in Groundwater Storage	Modeling

Notes

Subsurface outflow through the thin alluvial material beneath the river at the western boundary of the Basin is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

Recharge of applied water consists of deep percolation of irrigation water and conveyance system losses.

Changes in the volume of groundwater in storage are accounted for separately from the inflow and outflow terms in the groundwater budget.

The historical and current water budgets have been developed from prior and current studies of the hydrogeologic, land use, and water use characteristics of the Basin, including the development and calibration of a three-dimensional numerical groundwater flow model (GSI, 2021). The projected water budgets have been developed by building upon the methodology for the historical and current water budgets, using future estimates of land use build-out and associated human water demands and discharges, as well as incorporating climate-change scenarios provided by DWR for two future time horizons (the years 2030 and 2070). Details regarding the data sources, the time periods associated with each water budget, and the technical methods that are used to construct each water budget (including technical details about the numerical groundwater flow model) are provided below.

6.2.1 Data Sources and Key Basin Studies

The primary data sources for the historical water budget analyses are described in detail in the *Development of a Numerical Groundwater Flow Model for the Santa Clara River Valley East Groundwater Subbasin* (GSI, 2021) (model development report) (Appendix G) and are available as monthly and often daily records as follows:

- Precipitation data from the Newhall-Soledad rain gage (Station FC32CE), now located at Newhall Fire Station #73. Annual precipitation records extend back to the late 1880s and early 1900s, with monthly records available beginning in water year 1928.
- Streamflow gaging data where the Santa Clara River enters the Basin at Lang Station/Capra Railroad Crossing; this gage has been operated intermittently by LA County (including currently as Stations F93B-R and F93C-R) and the USGS (in the past as USGS Station 11107745) and has been relocated at least twice.
- Streamflow gaging data at a former gage (USGS Station 11108500, named “Santa Clara River at LA/Ventura County Line”) that was located 0.75 miles downstream of the western basin boundary and operated from water years 1953 through 1996.
- Streamflow gaging data at the existing replacement gage (USGS Station 11109000, named “Santa Clara River Near Piru”), which is located 3.5 miles downstream of the western basin boundary and has operated since October 1996.
- Gaged and ungaged inflows to Castaic Lake and releases of water from Castaic Lake/Castaic Lagoon into Castaic Creek, as reported by DWR.
- Releases of water from Bouquet Reservoir into Bouquet Creek, as reported by the Los Angeles Department of Water and Power (LADWP).
- Discharges of treated water from the Saugus and Valencia WRPs, as reported by the Los Angeles County Sanitation District.
- Reported and estimated discharges of water from groundwater treatment systems on and near the Whittaker-Bermite property.
- Municipal groundwater pumping, which includes all commercial and industrial water use needs in the Santa Clarita Valley.
- Groundwater pumping by agricultural and private wells (in some cases available only annually).

Key studies and reports used to construct the historical, current, and projected water budgets are as follows:

- Annual reports presenting pumping by water use sector since 1980 (LSCE, 2020)

- A USGS study (Robson, 1972) showing the locations of irrigated and non-irrigated agricultural lands prior to urbanization and including estimates of effective groundwater pumpage for 1945 through 1967[31]
- A report presenting the mapping of potential GDEs (ESA, 2020)
- The 2015 and 2020 UWMPs for the Santa Clarita Valley (KJC et al., 2016; KJ, 2021)
- A 2019 study of estimated future indoor water demands and inflows to WRPs from 2020 through 2050, which is the year that full build-out of development in the Santa Clarita Valley is expected to occur (Maddaus, 2019)
- Land use mapping for recent periods (Figure 6.2-2) and for the future full build-out of the Santa Clarita Valley's land uses (see Figure 6.2-3), as derived from the Southern California Association of Governments (SCAG) 2008 land use survey[32] and the One Valley One Vision (OVOV) land use planning process (Los Angeles County Department of Regional Planning and City of Santa Clarita, 2012)

6.2.2 Time Periods

As discussed below, a three-dimensional numerical groundwater model is used to quantify the water budget terms that cannot be directly measured in the field. The numerical groundwater flow model varies the natural hydrology and the water uses in the Basin on a monthly basis, to provide a more accurate quantification than would be achieved by varying these processes on an annual basis. The monthly results from the groundwater flow modeling evaluations are combined into the annual values presented in this section for each water year that is evaluated for historical, current, and projected future periods. This approach is consistent with recommendations provided in the *Water Budget Best Management Practices for the Sustainable Management of Groundwater (BMP)* guidance document (DWR, 2016) regarding the time intervals for quantifying and reporting the water budgets. Details regarding the definitions of the time periods for the historical, current, and projected water budgets follow.

6.2.2.1 Period for Historical Water Budget

The annual reports for the groundwater basin provide a thorough compilation of water use volumes by calendar year, beginning in 1980. Annual water use records are less readily available prior to 1980 and are particularly limited prior to the 1960s, when little municipal use occurred, and most groundwater pumped from the Basin was for agricultural irrigation. Aquifer conditions and groundwater uses prior to the 1970s are understood primarily from historical accounts and reconstruction efforts by prior researchers (Robson, 1972; RCS, 1986 and 1988), as well as from well construction records and aerial photos.

Consideration was given to beginning the historical water budget in the early to mid-1960s, to focus on the period of modern records (since 1980) while extending far enough back in time to approximately characterize the early period of urbanization, including the first years of operations by the two existing WRPs. Using water year 1965 (as the first year in the historical water budget) would have provided a 50-year duration when extending the historical period through water year 2014. Ending the historical analysis in water year 2014 would provide an accounting of conditions leading up to January 1, 2015, which is the reference date identified in the SGMA regulations for evaluating how basin conditions pertain to the establishment of measurable objectives, minimum thresholds, and sustainability criteria for the GSP.

---

[31] This USGS study described "effective pumpage" as the total pumping volume minus the portion of the total pumping volume that returns to the water table as deep percolation beneath irrigated lands. The study estimated that crops consume approximately 50 percent of the applied water on most of these lands, except along the South Fork Santa Clara River and in Castaic Valley, where soils are less permeable, and crops are likely to consume about 65 percent of the applied water.

[32] Available at https://scag.ca.gov/data-tools-geographic-information-systems. Accessed June 3, 2021.

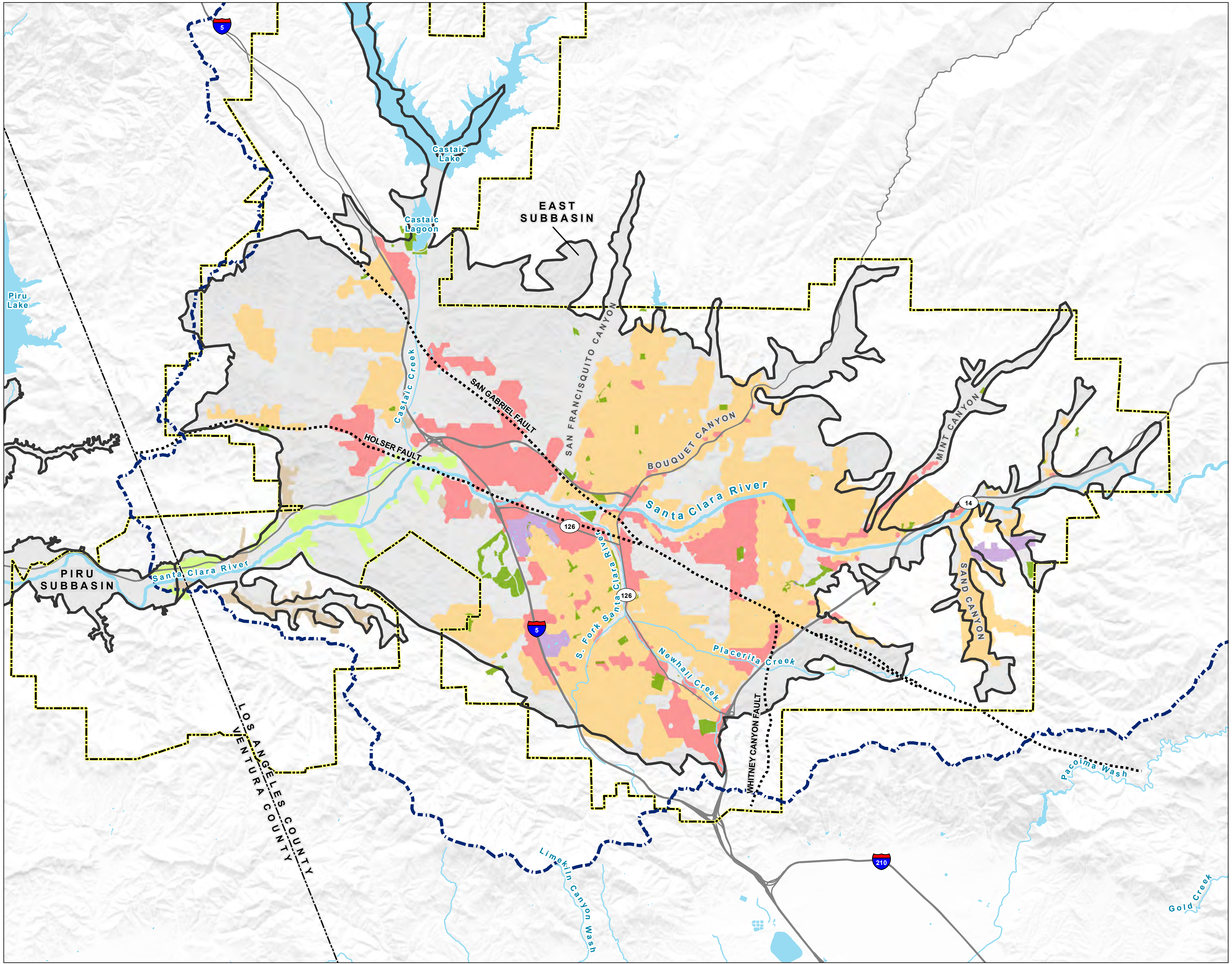

FIGURE 6.2-2

2014 Land Use

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- Santa Clara River Valley Groundwater Basin
- Watershed Boundary
- Service Boundary Area for SCV Water

Land Use

- 🟫 Agriculture (Dryland)
- 🟩 Agriculture (Irrigated)
- 🟩 Park
- 🟪 Golf Course
- 🟥 Commercial/Industrial
- 🟧 Residential

All Other Features

- Major Road
- Watercourse
- Waterbody

NOTE

SCV Water: Santa Clarita Valley Water Agency

N

0 5,000 10,000 15,000
Feet

Date: December 9, 2021
Data Sources: USGS, Southern California Association of Governments (2008), LA County and City of Santa Clarita (2012), DWR Bulletin 118

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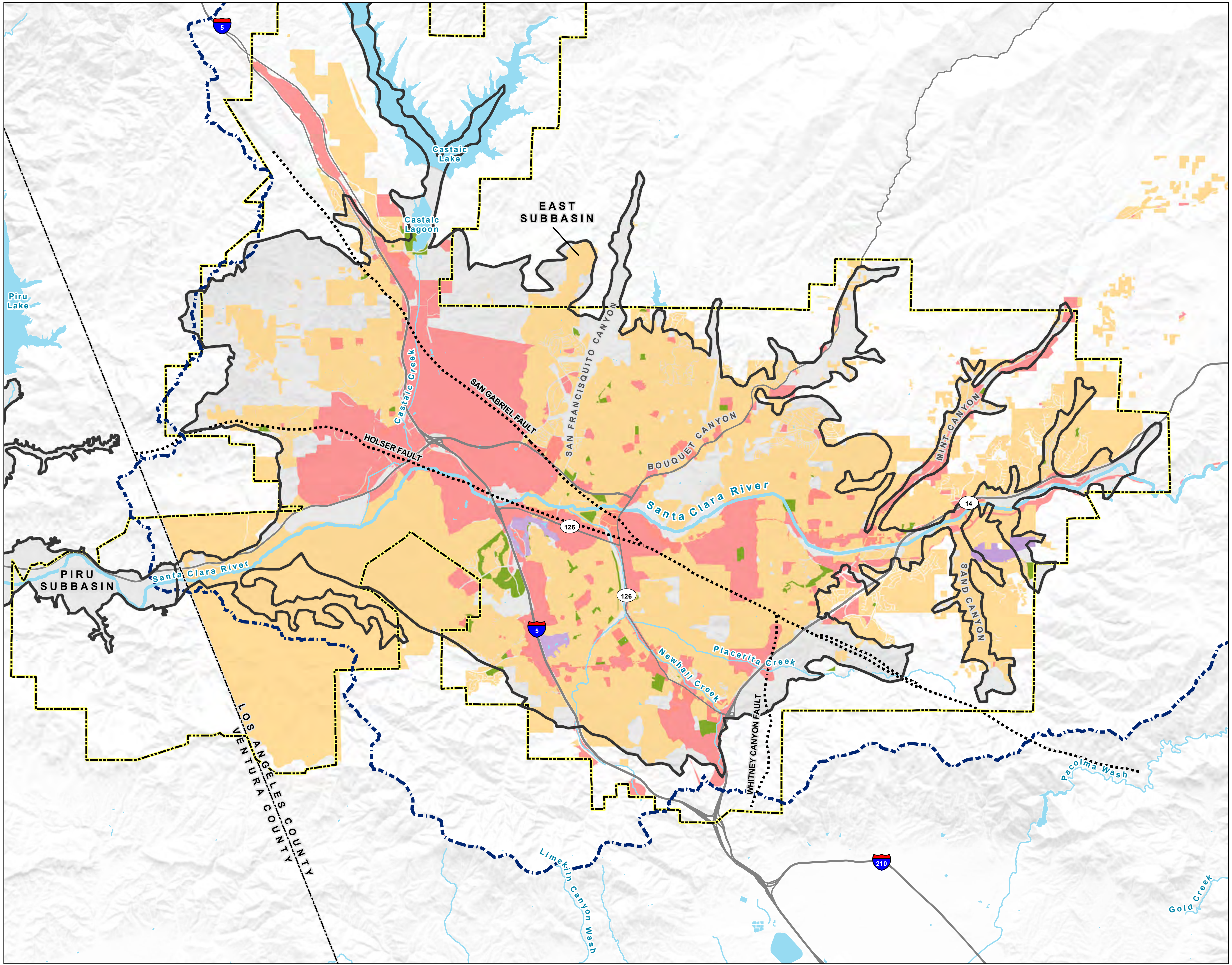

FIGURE 6.2-3

Future Land Use Under Full Build-out Conditions

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- Santa Clara River Valley Groundwater Basin
- Watershed Boundary
- Service Boundary Area for SCV Water

Land Use

- 🟩 Park
- 🟪 Golf Course
- 🟥 Commerical
- 🟧 Residential

All Other Features

- Major Road
- Watercourse
- Waterbody

NOTE

SCV Water: Santa Clarita Valley Water Agency

N

0 5,000 10,000 15,000
Feet

Date: December 13, 2021
Data Sources: USGS, Los Angeles County (2010), DWR Bulletin 118

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However, such a 50-year water budget would have left the region's longest drought period out of the historical analysis—a drought that was considered by the GSP development team to be important for evaluating the projected water budget. The precipitation cumulative departure curve (Figure 6.2-4) shows that a 20-year dry period began in water year 1946 and continued through water year 1965, as indicated by the prolonged period of decreasing cumulative departure values (albeit with periodic interruptions for normal or modestly wet years). Additionally, as described in a prior study of the Basin Operating Plan for the Basin (LSCE and GSI, 2009), the region (and much of California) experienced an intense drought from about 1928 through 1935. The GSP development team therefore decided to construct the projected water budget by simulating future land use and water use conditions on the historical hydrology that occurred beginning in water year 1925 and continuing through water year 2019 (with and without DWR's climate change factors applied to the hydrology of that historical period). As shown in Figure 6.2-4, the 95-year historical period contains 14 sequences for local basin hydrology, consisting of 5 wet periods, 4 normal periods, and 5 dry periods (droughts). Note that, in some individual water years, the classification system may produce a different year type than would be suggested by the precipitation data for that particular year alone; in these cases, the historical classification is still useful because it is developed by considering the prevailing conditions during the years before and after any individual year. For example, even though precipitation during water year 1958 was 31.48 inches at the Newhall-Soledad rain gage (approximately 14 inches greater than the historical average), water year 1958 is nonetheless included in a dry-year period because of the dry years that occurred for several years before and after water year 1958.

6.2.2.2 Period for Current Water Budget

As stated in §354.18(c)(1) of the GSP regulations, the current water budget must quantify basin inflows and outflows for "the most recent hydrology, water supply, water demand, and land use information." In its water budget BMP, DWR (2016) states "The GSP is required to provide an accounting of current water budget conditions to inform local resource managers and help the Department (DWR) understand the existing supply, demand, and change in storage under the most recent population, land use, and hydrologic conditions." In considering the time period to use to meet this objective, the technical team arrived at the conclusion that pumping conditions in the Basin should be consistent with a number of parameters, including the AB 3030 plan adopted by CLWA in 2003 and the version of the Basin Operating Plan described in a 2009 study of that plan (LSCE and GSI, 2009). Together, these documents have guided basin operations for nearly 2 decades and are indicative of what operators would consider current normal operations. The use of pumping data from 2015 through 2020, when pumping levels were extraordinarily depressed, would lead to erroneous conclusions regarding the basin's water balance. For these reasons, 2014 water use and groundwater pumping volumes were selected for the current water budget.

The current water budget examines how the land and water uses in 2014 would have affected the Basin on a long-term basis if the 2014 land and water uses were to be repeated throughout the historical precipitation sequence (i.e., for the historical precipitation and streamflow conditions that occurred during the period 1925 through 2019). This allows the 2014 water demand and supply usage condition to be evaluated against the same 95-year period for which the historical and projected water budgets are constructed, including during the prevailing dry conditions that occurred from 1945 through 1965 and the more intense drought period that began in 2012 and continued through 2016, as shown in Figure 6.2-4.

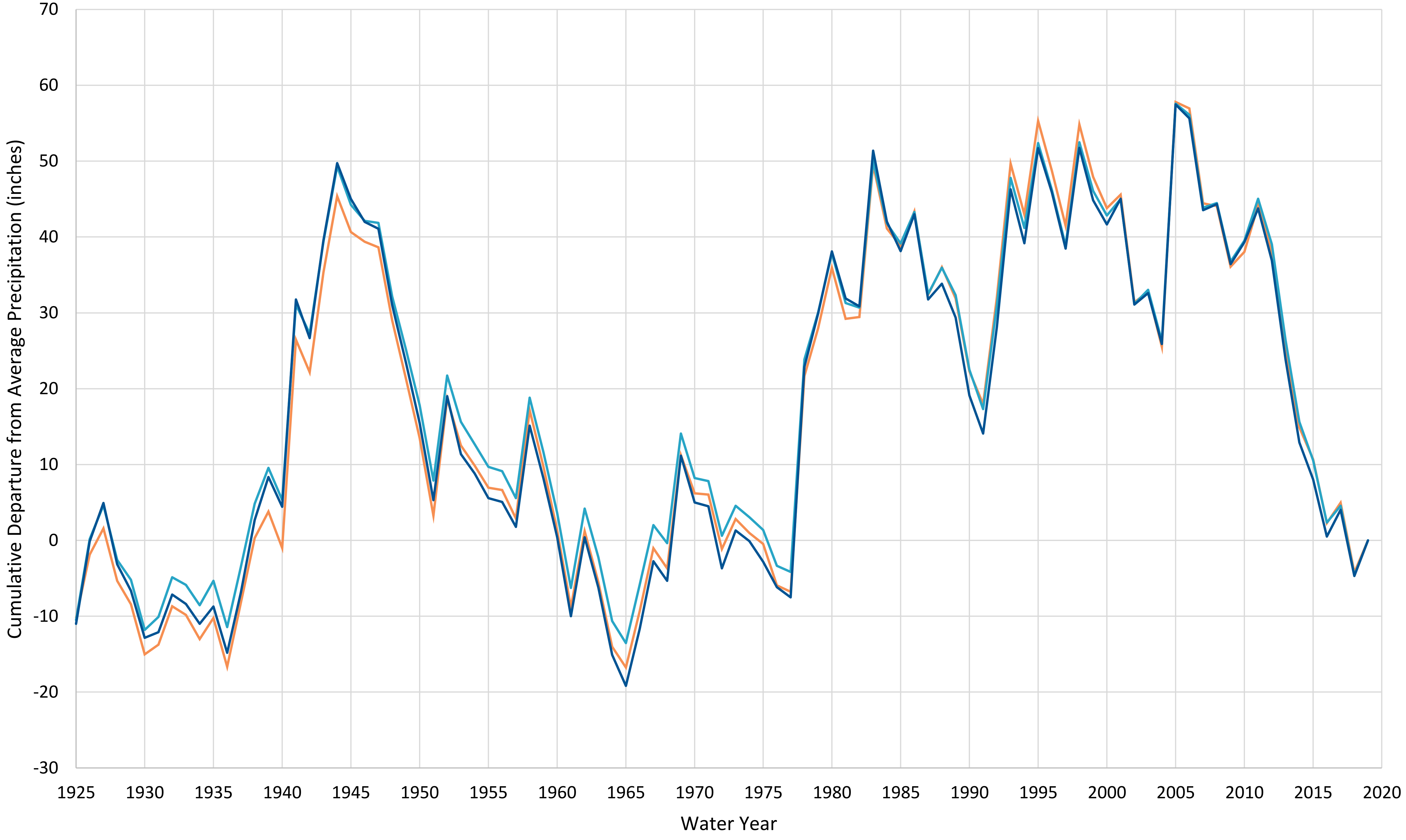

FIGURE 6.2-4

Precipitation Cumulative-Departure Curves at the Newhall-Soledad (Newhall Fire Station #73) Rain Gage With and WIthout Climate Change

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- Historical Precipitation
- Historical Precipitation with 2030 Climate Change
- Historical Precipitation with 2070 Climate Change

GSI
Water Solutions, Inc.

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6.2.2.3 Period for Projected Water Budget

The projected water budget represents full build-out conditions for the Basin, which are expected to occur by approximately the year 2050, as described in the 2020 UWMP (KJ, 2021) and other recent planning studies (e.g., Maddaus, 2019). Three projected water budgets have been developed that are distinguished by the following climate and land use/water use characteristics:

- A **full build-out water budget** without climate change provides insights on the effects of estimated future land and water uses on local groundwater conditions and provides a direct comparison with the historical and current water budgets without introducing the added factor of climate change.
- The **2042 water budget** uses the same full build-out condition for land and water uses as the prior water budget and adds a 2030 level of climate change. This water budget corresponds to the 20-year implementation time frame for groundwater sustainability measures to be implemented under the GSP.
- The **2072 water budget** uses the same full build-out conditions for land and water uses and adds a 2070 level of climate change. This water budget describes conditions for the 50-year planning and implementation horizon under SGMA.

Based on the current status of future development plans and the growth in water demands that is forecasted in the 2020 UWMP (KJ, 2021), it is anticipated that approximately 95 percent of the future growth in the Basin will have occurred by the year 2042, which will be the end of the 20-year period for implementing the GSP. Full build-out is expected to occur by the year 2050, as discussed in the 2020 UWMP (KJ, 2021). Given the uncertainties associated with the rate of development and given the desire to understand any potential consequences of full build-out of the Basin's land uses and water demands on groundwater sustainability, the GSP development team concluded that a conservative approach to developing the projected water budget should be used—specifically, to examine full build-out conditions for the year 2042 to account for all future anticipated human water demands, rather than estimating the actual level of human water demand in that year.

As a result, the distinction between the three projected water budgets lies in the representation of potential future changes in climate. The 2042 and 2072 projected water budgets use the 1925 through 2019 historical precipitation record, but with climate-change adjustment factors that are applied to the monthly historical record to account for future potential changes in precipitation and ET. The climate-change factors consist of multipliers for precipitation and reference ET that are the averages calculated by DWR from 20 global climate models. These precipitation and reference ET climate-change factors have been provided by DWR on a monthly basis for the period from January 1915 through December 2011 and are available at a 6-kilometer (3.75-mile) spatial resolution throughout California, including at the location of the Newhall-Soledad rain gage in the town of Newhall. Because it is impossible to know what precipitation and air temperatures will actually be in the years 2042 and 2072 (and in the preceding years), this approach of applying the climate-change factors to the historical climate allows the full build-out land-use and water-use conditions to be evaluated against the observed long-term record of historical year-to-year variability in climate while adjusting the magnitude of that variability to account for future potential changes in climate.

In addition to evaluating climate-change influences on the local hydrology and groundwater conditions in the Basin, the projected water budgets also account for potential climate-change influences on the availability of SWP supplies, as presented in future delivery capability assessments provided by DWR. DWR's most recent State Water Project Delivery Capability Report (DCR; DWR, 2020) has been used to develop a pattern of normal-year and dry-year (SWP curtailment-year) pumping from the Saugus Formation, as described in Section 6.5.1.1.

6.2.3 Model Description and Use for Water Budget Development

The historical water budget has been developed using a combination of historical data and groundwater modeling, while the current and projected water budgets use groundwater modeling to examine the effects of current and future land and water use scenarios. A three-dimensional numerical groundwater flow model has been developed for the Basin and is documented by GSI (2021). The numerical groundwater flow model has been used to quantify the terms that cannot be directly measured in the field, such as groundwater recharge volumes, groundwater withdrawals by phreatophytes, and year-to-year changes in the volume of groundwater in storage. Numerical groundwater models provide the most robust state-of-the-art method for quantifying these terms, especially when the model has been calibrated to historically measured groundwater levels and streamflows, as has occurred for this model.

The numerical groundwater flow model of the Basin simulates the occurrence and movement of groundwater flow in the two principal aquifer systems: the surficial Alluvial Aquifer and the underlying Saugus Formation. The model simulates groundwater flow processes and groundwater budgets in both aquifers, as well as the connection of the local groundwater resources to the Santa Clara River and its tributaries. The model uses multiple layers to provide a three-dimensional representation of groundwater movement horizontally within individual model layers and vertically between layers. The model is called the Santa Clarita Valley Groundwater Flow Model and is referred to as the SCVGWFM or the regional groundwater flow model. The model uses the USGS software MODFLOW-USG (Panday et al., 2013; Panday, 2021) and replaces a model that was first developed in 2004 (CH2M HILL, 2004) using the European MicroFEM® finite-element software (Hemker and de Boer, 2003 and 2017). The regional model has been developed by GSI for SCV Water to use as its primary tool for developing water budgets and analyzing groundwater management options in the context of projected (future) hydrology, human and environmental water demands, and water supply conditions in the valley.

In addition to using MODFLOW-USG, the new regional groundwater flow model relies on two other key companion codes for its successful operation: (1) a graphical user interface (Groundwater Vistas) (ESI, 2020) and (2) a customized tool specific to the Basin (and named the SCV Recharge Compiler) that compiles and translates all recharge terms into the form needed by the Recharge (RCH) Package for MODFLOW-USG. As described in Appendix G, the model development report (GSI, 2021), the SCV Recharge Compiler is a Microsoft Visual Basic program developed in Microsoft Excel® that was written by GSI to specify the total amount of recharge occurring (1) at each grid node in the uppermost model layer and (2) for each time period during a given model simulation. This tool also estimates the surface flow entering the model in ungaged tributary streams from the upper reaches of their watersheds (i.e., the portion of the watershed upstream of the Basin), and it provides mechanisms for tracking and infiltrating this flow as a given ephemeral stream enters the groundwater basin, thereby facilitating the development of the surface water inflow terms that are required to be reported in the historical, current, and projected surface water budgets.

Tables 6.2-3 and 6.2-4 identify the components of the groundwater model and the SCV Recharge Compiler that address each inflow and outflow term for the surface water and groundwater budgets, respectively. The methods for accounting for these terms in the groundwater flow model and the SCV Recharge Compiler, along with underlying assumptions regarding certain terms, are described in Section 6.2.4 below.

Table 6.2-3. Quantification Methods for Surface Water Inflows and Outflows in the Basin

Blue = Surface Water System Process
Green = Exchange with Groundwater
Purple = Internal Flow Process Within the Surface Water System

Surface Water Process	Quantification Method	How Used
INFLOWS		
In-Basin Precipitation	Rain Gage Data and Isohyetes	Volumetric Control on Stormwater Recharge
Stormwater Generated from In-Basin Precipitation	SCV Recharge Compiler	Volumetric Control on Stormwater Recharge
Stream Inflow (Santa Clara River)	Stream Gaging Data, Including Regression Analysis	Volumetric Control on Stormwater Recharge
Stream Inflow (Releases from Castaic Lake/Lagoon)	Flood Flow Data	Volumetric Control on Stormwater Recharge
Stream Inflow (Releases from Bouquet Reservoir)	Historical Data and Release Agreements	Volumetric Control on Stormwater Recharge
Stream Inflow (Other Santa Clara River Tributaries)	SCV Recharge Compiler	Volumetric Control on Stormwater Recharge
Discharges to Santa Clara River from WRPs	Data and Projections	Input to SFR Package in MODFLOW-USG
Discharges to Santa Clara River from Groundwater Treatment Systems	Data and Projections	Input to SFR Package in MODFLOW-USG
Groundwater Discharge to Streams	Numerical Flow Model (MODFLOW-USG)	Output from SFR Package in MODFLOW-USG
OUTFLOWS		
Santa Clara River Non-Storm Outflow at the Western Basin Boundary	Data and Numerical Flow Model (MODFLOW-USG)	Control data for MODFLOW-USG calibration
Groundwater Recharge from Precipitation	SCV Recharge Compiler	RCH Package in MODFLOW-USG
Groundwater Recharge from Streams	SCV Recharge Compiler for Stormwater Recharge in Ephemeral Streams and Numerical Flow Model (MODFLOW-USG) for Recharge of Other Streamflows	Input to RCH Package in MODFLOW-USG Plus Output from SFR Package in MODFLOW-USG
ET and Stormwater Outflow	Balancing the Water Budget	—
CHANGE IN STORAGE		
Change in Surface Water Storage (None)	—	—

Notes

Inflows to - and storage in - Castaic Lake and Bouquet Reservoir are not included in the surface water budgets because these water bodies lie at or upstream of the margins of the groundwater basin.

Subsurface outflow through the thin alluvial material beneath the Santa Clara River at the western boundary of the Basin is accounted for in the "Santa Clara River Outflow at the Western Basin Boundary" term because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

RCH = Recharge Package
SFR = Streamflow Routing Package
SCV = Santa Clarita Valley
WRP = water reclamation plant

Table 6.2-4. Quantification Methods for Groundwater Inflows and Outflows in the Basin

Blue = Exchange with Surface Water
Green = Groundwater System Process
Purple = Internal Flow Process Within the Groundwater System

Groundwater Process	Quantification Method	How Used
INFLOWS		
Recharge from Precipitation	SCV Recharge Compiler	Input to RCH Package in MODFLOW-USG
Recharge from Streams	SCV Recharge Compiler	Input to RCH Package in MODFLOW-USG
Subsurface Inflow Beneath Santa Clara River	Modeling	Computed by GHB Package in MODFLOW-USG
Subsurface Inflow Beneath Castaic Dam	Modeling	Input to WEL Package in MODFLOW-USG
Subsurface Inflow Beneath Other Tributaries	Modeling	Computed by GHB Package in MODFLOW-USG
Septic System Percolation	Data and SCV Recharge Compiler	Input to RCH Package in MODFLOW-USG
Recharge of Applied Water from Agricultural Water Uses	Data and SCV Recharge Compiler	Input to RCH Package in MODFLOW-USG
Recharge of Applied Water from Municipal Water Uses	Data and SCV Recharge Compiler	Input to RCH Package in MODFLOW-USG
OUTFLOWS		
Groundwater Pumping	Data and Projections	Input to CLN and WEL Packages in MODFLOW-USG
Riparian Evapotranspiration	Modeling	Computed by EVT Package in MODFLOW-USG
Groundwater Discharge to Streams	Modeling	Computed by SFR Package in MODFLOW-USG
OUTFLOWS		
Change in Groundwater Storage	Modeling	Computed by MODFLOW-USG

Notes

Subsurface outflow through the thin alluvial material beneath the river at the western boundary of the Basin is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

Changes in the volume of groundwater in storage are accounted for separately from the inflow and outflow terms in the groundwater budget.

CLN = Connected Linear Network Process
EVT = Evapotranspiration Package
GHB = General Head Boundary Package
RCH = Recharge Package
SCV = Santa Clarita Valley
SFR = Streamflow Routing Package
WEL = Well Package

6.2.4 Methods and Assumptions for Developing Specific Input Terms for the Water Budget Analyses

The methods, data, and assumptions that are used to simulate various water budget processes are described in detail in Appendix G, the model development report (GSI, 2021; see Section 3 and Appendix B of that report). The methods, data, and assumptions are summarized below for the following water budget processes that require estimation and/or data analysis methods to generate input to the numerical groundwater flow model:

- Deep percolation of precipitation falling within the groundwater basin boundary
- Streamflows entering the Basin in the Santa Clara River and its ungaged tributaries, and the subsequent infiltration of water from these ephemeral streams to the underlying water table
- Subsurface groundwater inflows
- Deep percolation of irrigation water from agricultural lands
- Deep percolation of irrigation water from urbanized lands
- Deep percolation from septic systems in areas served by municipal water supplies
- Point discharges of water into the Santa Clara River
- ET demands by phreatophytes in and outside of riparian habitat corridors

6.2.4.1 Deep Percolation of Precipitation Falling Within the Basin

Annual precipitation volumes arising from precipitation within the boundaries of the groundwater basin are estimated from annual precipitation data using a variation of a method described by Turner (1986). Turner empirically derived a power-function equation that describes the average statewide relationship between annual precipitation and ET rates, based on the measured yields from 68 different watersheds throughout California. Precipitation not taken up by ET is available for surface water runoff and infiltration to groundwater. During large storm events, some of this water leaves the Basin before it has a chance to infiltrate to groundwater. However, during smaller storm events, precipitation that is not consumed by ET eventually infiltrates to groundwater. Using the equation provided by Turner, the calibration process for the numerical groundwater flow model resulted in the following equation for the historical relationship between annual precipitation and annual infiltration in the Basin:

For historical conditions: Infiltration = Precipitation – 5.00*(Precipitation)$^{0.41}$ (Equation 6.2-1)

In Equation 6.2-1, the annual infiltration and precipitation values are in units of inches. DWR has published climate-change factors across California, including at the locations of the Newhall-Soledad rain gage (operated by the Los Angeles County Department of Public Works) and the nearby Pine Street rain gage (operated by SCV Water and formerly by its predecessor agency Newhall County Water District). The factors apply to precipitation and reference ET during the years 2030 and 2070. Each climate-change factor represents the average change[33] computed by DWR from the simulation results of 20 global climate models that have been downscaled throughout the state to grid blocks that are 6 kilometers (3.75 miles) on a side. Each climate-change factor is provided by DWR as a multiplier to apply to the local historical records of

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[33] In its BMP documents for water budgets and climate change analysis under SGMA, DWR (2016 and 2018) refers to the average change as the central-tendency evaluation. In some locations, DWR also provides precipitation and ET factors for two other scenarios named “drier with extreme warming (DEW)” and “wetter with moderate warming (WMW).” However, precipitation and ET factors for these two scenarios are not available for the Basin.

precipitation and reference ET; these multipliers are available on a monthly basis for the period 1915 through 2011.

GSI downloaded DWR's published climate-change factors for two adjoining grid blocks (denoted as blocks 10052 and 10134 on the SGMA web portal) that contain the two stations where long-term rainfall data are available (the Newhall-Soledad rain gage and the Pine Street rain gage). See Table 6.2-5 for a summary of the average climate change factors each month during the period 1925 through 2011 (which is an 87-year period containing 1,044 months of climate change factors). Table 6.2-5 shows that the average rainfall change factors are very close to 1.0 (ranging from 0.979 in 2030 to 0.933 in 2070), while the change factors for reference ET are notably higher than 1.0 (with average values, ranging from 1.048 in 2030 to 1.108 in 2070).

GSI applied the 1,044 monthly climate change factors for precipitation and the 1,044 monthly climate change factors for reference ET directly to the period of water years 1925 through 2011, then used the precipitation records during that period to select climate-change factors that are likely to be representative of climate change for the 8-year period of water years 2012 through 2019. As shown in Table 6.2-6, the 2030 and 2070 climate-change factors produce 0.94 percent and 1.29 percent less annual precipitation, respectively, on a water-year basis than was observed during the 95-year historical period (1925 through 2019). Figure 6.2-4 includes curves showing that the cumulative departures from average rainfall for the 2030 and 2070 climate-change scenarios are similar in their sequence of normal, wet, and dry years to the curve for historical rainfall. As shown in Table 6.2-7, DWR's change factors for reference ET result in future ET demands in the riparian hardwood forest that, on an annual basis, are 1.044 and 1.052 times the present-day demands in 2030 and 2070, respectively.

Future increases in ET will affect soil moisture levels in the Basin by reducing the amount of deep percolation to groundwater that results from precipitation. This phenomenon will increase the amount of precipitation needed to overcome soil moisture deficits and produce deep percolation to groundwater. As shown in Figure 6.2-5, the mathematical relationship shown in Equation 6.2-1 for historical conditions results in no deep percolation occurring until annual precipitation exceeds 15 inches. Examination of this relationship and the climate-change factors for reference ET indicates that future ET increases of 4.8 percent in 2030 and 10.8 percent in 2070 would increase the threshold annual precipitation amounts necessary to generate deep percolation from 15 inches (under historical conditions) to about 16 inches in 2030 and 18 inches in 2070. The equations for 2030 and 2070 that are used in the numerical groundwater flow model to simulate the effect of reduced annual precipitation and increased annual ET on deep percolation are as follows (in units of inches):

For 2030 climate change: Infiltration = Precipitation – 5.08*(Precipitation)$^{0.41}$ (Equation 6.2-2)

For 2070 climate change: Infiltration = Precipitation – 6.00*(Precipitation)$^{0.37}$ (Equation 6.2-3)

Through the use of these equations, the combination of slightly lower precipitation and higher ET is estimated to result in decreases in the amount of deep percolation to groundwater by about 5 percent under the 2030 average climate-change scenario and 14 percent under the 2070 average climate-change scenario.

Table 6.2-5. DWR's Local Climate-Change Factors for the Basin

	DWR Climate-Change Factors for Rainfall (1925-2011 Averages)		DWR Climate-Change Factors for Reference ET (1925-2011 Averages)	
Month	**Year 2030**	**Year 2070**	**Year 2030**	**Year 2070**
January	0.966	0.903	1.066	1.145
February	0.964	0.905	1.040	1.105
March	0.978	0.946	1.037	1.098
April	0.975	0.923	1.043	1.109
May	0.988	0.923	1.057	1.110
June	0.987	0.970	1.037	1.095
July	0.973	0.915	1.033	1.078
August	0.983	0.997	1.039	1.079
September	0.992	0.964	1.038	1.078
October	0.984	0.921	1.046	1.088
November	0.982	0.933	1.061	1.135
December	0.975	0.890	1.076	1.176
Minimum	**0.964**	**0.890**	**1.033**	**1.078**
Average	**0.979**	**0.933**	**1.048**	**1.108**
Maximum	**0.992**	**0.997**	**1.076**	**1.176**

Notes

All values are unitless and represent the average factors for DWR's grid blocks 10052 and 10134. Values are DWR's computed averages from 20 downscaled global climate models.

Table 6.2-6. Historical Water Year Rainfall With and Without DWR's Local Climate-Change Factors

	Without Climate Change	With Climate Change	
Water Year	Historical	Year 2030	Year 2070
1925	6.95	6.54	5.96
1926	25.53	27.67	27.84
1927	20.66	21.50	22.04
1928	10.28	9.80	8.87
1929	14.08	14.42	13.46
1930	10.60	10.41	10.79
1931	18.44	18.74	17.69
1932	22.27	22.24	21.92
1933	16.03	16.03	15.74
1934	13.99	14.34	14.35
1935	19.97	20.24	19.22
1936	10.75	10.93	10.87
1937	25.67	25.01	24.95
1938	25.68	25.32	26.49
1939	20.66	21.75	22.64
1940	12.41	12.79	13.04
1941	44.65	42.80	44.28
1942	12.88	13.18	11.86
1943	30.33	29.15	29.86
1944	27.27	26.94	27.15
1945	12.43	11.96	12.23
1946	15.92	14.92	13.95
1947	16.46	16.76	16.07
1948	7.57	7.33	6.91
1949	9.50	10.06	9.36
1950	9.32	9.64	9.01
1951	6.97	7.08	6.79
1952	32.56	30.89	30.67
1953	11.06	10.93	9.32
1954	14.55	14.08	14.42
1955	14.26	14.03	13.74
1956	16.88	16.44	16.46
1957	13.42	13.49	13.66
1958	31.48	30.28	30.31
1959	9.73	9.83	10.03
1960	8.78	9.01	9.21
1961	7.05	7.12	6.53
1962	27.24	27.50	27.37
1963	10.44	10.59	10.32
1964	8.68	8.64	8.13
1965	14.46	14.11	12.86
1966	24.59	24.70	24.44
1967	25.50	24.92	25.91
1968	14.54	14.63	14.39
1969	32.09	31.49	33.45
1970	12.16	11.13	10.80
1971	17.04	16.64	16.47
1972	10.01	9.81	8.77
1973	21.12	21.00	21.97
1974	15.34	15.51	15.56
1975	15.75	15.33	14.26
1976	11.72	12.32	13.61
1977	16.36	16.20	15.60
1978	45.61	45.04	47.34

Table 6.2-6. Historical Water Year Rainfall
With and Without DWR's Local Climate-Change Factors

	Without Climate Change	With Climate Change	
Water Year	**Historical**	**Year 2030**	**Year 2070**
1979	23.51	23.23	24.03
1980	25.15	24.81	25.12
1981	10.46	10.49	10.79
1982	17.41	16.41	15.91
1983	37.23	36.34	37.50
1984	8.83	8.80	7.61
1985	14.87	14.39	13.05
1986	21.72	21.19	21.84
1987	6.22	6.21	5.72
1988	20.82	20.48	19.05
1989	13.05	13.40	12.51
1990	7.62	7.22	6.71
1991	12.83	11.80	11.92
1992	31.26	30.68	31.04
1993	34.81	33.89	35.10
1994	10.48	10.41	9.86
1995	29.54	28.22	29.49
1996	10.60	10.87	11.15
1997	9.95	9.68	9.52
1998	30.54	30.62	30.26
1999	10.27	10.62	10.04
2000	13.06	13.78	13.80
2001	18.95	19.21	20.34
2002	3.03	3.17	3.03
2003	18.54	18.90	18.46
2004	9.96	10.28	10.26
2005	49.45	48.33	48.53
2006	16.33	15.54	15.15
2007	4.69	4.79	4.83
2008	16.80	17.62	17.80
2009	9.21	9.34	9.04
2010	19.12	19.76	19.84
2011	23.30	22.58	21.44
2012	10.94	11.00	10.06
2013	4.56	4.35	3.89
2014	6.81	6.32	6.09
2015	13.00	11.96	12.08
2016	8.77	8.80	9.43
2017	19.85	19.24	20.48
2018	8.00	7.86	8.25
2019	21.42	21.62	21.66
Total	1,632.66	1,617.38	1,611.65
Average	17.19	17.03	16.96
Percent Change from Historical		-0.94%	-1.29%

Notes

All values are in units of inches.

Data are for calendar years, to be consistent with 1980-2019 water use information presented in annual reports.

Table 6.2-7. Influence of DWR's Local Climate-Change Factors on ET Demands in the Mixed Hardwood Forest Riparian Corridor

	DWR ET Change Factors (1925-2011 Averages)		Potential Riparian ET (feet per month)		
Month	**Year 2030**	**Year 2070**	**Historical**	**Year 2030**	**Year 2070**
January	1.066	1.145	0.22	0.23	0.25
February	1.040	1.105	0.22	0.23	0.25
March	1.037	1.098	0.32	0.33	0.35
April	1.043	1.109	0.45	0.47	0.50
May	1.057	1.110	0.59	0.63	0.66
June	1.037	1.095	0.77	0.80	0.84
July	1.033	1.078	0.87	0.89	0.93
August	1.039	1.079	0.84	0.88	0.91
September	1.038	1.078	0.64	0.67	0.69
October	1.046	1.088	0.51	0.53	0.56
November	1.061	1.135	0.31	0.32	0.35
December	1.076	1.176	0.21	0.23	0.25
Total			**5.96**	**6.22**	**6.54**
Ratio (Future/Historical)				**1.044**	**1.052**

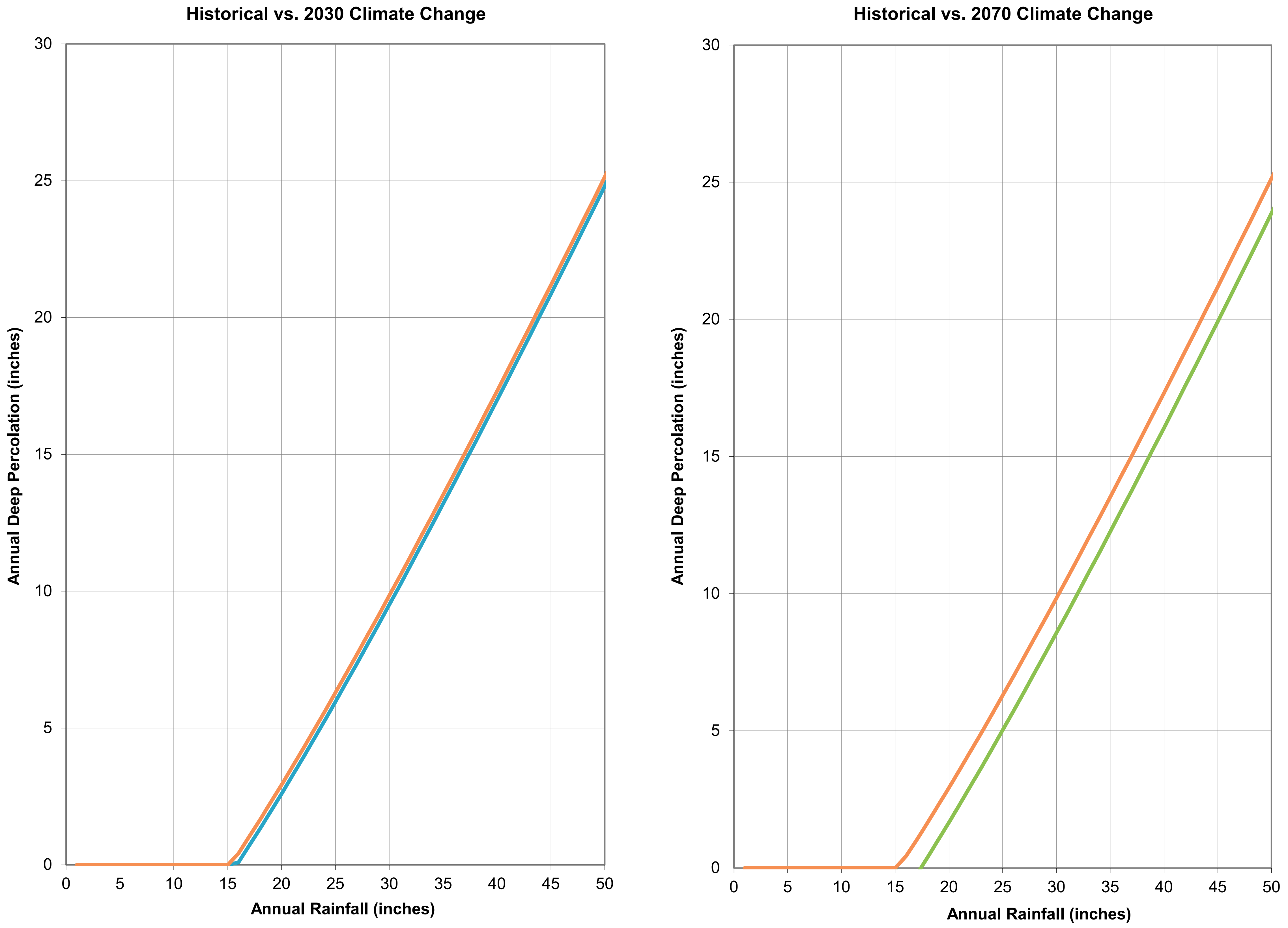
Notes

ET change factors are unitless and represent the average factors for DWR's grid blocks 10052 and 10134.
Values are DWR's computed averages from 20 downscaled global climate models.

FIGURE 6.2-5

Rainfall-Recharge Relationship Under Historical Conditions and the 2030 and 2070 Average Climate Change Scenarios

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan



LEGEND

— 2030 Climate Change
— 2070 Climate Change
— Historical Conditions

NOTES

For historical conditions, the rainfall-recharge relationships are derived from model calibration.
For 2030 and 2070 climate change, the rainfall-recharge relationship is developed using factors for rainfall and ET that are provided by DWR for the East Subbasin on its SGMA web portal https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#waterbudget
DWR: California Department of Water Resources
ET: evapotranspiration
SGMA: Sustainable Groundwater Management Act

6.2.4.2 Stream Inflows and Subsequent Infiltration

For each month of a given model simulation, the SCV Recharge Compiler calculates the amounts of stormwater flow and groundwater recharge in streams, plus the amount of surface water inflow and subsequent groundwater recharge arising from controlled releases to Castaic Creek and Bouquet Creek from impoundments on those streams. Details regarding these methods are presented in Appendix G, the model development report. A summary is as follows:

- For the Santa Clara River, historical volumes of streamflow entering the Basin are defined from measured and estimated streamflow data at the Lang Station/Capra Railroad Crossing stream gage. These historical streamflows are reduced by 4.8 percent and 10.8 percent for the 2030 and 2070 climate change simulations, respectively.
- For ungaged tributaries of the Santa Clara River, the natural inflows of stormwater generated in the watershed areas lying outside the groundwater basin boundary are generated by the SCV Recharge Compiler using precipitation data, rainfall isohyets,[34] and the watershed area as described in Appendix G, the model development report (Section 4.2.1 of Appendix B of that report) (GSI, 2021). For historical conditions, Equation 6.2-1 is then used to define the amount of the water generated in the upstream watershed that enters into the basin and is available to infiltrate to groundwater. Equations 6.2-2 and 6.2-3 are used to estimate these inflow volumes for the 2030 and 2070 climate-change scenarios, respectively.
- Historical stormwater flows generated in the contributing watershed to Castaic Lake are derived from inflow and outflow records reported by DWR's Southern Field Division Water Operations office in its monthly operations tables for the complex comprising Pyramid Lake, the Elderberry Forebay, Castaic Lake, and Castaic Lagoon. These reports date back to 1974 and account for releases of stormwater impounded behind Castaic Dam and periodic releases of SWP water to downstream users in Ventura County. Additional details regarding how these flows are treated in the modeling analyses for the historical, current, and projected water budgets are as follows:
    - For years prior to 1974, precipitation records at the Newhall-Soledad rain gage are used to identify individual years during the period of historical record (1974 through 2019) that provide reasonable prototypes for estimating the stormwater flows that occurred prior to 1974. The historical, current, and projected water budgets use these estimated stormwater flows prior to 1974, while the historical water budget uses the actual historical monthly and annual releases that occurred during the period 1974 through 2019.
    - In the current and projected water budgets, the releases from Castaic Lake from 1974 through 2019 consist solely of stormwater as defined from gaged and ungaged flows reported by DWR during this period. Accordingly, the releases from Castaic Lake for the entire period of 1925 through 2019 consist solely of storm flows and do not include releases of SWP water. This method is used to avoid including SWP deliveries to downstream users, because the timing and magnitude of future releases of SWP water are unknown.
    - In the projected water budget, the stormwater flows are reduced by 4.8 percent and 10.8 percent for the 2030 and 2070 climate change simulations, respectively. No such adjustments are made, however, for the version of the projected water budget that does not include climate change.

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[34] Isohyets are contour maps showing the spatial distribution of rainfall on a long-term basis.

- Releases from Bouquet Reservoir are based on LADWP's recorded values for the historical water budget and the 1978 release agreement between LADWP and the United Water Conservation District[35] for the current and projected water budgets. Based on the results of the groundwater flow model calibration process, it is estimated that only a small fraction of these releases enters the basin as surface flow (assumed to be 5 percent for modeling purposes) and that a portion of these releases may also enter as subsurface flow that is implicitly accounted for via the use of the General-Head Boundary (GHB) condition that allows subsurface flow from outside the basin boundary to enter the basin in the thin alluvial veneer present in this area.
- The infiltration of stormwater and controlled flow releases is computed by the SCV Recharge Compiler, using a streamflow accounting method from one groundwater flow model grid cell to another, coupled with streambed permeability terms that were developed during calibration of the groundwater flow model. See Appendix G, the model development report (GSI, 2021) (Section 4.2.5 of Appendix B of that report) for further details. Where groundwater elevations rise above the elevation of the riverbed intermittently or perennially, the Streamflow Routing (SFR) Package in MODFLOW-USG computes the rate of groundwater discharge to the stream and routes the water downstream to allow for possible re-infiltration of this water.

6.2.4.3 Subsurface Inflows to the Alluvial Aquifer in Tributary Valleys

GHBs are used in MODFLOW-USG to simulate the subsurface inflows of water that are likely to occur from the thin surficial alluvium underlying the Santa Clara River and its 48 tributaries that provides subterranean flow into the model (groundwater basin) boundary from these 49 upstream watersheds. The GHBs are also used to help guide the model on groundwater elevations in the upper ends of these tributaries and were checked during construction and calibration of the model to ensure that flow is predominantly (if not exclusively) into the model domain (i.e., inflow to the model) rather than flowing out of (discharge from) the model. A total of 149 grid cells use GHBs in the model, and the application of a GHB in any given model cell is identical for each of the water budget periods.

6.2.4.4 Deep Percolation of Irrigation Water from Agricultural Lands

As discussed previously, there has been a long history of agricultural development and irrigation in the Basin, including by the Newhall Land and Farming Company (Newhall Land), the former Wayside Honor Rancho, and the Disney Corporation. The largest amount of agricultural irrigation occurs on lands owned by Newhall Land, a subsidiary of FivePoint.

Due to a wide variety of factors, irrigation use has varied substantially over the historical period of record. Further, a portion of Newhall Land's agricultural operations are downstream of the Basin and cropping patterns and usage between lands overlying the Basin and those downstream also varies year to year. Appendix G Table 3-11 depicts estimated groundwater pumping by agricultural water users from 1980 through 2019.

To deal with this complexity, as further described in Appendix G (see Appendix B, SCV Recharge Compiler, of that appendix), a detailed assessment of deep percolation from Newhall Land properties was performed for agricultural use during the period 1996 through 2000. Deep percolation factors from that assessment were applied to historical water use proportional to pumping. Those amounts are depicted in Table B-6 of Appendix B of Appendix G.

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[35] Agreement No. 10162 between Department of Water and Power of the City of Los Angeles and United Water Conservation District, dated March 9, 1978.

For the current conditions, agricultural water use and deep percolation estimates are the average of estimates from 2010 through 2019. For future conditions, it is forecast that no agricultural use by Newhall Land will occur overlying the basin and thus no deep percolation from Newhall Land pumping would occur in these scenarios.

6.2.4.5 Deep Percolation of Irrigation Water from Urbanized Lands

As derived by CH2M HILL (2004), the long-term infiltration rates of applied irrigation water in urban areas as defined in the SCV Recharge Compiler is calculated to be 1.0 in/yr for industrial and retail lands, 2.2 in/yr for residential developments and parks, and 4.6 in/yr for golf courses. An additional separate infiltration rate has been defined for schools and recreational facilities (ranging from 3.4 in/yr to 4.6 in/yr). These rates are applied during each year (and each month) of the simulation period but are varied in the historical water budget to reflect changes in urban water use volumes from year to year. In the current water budget, these rates are unchanged from year to year, reflecting conditions in 2014. See Appendix G, the model development report (GSI, 2021) (Section 4.4 of Appendix B of that report) for further details.

The areas over which these rates are applied are as follows:

- Land uses in the historical and current water budgets are defined from land use data provided to the local water purveyors by the City of Santa Clarita in 2013 when an update was occurring to the original finite-element groundwater flow model of the Basin (GSI and LSCE, 2013).
- For the projected water budget, the locations and categories of land use are defined from geographic information system (GIS) coverages that were developed during preparation of the Salt and Nutrient Management Plan for the Basin (GSSI, 2016; GSI, 2014). Those coverages were obtained from the following sources: (1) the SCAG 2008 land use survey; (2) the OVOV land use planning process; and (3) Newhall Land personnel for the *Final Additional Analysis to the Specific Plan and Water Reclamation Plant Final Environmental Impact Project Report* (Newhall Ranch Specific Plan) (Impact Sciences, 2003) and four other developments (Legacy Village, Entrada North Village, Entrada South Village, and Valencia Commerce Center). These land use coverages provide planning-level estimates of future land uses; actual land uses will differ as development plans are permitted in the future.

6.2.4.6 Deep Percolation from Septic Systems

Infiltration from septic systems was defined for residential developments that are served by public water supplies but not served by sanitary storm sewers. In these developments, the onsite treatment of wastewater (via septic systems) represents an importation of water into the residential development with resulting recharge to groundwater from the septic systems.

The locations of these areas were obtained in 2013 during development of the Salt and Nutrient Management Plan for the Basin (GSSI, 2016; GSI, 2014). In the historical water budget, septic systems are introduced beginning in 1961 and are assumed to have increased to a full build-out level for septic systems by the late 1980s. The current and projected water budgets maintain the full build-out (late 1980s) number of septic systems. The deep percolation rate from septic systems is 2,432 AF/yr, which is the rate that was estimated during development of the Salt and Nutrient Management Plan (GSSI, 2016; GSI, 2014). The loading rate from septic systems over the 1,750-acre area in the groundwater model grid where septic systems are present is 1.39 ft per year, which is equivalent to 16.7 in/yr.

6.2.4.7 Point Discharges of Water into the Santa Clara River

No diversions of water are known to occur from the Santa Clara River or its tributaries within the Basin. Water is discharged into the Santa Clara River from the Saugus WRP east of I-5 and the Valencia WRP west of I-5, both of which are owned and operated by the Los Angeles County Sanitation District, which was the source of the discharge data that were used to construct the historical water budget. A third WRP (the Newhall WRP) is planned to be constructed just east of the western basin boundary to treat wastewater from the future Newhall Ranch community and is likely to discharge a portion of its treated wastewater during the coolest months of the year.

Additionally, periodic short-duration discharges to the river have occurred from two outfalls conveying treated water from perchlorate-treatment programs at certain wells pumping from the Saugus Formation. A third outfall began operating in 2017, is currently in operation, and is expected to continue operating for the indefinite future. These three outfalls are the following:

- Outfall for wells SCWD-Saugus1 and SCWD-Saugus2, discharging just upstream of the Saugus WRP; operated from May 2010 through January 2011; further discharges are unlikely because the treatment system has been permitted to allow for the treated water to be used as municipal supply.
- Outfall for well VWD-201, discharging just downstream of the Saugus WRP; began operating in January 2018 and continues operating at this time; this is expected to end soon because the treatment system is being permitted to allow for the treated water to be used as municipal supply.
- Outfall for onsite extraction wells at the Whittaker-Bermite property, discharging about 1 mile upstream of the Saugus WRP: began operating in August 2017; discharges currently at or below about 500 AFY; future discharges assumed to be 500 AFY.

6.2.4.8 Evapotranspiration Demands by Phreatophytes

As described in Section 3.3.5 of Appendix G, the model development report (GSI, 2021), the groundwater flow model simulates uptake of groundwater by phreatophyte plant communities. The locations of two types of communities identified as potential GDEs in the Basin are described by ESA (2020) and are programmed into the model; these communities are riparian mixed hardwood forests and coast live oak woodlands. See Figure 6.1-6 for a map showing their geographic distribution. The riparian mixed hardwood forests and coast live oak woodlands occupy 1,780 acres and 520 acres, respectively, in the model grid.

The mapping work indicates that the predominant species that are present in the riparian mixed hardwood forests are Fremont cottonwood (40 percent), willow trees and shrubs (30 percent), and non-native grasses such as *Arundo donax (Arundo)* (30 percent). For this mixed plant community, monthly ET demands under current conditions (i.e., without climate change) range from 0.22 to 0.87 ft per month (ft/month) (67 to 270 millimeters per month [mm/month]), with peak demands occurring during the summer. ET demands for the coast live oak woodlands range from 0.02 to 0.33 ft/month (5 to 100 mm/month), with peak demands occurring during the winter and spring, and the lowest demands occurring in the late summer and early fall. (See Section 3.3.5 of Appendix G, the model development report [GSI, 2021] for details regarding the derivation of the monthly ET demands.) The monthly distributions for ET demands by these two types of plant communities are programmed directly into the groundwater flow model and are assumed to be representative of potential ET demands in all years throughout the 1925 through 2019 period for the historical water budget. These rates are adjusted upwards for the 2030 and 2070 climate change scenarios, respectively, based on the DWR climate-change factors for reference ET that are listed in Table 6.2-5. As shown in Table 6.2-7, the climate-change adjustment for the riparian mixed hardwood forest results in future ET demands that are 1.044 and 1.052 times the present-day demands in 2030 and 2070, respectively.

6.3 Historical Water Budget

This section presents a summary-level description of historical water uses in the Basin (Section 6.3.1), the historical surface water and groundwater budgets (Sections 6.3.2 and 6.3.3), a summary of the influence of land and water use conversions on the historical water budget (Section 6.3.4), and the uncertain aspects of the historical water budget (Section 6.3.5). Figures 6.3-1 and 6.3-2 and Table I-1 in Appendix I present the year-by-year historical surface water budget. Figures 6.3-3 and 6.3-4 and Table I-2 in Appendix I present the year-by-year historical groundwater budget.

6.3.1 Description of Historical Water Uses in the Basin

As discussed in Section 6.1, the Basin was largely rural during the 1800s and early 1900s, with ranches, rural populations, and small villages present. The first large-scale use of groundwater is thought to have occurred with the construction of agricultural supply wells along the Santa Clara River in the western and central portions of the Basin beginning in the mid-1930s. Inspection of air photos from 1947 and a USGS study of the Basin's agricultural and early urban years (Robson, 1972) indicates that groundwater pumping for agricultural uses supported irrigated crop cultivation on as much as 6,100 acres (approximately) of land lying along the alluvial corridors that hold the Santa Clara River and certain tributaries. See Appendix I for the locations of these lands and the wells that are estimated to have provided the irrigation water supply, based on their construction dates. Calculations by Robson (1972), CH2M HILL (2004), and GSI (2021) for the mixture of crops farmed in those days and more recently indicate that (1) crop irrigation demands range from about 4 to 10 acre-feet (AF) per acre per year and (2) crops consume approximately 50 to 70 percent of the land-applied irrigation water pumped from the Alluvial Aquifer, with the remainder lost to evaporation from soils and seepage back to the underlying water table. Accordingly, annual groundwater pumping in the Basin to support agricultural irrigation is thought to have averaged approximately 50,000 acre-feet per year (AFY) by the mid-1940s and continuing through much, if not all, of the 1950s. Beginning in the early 1960s, certain parcels of agricultural land, located primarily east of the modern-day I-5 freeway, were retired and eventually urbanized. Agricultural groundwater pumping from the Alluvial Aquifer declined to 23,000 AFY by 1967 (Robson, 1972), and, until the mid-1990s, total pumping from the Alluvial Aquifer (for agricultural plus municipal supplies) remained below 30,000 AFY in most years as the Basin gradually urbanized. Pumping from the Alluvial Aquifer has averaged approximately 36,000 AFY since the mid-1990s, which includes an assumed 500 AFY of small domestic uses in unincorporated rural areas. The highest annual pumping volume from the Alluvial Aquifer since urbanization began in the 1960s (43,406 AFY during 1999)[36] was approximately 6,600 AFY below the historical average amount of agricultural pumping (50,000 AFY).

The Saugus Formation was not a source of groundwater supply until the early 1950s, when the newly formed Newhall County Water District drilled wells along the South Fork Santa Clara River in the town of Newhall. In 1964, an irrigation well was drilled in the Saugus Formation to supply a newly built golf course west of the Valencia Town Center, which was also under development. The Newhall Land and Farming Company constructed an agricultural water supply well in the Saugus Formation in 1961; this was generally pumped only periodically until it was taken out of service in 2012 and then abandoned. Pumping from the Saugus Formation remained below 5,000 AFY until 1986, then rose to between 10,600 and 14,900 AFY during the early 1990s before decreasing to below 10,000 AFY for nearly 20 years and then returning to levels between approximately 10,000 and 12,000 AFY in recent years. Pumping from the Saugus Formation is primarily for municipal uses, although The Disney Corporation pumps localized Saugus Formation groundwater for irrigation supply along the southern margin of the Basin.

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[36] See Table 3 in Appendix A of LSCE, 2020.

Table 6.3-1 shows the historical human water demands and the sources of water used to meet those demands. As discussed in Sections 6.1 and 6.2, the values prior to 1980 are estimates, whereas the values from 1980 through 2019 are obtained from the most recent annual water report for the Basin (LSCE, 2020). Table 6.3-2 summarizes the historical annual groundwater pumping by water-use sector. Agriculture was the dominant user of groundwater during the peak agricultural years of 1945 through 1960 and remained the largest use through the late 1970s and into the early 1980s. Golf course water use began in the 1960s, and small domestic uses are thought to have begun in the 1960s as urbanization was accompanied by an increase in the number of rural homes and their associated domestic water uses. The past four decades as a whole have been characterized by municipal uses becoming the largest uses of groundwater, followed by agricultural irrigation (which occurs primarily along I-5 in and near Castaic Junction and in portions of the alluvial valley situated west of I-5). Golf course water use has also been higher during the past four decades than before 1980.

6.3.2 Historical Surface Water Budget

The GSP regulations (§354.18) require development of a surface water budget for the GSP. The surface water budget quantifies important sources of surface water and evaluates their historical and future reliability. The BMP document for water budget development (DWR, 2016; see page 19) states that surface water sources should be identified as one of the following:

- Central Valley Project
- State Water Project
- Colorado River Project
- Local imported supplies
- Local supplies

The Basin has three of these surface water source types: (1) SWP water and (2) local imported supplies, both of which are stored in Castaic Lake, which lies along the margin of the Bulletin 118 basin boundary for the Basin; and (3) local river/stream systems, which are not sources of agricultural, municipal, or private water supplies in the Basin but instead exist in the form of perennial streamflows in the western portion of the Basin and ephemeral streamflows in other portions of the Basin. Following are discussions of these historical surface water source types.

Table 6.3-1. Historical Municipal and Non-Municipal Water Demands and Supplies

	Municipal Users				Other Users	Total	
Calendar Year	Local Groundwater	Imported Water	Recycled Water	Total	Local Groundwater	Local Groundwater	Demand
1925	0	0	0	0	0	0	0
1926	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0
1928	0	0	0	0	0	0	0
1929	0	0	0	0	0	0	0
1930	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0
1933	0	0	0	0	0	0	0
1934	0	0	0	0	0	0	0
1935	0	0	0	0	0	0	0
1936	0	0	0	0	4,933	4,933	4,933
1937	0	0	0	0	9,865	9,865	9,865
1938	0	0	0	0	14,798	14,798	14,798
1939	0	0	0	0	19,730	19,730	19,730
1940	0	0	0	0	24,663	24,663	24,663
1941	0	0	0	0	29,595	29,595	29,595
1942	0	0	0	0	34,528	34,528	34,528
1943	0	0	0	0	39,460	39,460	39,460
1944		0	0	0	44,393	44,393	44,393
1945	0	0	0	0	49,325	49,325	49,325
1946	0	0	0	0	49,325	49,325	49,325
1947	0	0	0	0	49,325	49,325	49,325
1948	0	0	0	0	49,325	49,325	49,325
1949	0	0	0	0	49,325	49,325	49,325
1950	500	0	0	500	49,325	49,825	49,825
1951	500	0	0	500	49,325	49,825	49,825
1952	500	0	0	500	49,325	49,825	49,825
1953	500	0	0	500	49,325	49,825	49,825
1954	500	0	0	500	49,325	49,825	49,825
1955	500	0	0	500	49,325	49,825	49,825
1956	500	0	0	500	49,325	49,825	49,825
1957	500	0	0	500	49,325	49,825	49,825
1958	500	0	0	500	49,325	49,825	49,825
1959	500	0	0	500	49,325	49,825	49,825
1960	1,000	0	0	1,000	49,325	50,325	50,325
1961	1,000	0	0	1,000	47,512	48,512	48,512
1962	1,000	0	0	1,000	41,532	42,532	42,532
1963	4,000	0	0	4,000	35,364	39,364	39,364
1964	5,500	0	0	5,500	29,291	34,791	34,791
1965	8,000	0	0	8,000	23,657	31,657	31,657
1966	9,500	0	0	9,500	24,584	34,084	34,084
1967	10,500	0	0	10,500	18,370	28,870	28,870
1968	11,250	0	0	11,250	18,149	29,399	29,399
1969	12,000	0	0	12,000	17,866	29,866	29,866
1970	12,750	0	0	12,750	17,583	30,333	30,333
1971	13,500	0	0	13,500	17,362	30,862	30,862
1972	14,250	0	0	14,250	17,079	31,329	31,329
1973	15,000	0	0	15,000	16,797	31,797	31,797
1974	15,750	0	0	15,750	16,575	32,325	32,325
1975	16,500	0	0	16,500	16,292	32,792	32,792
1976	17,250	0	0	17,250	16,010	33,260	33,260
1977	18,000	0	0	18,000	15,788	33,788	33,788
1978	18,750	0	0	18,750	15,506	34,256	34,256
1979	19,500	7	0	19,507	15,223	34,723	34,730
1980	20,639	1,126	0	21,765	15,413	36,052	37,178

Table 6.3-1. Historical Municipal and Non-Municipal Water Demands and Supplies

	Municipal Users				Other Users	Total	
Calendar Year	Local Groundwater	Imported Water	Recycled Water	Total	Local Groundwater	Local Groundwater	Demand
1981	18,482	5,817	0	24,299	17,278	35,760	41,577
1982	12,253	9,659	0	21,912	13,705	25,958	35,617
1983	12,201	9,185	0	21,386	11,937	24,138	33,323
1984	16,390	10,996	0	27,386	15,377	31,767	42,763
1985	16,659	11,823	0	28,482	13,403	30,062	41,885
1986	17,393	13,759	0	31,152	12,297	29,690	43,449
1987	17,592	16,285	0	33,877	10,611	28,203	44,488
1988	18,601	19,033	0	37,634	9,975	28,576	47,609
1989	21,195	21,618	0	42,813	10,285	31,480	53,098
1990	21,453	21,613	0	43,066	11,284	32,737	54,350
1991	31,825	7,968	0	39,793	10,279	42,104	50,072
1992	27,355	13,911	0	41,266	11,160	38,515	52,426
1993	29,959	13,393	0	43,352	10,777	40,736	54,129
1994	31,599	14,389	0	45,988	13,559	45,158	59,547
1995	28,677	16,996	0	45,673	14,347	43,024	60,020
1996	32,054	18,093	0	50,147	14,570	46,624	64,717
1997	32,025	22,148	0	54,173	15,319	47,344	69,492
1998	28,604	20,254	0	48,858	13,599	42,203	62,457
1999	29,968	27,282	0	57,250	17,154	47,122	74,404
2000	28,409	32,579	0	60,988	15,608	44,017	76,596
2001	25,367	35,369	0	60,736	16,362	41,729	77,098
2002	26,457	41,763	0	68,220	16,979	43,436	85,199
2003	22,978	44,416	50	67,444	14,829	37,807	82,273
2004	24,671	47,205	420	72,296	15,590	40,261	87,886
2005	32,316	37,997	418	70,731	12,785	45,101	83,516
2006	33,061	40,048	419	73,528	17,312	50,373	90,840
2007	31,690	45,151	470	77,311	14,768	46,458	92,079
2008	33,884	41,705	311	75,900	14,750	48,634	90,650
2009	31,100	38,546	328	69,974	16,564	47,664	86,538
2010	33,152	30,578	336	64,066	16,098	49,250	80,164
2011	33,624	30,808	373	64,805	15,439	49,063	80,244
2012	33,726	35,558	428	69,712	15,694	49,420	85,406
2013	29,779	43,281	400	73,460	16,151	45,930	89,611
2014	34,612	33,092	474	68,178	12,885	47,497	81,063
2015	29,893	24,148	450	54,491	12,079	41,972	66,570
2016	26,329	31,130	507	57,966	14,360	40,689	72,326
2017	16,403	46,651	501	63,555	13,438	29,841	76,993
2018	22,869	41,999	352	65,220	13,071	35,940	78,291
2019	17,547	42,072	458	60,077	12,510	30,057	72,587

Notes

All values are in units of acre-feet per year. Values for 1980-2019 are from basin annual reports. Prior years are estimated.
Data are for calendar years, to be consistent with 1980-2019 water use information presented in annual reports.

See Table I-2 in Appendix I for water-year values of groundwater pumping.

Municipal supplies are currently provided by SCV Water and Los Angeles County Water Works District 36 (LACWD).
Municipal users include all commercial and industrial water users in the Santa Clarita Valley.

Other users are FivePoint (The Newhall Land and Farming Company), which historically has pumped from the Alluvial Aquifer and the Saugus Formation; the Pitchess Detention Center and Sand Canyon Country Club, which pump from the Alluvial Aquifer; Valencia County Club, Vista Valencia Golf Course, and the groundwater pumping/treatment system on the Whittaker-Bermite property, all of which pump from the Saugus Formation; and small private domestic well owners, who pump primarily from the Alluvial Aquifer but may also pump small quantities of water from adjoining bedrock units.

Table 6.3-2. Estimated Historical Municipal and Non-Municipal Groundwater Use by Water Use Sector for the Basin (Calendar Years 1945—2019)

Water Use Sector	Minimum	Maximum	Average
Peak Agricultural Period (1945-1960)			
Agricultural	---	---	50,000
Municipal	---	---	1,000
Golf Courses	0	0	0
Rural Domestic	---	---	---
Small Public Water Systems	0	0	0
Total	—	—	51,000
Transitional Period (1961-1979)			
Agricultural	14,200	47,500	21,500
Municipal	1,000	19,500	11,800
Golf Courses	0	500	375
Rural Domestic	0	500	250
Small Public Water Systems	0	0	0
Total	28,900	48,500	33,900
Modern Record (1980-2019)			
Agricultural	5,950	14,300	10,350
Municipal	12,200	34,600	25,800
Golf Courses	425	1,375	800
Rural Domestic	500	500	500
Small Public Water Systems	1,000	3,500	2,350
Total	24,150	50,375	39,800

Notes

All values are in units of acre-feet. Values for 1980-2019 are from basin annual reports. Prior years are estimated.

Data are for calendar years, to be consistent with 1980-2019 water use information presented in annual reports.

Municipal supplies are currently provided by SCV Water and Los Angeles County Water Works District 36 (LACWD). Municipal water demands include all commercial and industrial water uses in the Santa Clarita Valley.

Agricultural groundwater use is by The Newhall Land and Farming Company. These pumping volumes do not include agricultural pumping by the Disney Corporation along the southern margin of the basin.

For the period of modern record (1980-2019), the "small public water system" water use sector consists solely of the Pitchess Detention Center (which was formerly called Wayside Honor Rancho).

Golf course groundwater is dedicated to golf courses and is not obtained from potable water supplies.

Dashed values are for cases where the values are unknown and cannot be readily estimated.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual values because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

6.3.2.1 Historical Imported Supplies

SCV Water's portfolio of imported water supplies consists of SWP water and local imported supplies that are available from groundwater banking and water exchange programs outside the Basin (LSCE, 2020). Historically, the imported supplies used by SCV Water have consisted primarily of SWP water. As documented in the 2010 and 2015 UWMPs (KJC et al., 2011 and 2016), the 2017 *Water Supply Reliability Plan Update* (Clemm and KJC, 2017), the 2020 UWMP (KJ, 2021), and the 2021 *Draft Water Supply Reliability Plan Update* (Geosyntec, 2021), the combination of imported water management in conjunction with the operating plan for the local groundwater basin forms the basis for current and future water planning in the Santa Clarita Valley. By design, the Basin Operating Plan draws upon the groundwater storage reserves of the Basin (primarily in the Saugus Formation) to augment imported supplies during drought years in the SWP, then reduces pumping at other times to facilitate the natural replenishment of those reserves. This operating plan is integral to the water resources plan for SCV Water as described in its UWMPs, as the imported water puts the region in a position where available water supplies exceed human demands for water (KJ, 2021).

SCV Water takes deliveries of its imported water supplies at Castaic Lake, which serves as the terminal reservoir of the SWP's West Branch. SCV Water treats this water at its Earl Schmitt Filtration Plant or its Rio Vista Water Treatment Plant. This treated water then enters the municipal water supply distribution system where it is blended with locally pumped municipal groundwater supplies. No accounting is available to track the amount of the imported supply applied to different categories of urban land uses. Hence, in the Basin it is not possible to develop an accounting of applied surface water by water use sector (as described in the water budget BMP [DWR, 2016] with regards to the requirements of §354.18(b)(1) of the GSP regulations). The historical annual usage of imported water supplies is tabulated in the annual water reports for the Basin (LSCE, 2020) and is included in Table 6.3-1.

In 2017, CLWA (SCV Water's predecessor agency) prepared a Water Supply Reliability Report Update that demonstrated the ability of CLWA's imported water supply portfolio to meet supplemental water demands fully and reliably within CLWA's service area. The reliability study incorporated the Basin Operating Plan and analyzed CLWA's imported water portfolio through 2050 build-out using the variety of historical hydrologic conditions that have been recorded in the region for nearly a century. The report demonstrated full reliability under 2015 UWMP assumptions. The report also concluded that, even with a significant reduction in the delivery capability of the SWP system, the full demands within the service area can be met without exceeding the pumping volumes outlined in the Basin Operating Plan. The 2021 *Draft Water Supply Reliability Plan Update* (Geosyntec, 2021) reached the same conclusions—specifically, that, with planned investments, there would be a supply surplus that would greatly exceed any projected shortfalls, as long as the remaining supply capacity in the Saugus Formation and/or in specific water banks is fully developed.

6.3.2.2 Historical Local Surface Water Inflows

Local surface water inflows in river and stream systems are not sources of municipal or agricultural water supply in the Basin, but instead consist solely of stormwater and other flows in the Santa Clara River and its tributaries. These surface water inflows consist of the following:

- Ungaged surface water flows arising as precipitation runoff (stormwater) within the Basin (estimated from precipitation data and modeling studies)
- Gaged surface water flow in the Santa Clara River that enters the Basin from the upstream Acton Basin (obtained from intermittently available stream gaging records at Lang Station and from streamflow regression estimates)

- Ungaged surface water flows that enter the Basin in other tributaries to the Santa Clara River, which originate in the upper portions of the watersheds lying outside the groundwater basin boundary (estimated from precipitation data and modeling studies)
- Periodic releases of water into Castaic Creek from the Castaic Lake/Lagoon complex (from records maintained by DWR)
- Releases of water from Bouquet Reservoir into Bouquet Creek upstream of the Basin, a portion of which can flow into the Basin (estimated from data and modeling studies)
- Discharges of treated water to the Santa Clara River from the Saugus and Valencia WRPs (from records provided by the Los Angeles County Sanitation District)
- Periodic point discharges to the river from groundwater treatment facilities
- Natural discharges of groundwater, which occur primarily in perennial (gaining) reaches of the Santa Clara River

Table 6.3-3 summarizes the average, minimum, and maximum values of these annual historical surface inflows to the Basin.

6.3.2.3 Historical Surface Water Outflows

The estimated annual surface water outflow leaving the Basin (as storm and non-storm flows in the Santa Clara River at the western basin boundary, deep percolation from ephemeral streams, and evaporative losses) are summarized in Table 6.3-4 for the historical base period. The non-storm flow in the Santa Clara River at the western basin boundary is estimated from groundwater flow modeling, given that the historical period begins before stream gaging began.

For the purpose of reporting the water budgets, the historical non-storm flows in the Santa Clara River at the western basin boundary include the amount of subsurface outflow that occurs within a thin veneer of alluvium that is present at the western basin boundary, which comprises the western boundary of the groundwater flow model. These subsurface flows are included in the non-storm surface water outflow term because (1) the alluvium generally thins in a westerly direction in this area, and (2) aerial imagery indicates the stream channel becomes more defined (less braided and narrower) just downstream of the western basin boundary with notable streamflow continuing downstream to the existing stream gage at Las Brisas Bridge (USGS Station 11109000, located 3.5 miles downstream of the western basin boundary).

6.3.2.4 Historical Surface Water Budget

A comparison of Tables 6.3-3 and 6.3-4 shows the following noteworthy observations about the historical surface water budget:

- The point discharges to the river are a minor portion of the total surface water inflows. However, because these discharges occur primarily in the western portion of the Basin, they have a notable influence on streamflows at the western basin boundary, as shown by a comparison of the point discharges with gaging records near the western basin boundary during the summer season, when little to no storm flow occurs in the river. (See Figure 6.3-2.)
- The controlled releases of water from Bouquet Reservoir also are a minor portion of the total surface water inflows. In contrast, controlled releases from Castaic Lake can be significant during wet years but have little to no influence on the surface water budget during dry periods.
- The amount of stormwater generated from precipitation falling directly within the Basin is an important component of the surface water budget, as is the streamflow entering the Basin in the Santa Clara River and its tributaries.

- Groundwater discharges to the perennial reach of the river are the highest source of inflow to surface water on average, and the minimum value of these discharges is also the highest of the minimums for all surface water inflow terms.
- As shown in Table 6.3-4 and in Table I-1 of Appendix I, on average, 16 percent of the surface water generated in the Basin leaves as non-storm flow at the western basin boundary while another 33 percent is lost to a combination of stormwater outflow and ET. Groundwater recharge within and outside of stream channels constitutes 43 percent and 8 percent, respectively, of the total surface water outflow from the Basin.
- As shown in Table I-1 of Appendix I, for the non-storm surface water outflows, the minimum annual volume (11,311 AFY) is about 25 percent of the average annual volume for the 95-year historical period (44,905 AFY). As shown in Figures 6.3-2 and 6.3-4, the lowest flows occurred during the mid-1940s through the early 1960s, which is the period when groundwater pumping from the Alluvial Aquifer was at its historical highest (to meet agricultural irrigation needs before urbanization began).

Table 6.3-3. Estimated Historical Annual Surface Water Inflows to the Basin (Water Years 1925–2019)

Surface Water Inflow Component	Minimum	Maximum	Average	Percent of Total
In-Basin Precipitation	27,400	224,500	87,600	32%
Stormwater Generated from In-Basin Precipitation	25,100	135,800	67,000	---
Stream Inflow (Santa Clara River)	0	37,850	5,170	2%
Stream Inflow (Releases from Castaic Lake/Lagoon)	0	101,800	14,750	5%
Stream Inflow (Releases from Bouquet Reservoir)	0	130	95	0.03%
Stream Inflow (Other Santa Clara River Tributaries)	0	148,400	24,150	9%
Discharges to Santa Clara River from Saugus WRP	0	7,840	2,800	1%
Discharges to Santa Clara River from Valencia WRP	0	18,150	4,975	2%
Discharges to Santa Clara River from Groundwater Treatment Systems	0	3,700	85	0.03%
Groundwater Discharge to Streams	62,600	268,500	134,500	49%
Total	98,900	766,000	274,100	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the period of water years 1925 through 2019. Percentages are calculated from the average values.
All values are rounded from the statistics calculated in Table I-1 of Appendix I.

Bouquet Reservoir releases began in 1934. 5% of the releases from this reservoir are assumed to remain as surface flow where the creek enters the Basin.

Castaic Lake/Lagoon releases began in 1974. Flows in earlier times were natural streamflows prior to construction of Castaic Dam.

Releases from the Saugus WRP and the Valencia WRP began in 1963 and 1967, respectively.

During the 95-year period for this water budget, discharges from groundwater treatment systems occurred in 2011, 2018, and 2019.

Total values do not include stormwater generated from in-basin precipitation, which is an internal flow process (and not an inflow to, or outflow from, the basin).

For the minimum and maximum and average values, the total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values of the individual terms are for different years.

Table 6.3-4. Estimated Historical Annual Surface Water Outflows from the Basin (Water Years 1925–2019)

Surface Water Outflow Component	Minimum	Maximum	Average	Percent of Total
Santa Clara River Non-Storm Outflow at the Western Basin Boundary	11,300	100,000	44,900	16%
Groundwater Recharge from Precipitation	0	103,000	20,600	8%
Groundwater Recharge from Streams	51,200	253,000	117,300	43%
ET and Stormwater Outflow	24,300	331,500	91,300	33%
Total	98,900	766,000	274,100	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the period of water years 1925 through 2019. Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-1 of Appendix I.

Outflows at County line are from modeling analyses, rather than using data from the gages which are located further downstream.

Subsurface outflow through the thin alluvial material beneath the river at the western boundary of the Basin is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual outflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

ET = evapotranspiration

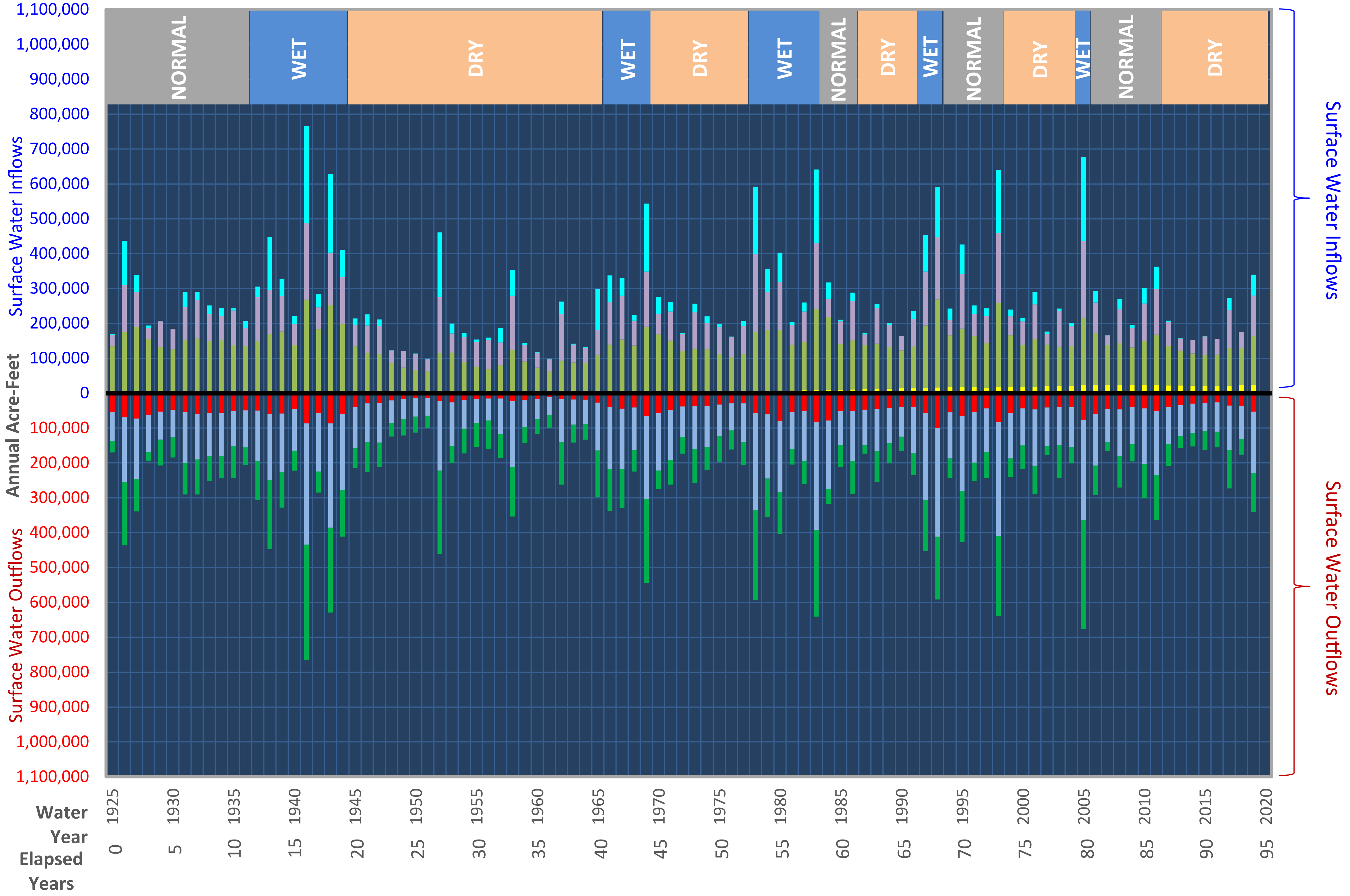

FIGURE 6.3-1

Historical Surface Water Budget (Water Years 1925-2019)

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟪 Precipitation
- 🟦 Stream Inflows
- 🟦 Point-Source Flows to Streams
- 🟩 Net Inflow from Groundwater
- 🟥 Non-Storm Flow at County Line
- 🟩 ET and Storm Outflows
- 🟦 Groundwater Recharge from Streams and Rainfall

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
ET: evapotranspiration

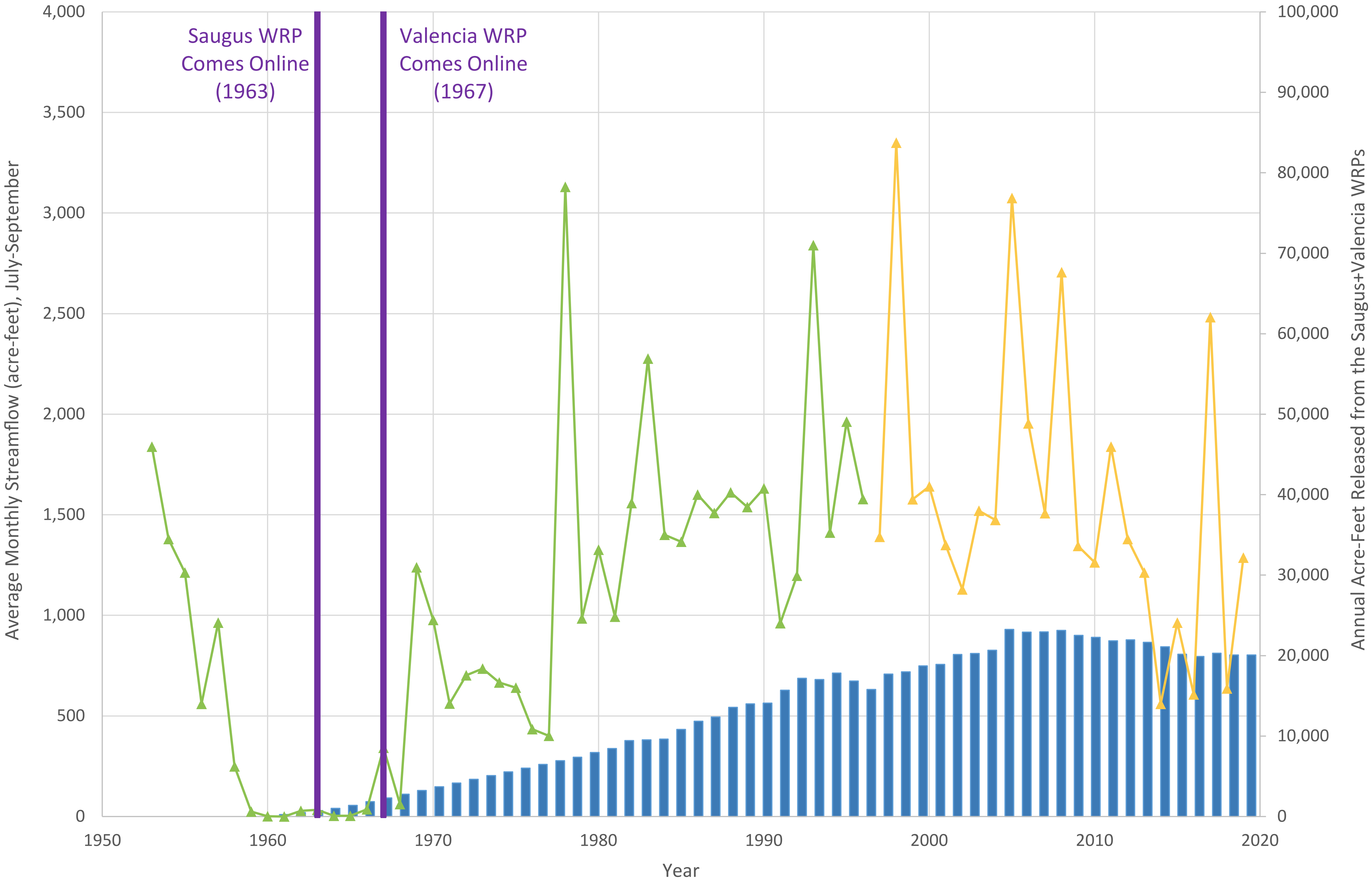

FIGURE 6.3-2

Historically Measured Annual WRP Flow Volumes and Summer-Season Streamflow Volumes in the Santa Clara River at the LA/Ventura County Line and Piru Stream Gages

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- ▬ Annual WRP Discharge Volume (Saugus+Valencia)
- ▲ LA/Ventura County Line Stream Gage
- ▲ Piru Stream Gage

NOTES
LA: Los Angeles
WRP: Water Reclamation Plant

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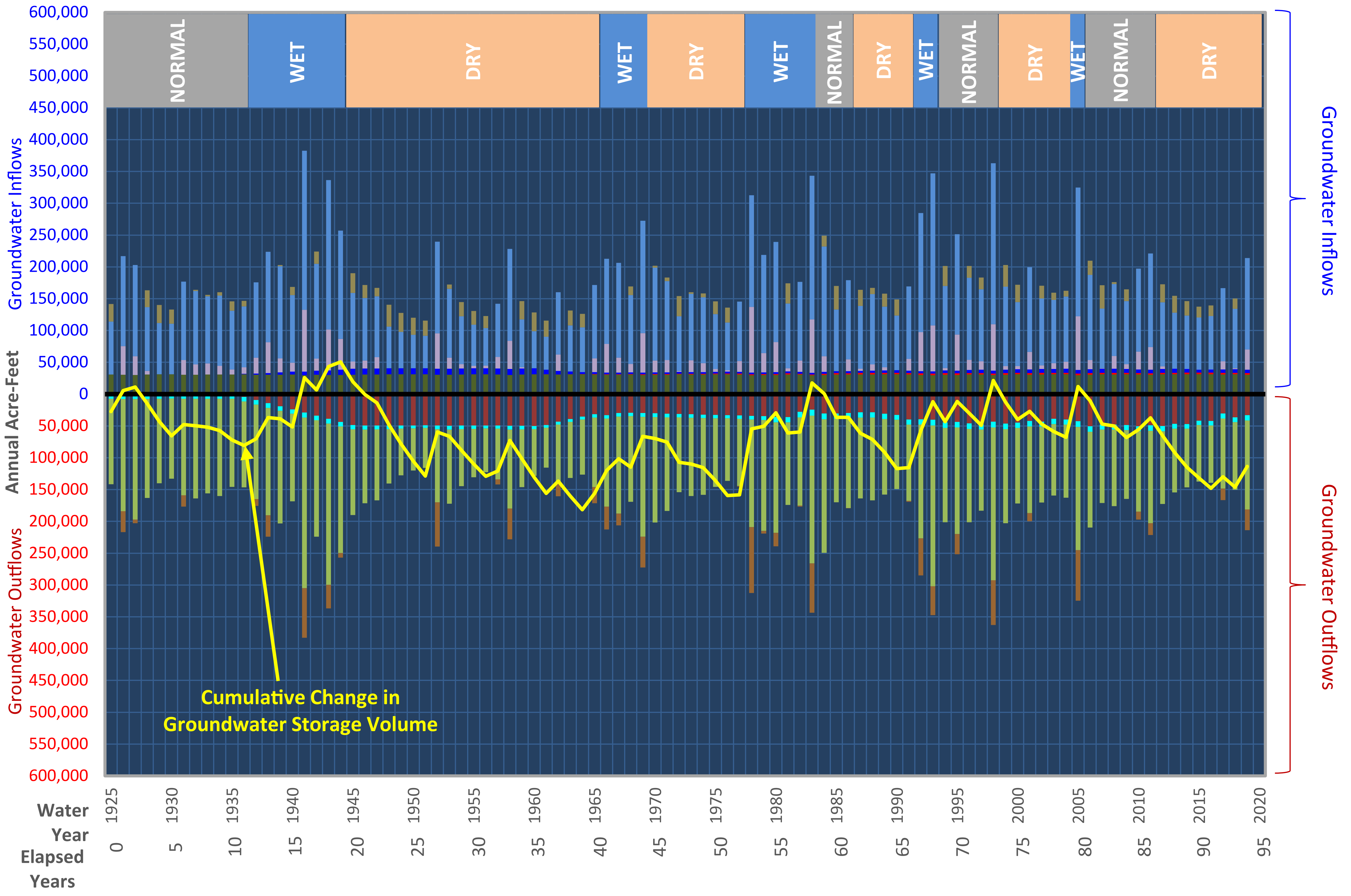

FIGURE 6.3-3

Historical Groundwater Budget (Water Years 1925-2019)

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

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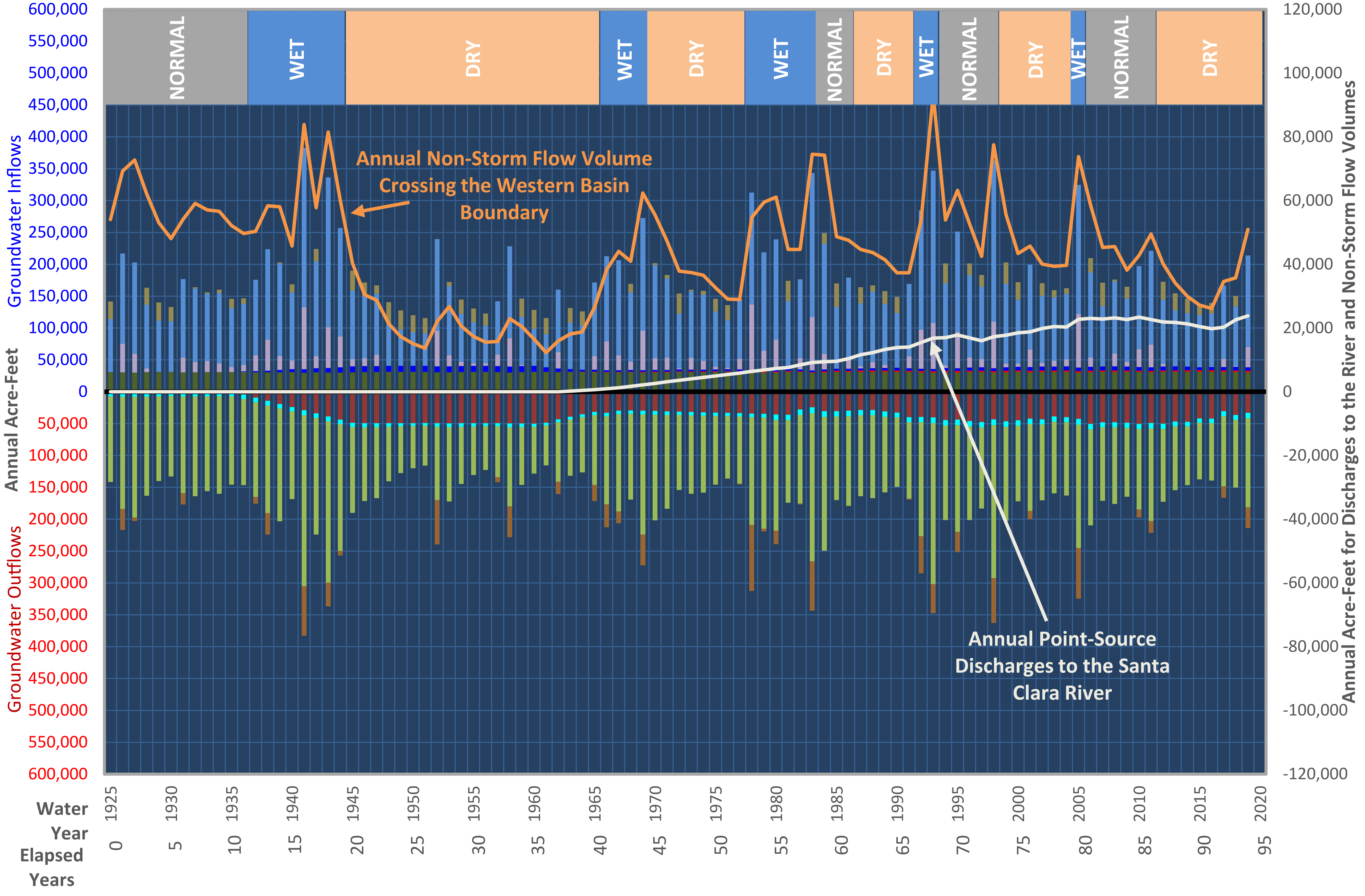

FIGURE 6.3-4

Historical Groundwater Budget and Annual Non-Storm Flows at the Western Basin Boundary

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

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6.3.3 Historical Groundwater Budget

The annual historical groundwater budget is shown on Figures 6.3-3 and 6.3-4 and in Table I-2 in Appendix I.

6.3.3.1 Historical Groundwater Inflows

Table 6.3-5 summarizes the average, minimum, and maximum values of the annual inflows to groundwater in the Basin. Noteworthy observations are as follows:

- Recharge from streams provides by far the most important source of recharge to the Basin's groundwater resources, contributing about 67 percent of the total recharge on average during the 95-year historical period.
- During wet years, recharge from precipitation falling within the Basin is also an important source of groundwater recharge; however, the 95-year average of this recharge term is only 12 percent of total recharge.
- Subsurface inflows entering the Basin in the thin veneers of alluvium that are present beneath the Santa Clara River and its 48 tributaries are the second-highest recharge source during normal and dry years, as the upstream contributing watersheds steadily drain their water and provide it in the form of a steady subterranean flow into the Basin.
- On average, septic systems have provided less than 1 percent of total recharge to groundwater in the Basin, while irrigation (applied water) has provided almost 3 percent of the total recharge to groundwater. The contribution from irrigation on a long-term basis has been below 3 percent, regardless of whether the irrigation uses comprised agricultural irrigation alone (as occurred before the 1960s) or a mixture of agricultural and municipal irrigation (since 1960). However, during the peak agricultural years, the estimated maximum value of irrigation recharge (9,540 AFY) may have provided as much as 10 percent of total recharge to groundwater during the low-precipitation periods (such as water years 1948 through 1951 and 1960; see Table I-2 of Appendix I).

6.3.3.2 Historical Groundwater Outflows

Table 6.3-6 summarizes the average, minimum, and maximum values of the annual outflows (discharges) of groundwater from the Basin. Groundwater discharges to streams are by far the biggest source of outflow, with groundwater pumping becoming the second largest source of outflow once the Basin went into agricultural production and continuing with the expansion of urbanization after 1960. Groundwater withdrawals by riparian vegetation (phreatophytes) have remained within a relatively narrow range of values, varying over a range of about 5,150 AFY (from about 4,100 to 9,250 AFY), in contrast to an average of about 175,650 AFY for total groundwater discharge (which ranged between 115,500 AFY and 305,100 AFY).

Table 6.3-5. Estimated Historical Annual Inflows to Groundwater in the Basin (Water Years 1925–2019)

Groundwater Inflow Component	Minimum	Maximum	Average	Percent of Total
Recharge from Precipitation	0	103,000	20,600	12%
Recharge from Streams	51,200	253,000	117,300	67%
Subsurface Inflow Beneath Castaic Dam	1,675	1,680	1,675	1%
Subsurface Inflow Beneath Santa Clara River and Other Tributaries	28,000	29,700	29,070	17%
Septic System Percolation	0	2,440	1,140	<1%
Recharge of Applied Water	0	9,540	4,690	<3%
Total	90,350	382,750	174,450	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the period of water years 1925 through 2019. Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-2 of Appendix I.

Deep percolation from streams is the combined amount in ephemeral and perennial reaches.

Deep percolation from irrigation is the sum for agricultural and municipal lands.

Septic system percolation applies to areas served by public water supplies that do not have public sewer collection systems.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual inflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

Table 6.3-6. Estimated Historical Annual Groundwater Outflows from the Basin (Water Years 1925–2019)

Groundwater Outflow Component	Minimum	Maximum	Average	Percent of Total
Groundwater Pumping	0	50,500	34,160	19%
Riparian Evapotranspiration	4,100	9,250	7,025	4%
Groundwater Discharge to Streams	62,600	268,500	134,500	77%
Total	115,500	305,130	175,650	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the period of water years 1925 through 2019. Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-2 of Appendix I.

Groundwater discharge to streams is the combined amount in ephemeral and perennial reaches.

Subsurface outflow through the thin alluvial material beneath the river at the western boundary of the Basin is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual outflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

6.3.3.3 Historical Changes in Groundwater Storage

The yellow line on Figure 6.3-3 shows how much the volume of stored groundwater changes progressively over time. The slopes of this cumulative-change-in-storage line are the primary indicators of the storage changes over the short and long terms. A rising slope indicates that recharge is greater than discharge, and a declining slope indicates that recharge is less than discharge. Figure 6.3-3 shows that the occurrence of rising compared with declining slopes varies frequently during the 95-year historical period. In the year 2011, which was one year before the recent drought began, the cumulative change in storage was similar to that of the first year in the 1925 through 2019 historical period, indicating that no long-term decline in storage had occurred. In 2012, the onset of the drought began a period of declining storage that lasted until the curve began rising in 2017. The curve's slope during the drought from 2012 through 2016 is similar to that calculated for prior drought periods, such as 1945 through 1965 and 1987 through 1991. Most importantly, the historical water budget indicates that the onset of groundwater pumping and the changing locations and uses of groundwater have not resulted in an overdraft condition in the Basin.

6.3.4 Influence of Land and Water Use Conversions on the Historical Water Budget

The historical surface and groundwater budgets are influenced by the conversion of land and water uses in the Basin beginning in the 1960s.

- For the surface water budget, historical stream gaging data show that stormwater flows into and out of the Basin were highly variable from year to year, based on year-to-year variations in precipitation. Figure 6.3-2 shows that historically, the seasonal low (summer-season) flow volumes in the river at and downstream of the western basin boundary have increased since 1965 because of increases in treated water discharges from WRPs as the Basin became increasingly urbanized and more water was imported from SWP to meet human water demands. The annual volume of combined discharges to the river from the two local WRPs increased to as high as 22,900 AFY in 2005 and ranged between approximately 20,000 AFY and 22,000 AFY from 2011 through 2019. As shown in Figure 6.3-4, groundwater flow model simulations of historical conditions indicate that annual non-storm flow volumes crossing the western basin boundary were likely lower during the period of peak agricultural production (from the mid-1940s through the early to mid-1960s) than occurred before or after that period. This is thought to be the result of the prevailing dry conditions in the region plus groundwater pumping from the Alluvial Aquifer (which was greater in those years than any other time before or after). This is consistent with an early water budget analysis for the downstream Piru Subbasin by Mann (1959), which estimated groundwater inflows from the Basin but did not quantify dry-weather surface inflows from the Basin, which suggests that dry-weather surface flows out of the Basin were negligible prior to the onset of urbanization in the Basin.
- In the groundwater budget, the initiation of urbanization and the corresponding retirement of certain agricultural lands from the 1960s through the 1980s coincides with an increase in the minimum and maximum inflection points on the cumulative-change curve shown in Figure 6.3-3 for groundwater storage volumes. These inflection points arise partly from greater precipitation but also from reduced pumping (see the maroon bars) as agricultural pumping quickly decreased while urban pumping slowly increased. The gradual rise in the cumulative change in storage curve (the yellow line in Figure 6.3-3) continued through the early to mid-2000s despite increased municipal pumping during this period, in part because of the lack of a prolonged drought but also because of the continued pumping of the Alluvial Aquifer at levels lower than occurred during the years of peak agricultural land uses. Along with the increased importation of SWP water into the Basin starting in 1979, the changing groundwater pumping patterns and changing water use patterns associated with urbanization and reduced agricultural production have kept the Basin in a sustainable condition with respect to the SGMA criterion of chronic lowering of groundwater levels.

6.3.5 Uncertain Aspects of the Historical Water Budget

The definitions section of the GSP regulations (§351) defines uncertainty as follows:

> (ai) "Uncertainty" refers to a lack of understanding of the basin setting that significantly affects an Agency's ability to develop sustainable management criteria and appropriate projects and management actions in a Plan, or to evaluate the efficacy of Plan implementation, and therefore may limit the ability to assess whether a basin is being sustainably managed.

Uncertainties in the historical water budget exist in the form of (1) data gaps and measurement accuracy and (2) modeling uncertainties.

The primary data gaps and uncertainties that may have effects on the groundwater flow model and the historical water budget are the following:

- A long record of precipitation data is available in the Basin, consisting of monthly records dating back to late 1927 and annual (calendar-year) records dating to the late 1880s. In contrast, no streamflow records are available prior to the early 1950s for the Santa Clara River and prior to 1974 for the watershed upstream of Castaic Lake. Precipitation records and regression techniques have been used to estimate streamflows prior to these times, as well as to fill in data gaps during the period of record (an issue primarily at the Lang Gage, where the Santa Clara River enters the Basin).
- For agricultural lands, data on groundwater pumping volumes, irrigated crop types and acreages, and irrigation return flow volumes are not available prior to the modern era of record-keeping (i.e., prior to 1980). This information has been estimated from aerial photos showing the locations of agricultural lands, general descriptions of historical cropping, and the application of more recent data on the water needs of various types of crops.
- Pumping volumes for wells owned by SCV Water are metered and are available from recording systems that provide real-time operational information, thereby minimizing uncertainty in municipal groundwater pumping records. Other wells in the Basin report their groundwater pumping on an annual, or occasionally monthly, basis using meter readings and/or electrical performance tests.
- Elevation surveys are not available for some non-purveyor-owned wells in the Basin. This creates a small amount of uncertainty in converting groundwater level depth measurements to groundwater elevations. Additionally, the documentation of protocols for measuring "static" groundwater levels at other non-purveyor-owned wells (when they are not pumping) is not readily available. These factors create uncertainty in interpreting groundwater level measurements in the western portion of the Basin and calibrating the groundwater flow model in this area.
- Few wells are present in certain areas—specifically, in the northwestern portion of the Saugus Formation and in certain tributary valleys in the Alluvial Aquifer. This creates uncertainty in calibrating the groundwater flow model in these outlying areas.

Groundwater flow modeling uncertainties pertain to (1) a model's general ability to replicate actual physical conditions in streams and in the subsurface and (2) a model's calibration quality. As discussed in Appendix G, the model development report (GSI, 2021), the regional groundwater flow model for the Basin has been created through a detailed process of planning, construction, and calibration, which has evolved over the course of the past 20 years and included the development of an earlier version of the groundwater flow model (CH2M HILL, 2004) and numerous applications of that earlier model. In the judgment of the GSP development team, the model and its underlying data render the current model a viable and reliable tool for the SCV-GSA and SCV Water to use for development, implementation, and monitoring of the GSP for the Basin, and for other groundwater resource planning and management programs. Nonetheless, despite its detail and the in-depth nature of the calibration and validation process, the groundwater flow model is a simplification of a complex hydrogeologic system and has been designed with certain built-in assumptions. As with any groundwater model, there are data limitations inherent in the use of the model, as described above. Nonetheless, reasonable estimates of conditions for periods when data are missing or are uncertain have been possible to derive in the Basin using information from periods of more detailed recordkeeping. Additionally, the process of calibrating the model to a 40-year record of (1) streamflows at the western basin boundary and (2) groundwater level fluctuations in numerous pumping and non-pumping wells in both the Alluvial Aquifer and the Saugus Formation has provided substantial insights regarding the relative influences of the multiple hydrologic processes across the Basin and in specific locations. As discussed in Appendix G, the model development report, the modeling tools and the basin understanding that have arisen from the process of collecting data routinely for 40 years and fitting a model to those data have provided tools and a historical water budget that likely would not change appreciably if additional calibration refinements were to be sought. This means that the SCV-GSA's approach to maintaining the historical non-overdraft condition and conducting related decision-making is not likely to change with further calibration work, which in turn means that the definition of uncertainty as cited in §351 of the GSP regulations does not exist with regards to the historical water budget.

6.4 Current Water Budget

As discussed in Section 6.2.2.2, the current water budget examines how the land and water uses in 2014 would have affected the Basin on a long-term basis if the 2014 land and water uses were to be repeated throughout the historical precipitation sequence (i.e., the historical precipitation and streamflow conditions during the period 1925 through 2019).

6.4.1 Current Water Uses Under the 2014 Level of Development

The current water budget uses SCV Water's actual 2014 pumping distribution and the overlying land uses that were present that year. The 2014 land uses are believed to be within 1 percent of those found in 2019, based on the number of water accounts served by SCV Water. For other pumpers, the current water budget uses those purveyors' average pumping during the last 10 years. This is consistent with estimation procedures used in past UWMP analyses. Table 6.4-1 shows how human water demands would be satisfied at the current level of development and the associated current level of human water demands and groundwater pumping. Table 6.4-2 shows the annual groundwater pumping by water use sector under the 2014 level of development, as evaluated for the current water budget.

6.4.2 Current Surface Water Budget

For the current water budget (which evaluates the effects of the 2014 level of development and water use for the historical hydrology that occurred during water years 1925 through 2019), the annual surface water budget is shown on Figure 6.4-1 and in Table I-3 of Appendix I.

6.4.2.1 Current Imported Supplies

The historical annual usage of imported water supplies is tabulated in the annual water reports for the Basin (LSCE, 2020) and presented in Table 6.3-1 for the period 1925 through 2019 that is used to report the historical water budget. For the current water budget, the imported water volume is 33,092 AF, which was the actual amount of water imported into the Basin in 2014.

As discussed in the annual water reports for the Santa Clarita Valley (such as LSCE, 2020), SCV Water's imported water supply initially consisted of SWP water only but now includes several additional sources of water outside of the Basin. As of 2020, these programs consist of the following:

- Two water banks (one with the Semitropic Water Storage District [now called the Stored Water Recovery Unit, SWRU] and one with the Rosedale Rio-Bravo Water Storage District)
- Two water exchange programs (one with the Antelope Valley-East Kern Water Agency, and one with the United Water Conservation District)
- An option contract under the Yuba Accord Agreement with DWR and the Yuba County Water Agency

These imported supplies are in addition to the SWP water supply, for which SCV Water holds a contractual Table A amount of 92,500 AFY.[37] During the recent drought, SCV Water's allocations of Table A water (excluding Article 56 carryover water) ranged from 5 percent in 2014 to 60 percent in 2016. After the drought period, the Table A allocations were 85 percent in 2017, 35 percent in 2018, 75 percent in 2019, and 20 percent in 2020.

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[37] The amount of SWP water received by each SWP contractor each year is determined by multiple factors, including the contractor's maximum contracted allotment (referred to as its Table A amount) and the amount of available water supply in the SWP system.

Table 6.4-1. Municipal and Non-Municipal Water Demands and Supplies for the Current Water Budget (Under the 2014 Level of Development)

Municipal Users				Other Users	Total	
Local Groundwater	Imported Water	Recycled Water	Total	Local Groundwater	Local Groundwater	Demand
34,612	33,092	474	68,178	14,623	49,235	82,801

Notes

All values are in units of acre-feet per year (AFY) and are for 365-day years. Values will be higher in leap years.

Municipal supplies are currently provided by SCV Water and Los Angeles County Water Works District 36 (LACWD). Municipal water demands include all commercial and industrial water uses in the Santa Clarita Valley.

Groundwater pumping consists of actual 2014 municipal water use, 2010-2019 average pumping for other pumpers, and 500 AFY for the groundwater pumping/treatment system on the Whittaker-Bermite property.

Other users are FivePoint (The Newhall Land and Farming Company), the Pitchess Detention Center, and Sand Canyon Country Club, which all pump from the Alluvial Aquifer; Valencia County Club, Vista Valencia Golf Course, and the groundwater pumping/treatment system on the Whittaker-Bermite property, all of which pump from the Saugus Formation; and small private domestic well owners, who pump primarily from the Alluvial Aquifer but may also pump small quantities of water from adjoining bedrock units.

Table 6.4-2. Estimated Annual Municipal and Non-Municipal Groundwater Pumping by Water Use Sector for the Basin (Under the 2014 Level of Development)

Water Use Sector	Annual Groundwater Pumping
Agricultural	10,497
Municipal	34,612
Golf Courses	1,044
Rural Domestic	500
Small Public Water Systems	2,082
Whittaker-Bermite Contaminant Treatment/Extraction System	500
Total	**49,235**

Notes

All values are in units of acre-feet per year (AFY) and are for 365-day years. Values will be higher in leap years.

Municipal supplies are currently provided by SCV Water and Los Angeles County Water Works District 36 (LACWD).
Municipal water demands include all commercial and industrial water uses in the Santa Clarita Valley.

Agricultural groundwater use is by The Newhall Land and Farming Company. These pumping volumes do not include agricultural pumping by the Disney Corporation along the southern margin of the basin.

The Pitchess Detention Center is counted as a small public water system for the purpose of calculating the current water budget.

Golf course groundwater is dedicated to golf courses and is not obtained from potable water supplies.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual values because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

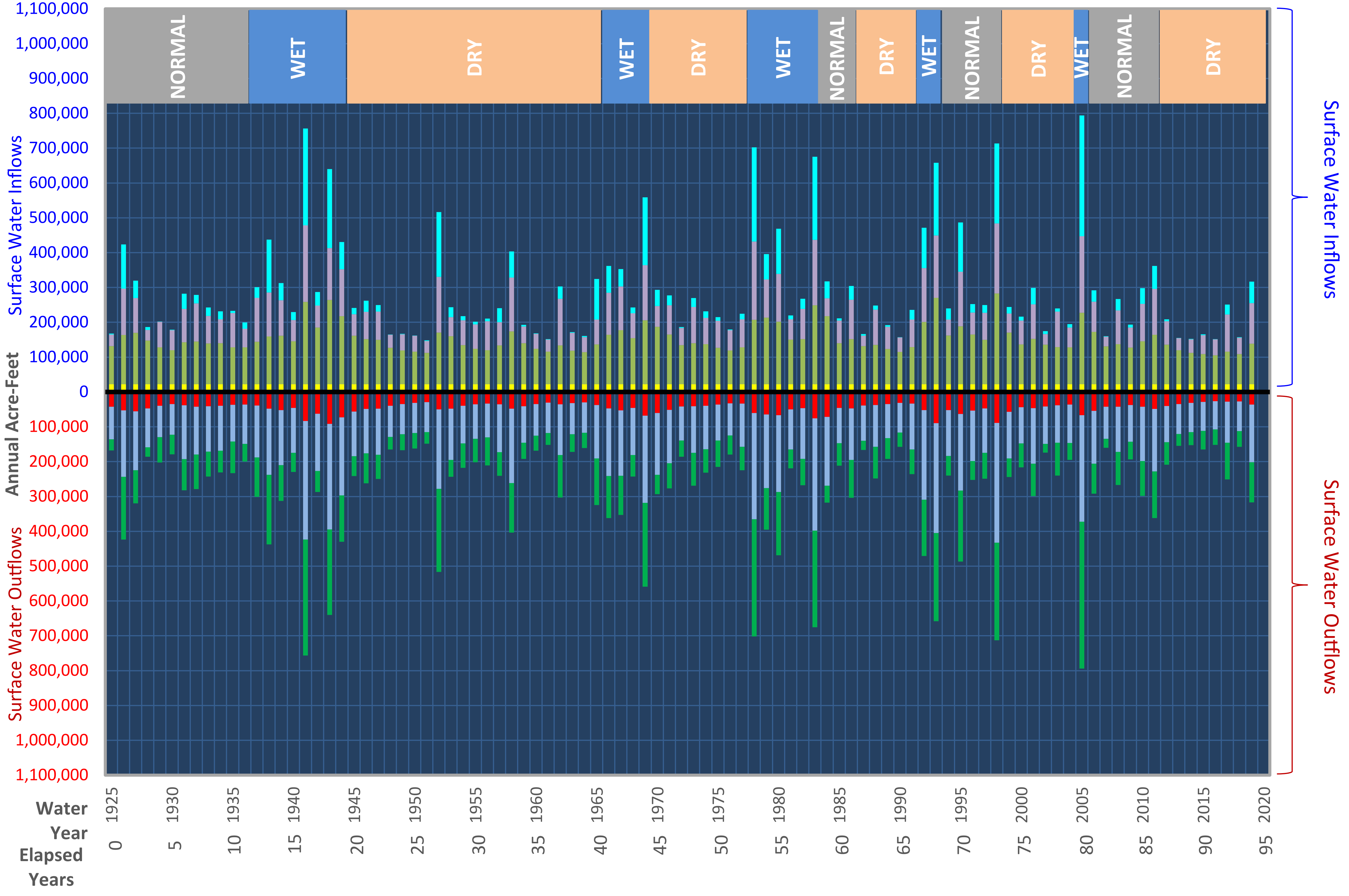

FIGURE 6.4-1

Current Surface Water Budget
Under the 2014
Level of Development

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- ■ Precipitation
- ■ Stream Inflows
- ■ Point-Source Flows to Streams
- ■ Net Inflow from Groundwater
- ■ Non-Storm Flow at County Line
- ■ ET and Storm Outflows
- ■ Groundwater Recharge from Streams and Rainfall

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
ET: evapotranspiration

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6.4.2.2 Current Local Surface Water Inflows

Table 6.4-3 summarizes the average, minimum, and maximum values of these annual surface water inflows to the Basin in the current water budget, as computed by applying the 2014 level of human water demand to the historical hydrology of 1925 through 2019. (See Figure 4-1 and Table I-3 in Appendix I for the annual water budgets during each year.) In-basin precipitation and upwelling of groundwater are the largest sources of inflows to the surface water system, even during below-normal precipitation years (such as the drought years of 2012 through 2016). On average, the next largest sources of streamflow are the combined natural and controlled inflows to the Santa Clara River and its tributaries, followed by discharges to the Santa Clara River in the western portion of the Basin from local WRPs.

6.4.2.3 Current Surface Water Outflows

Surface water outflows for the current water budget are shown in Figure 6.4-1, Table 6.4-4, and Table I-3 of Appendix I. Groundwater recharge in streambeds is the largest outflow term, comprising 43 percent of the total outflow of surface water on average during the period 1925 through 2019. Evaporative losses (ET) and stormwater outflows together comprise 33.5 percent of the total outflow of surface water on average.[38] Non-storm streamflows at the western basin boundary are the next-highest outflow (16 percent on average), followed by groundwater recharge from in-basin precipitation outside of streambeds (7 percent). During drought periods (such as the years 2015, 2016, and 2018), most stormwater generated from precipitation within the Basin is lost to evaporation, because little to no deep percolation of this stormwater occurs.

6.4.3 Current Groundwater Budget

The groundwater budget for current conditions (which simulated the effects of the 2014 level of development and water use for the historical hydrology that occurred during water years 1925 through 2019) is shown on Figure 6.4-2 and in Table I-4 of Appendix I.

6.4.3.1 Current Groundwater Inflows

Table 6.4-5 summarizes the average, minimum, and maximum values of the annual inflows to groundwater in the Basin. The percentage contribution of each recharge term in the current water budget to total groundwater recharge is similar to the percentages in the historical water budget (shown in Table 6.3-5). Recharge from streams provides by far the most important source of recharge to the Basin’s groundwater resources, followed by subsurface inflows and precipitation recharge, with irrigation and septic system recharge being minor contributors.

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[38] As discussed in Section 6.3.2.3 for the historical water budget, the non-storm flows in the Santa Clara River at the western basin boundary under the current water budget include the amount of subsurface outflow that occurs within a thin veneer of alluvium that is present at the western basin boundary, which comprises the western boundary of the groundwater flow model.

Table 6.4-3. Estimated Annual Surface Water Inflows to the Basin for the Current Water Budget (Under the 2014 Level of Development and Using 1925–2019 Rainfall)

Surface Water Inflow Component	Minimum	Maximum	Average	Percent of Total
In-Basin Precipitation	27,400	224,500	87,600	30%
Stormwater Generated from In-Basin Precipitation	25,100	135,800	67,000	---
Stream Inflow (Santa Clara River)	0	37,850	5,170	2%
Stream Inflow (Releases from Castaic Lake/Lagoon)	200	197,500	20,050	7%
Stream Inflow (Releases from Bouquet Reservoir)	110	110	110	0.04%
Stream Inflow (Other Santa Clara River Tributaries)	0	148,400	24,150	8%
Discharges to Santa Clara River from Saugus WRP	5,005	5,020	5,010	2%
Discharges to Santa Clara River from Valencia WRP	16,815	16,860	16,825	6%
Discharges to Santa Clara River from Groundwater Treatment Systems	500	501	500	0.2%
Groundwater Discharge to Streams	83,200	260,450	130,700	45%
Total	148,600	793,800	290,100	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which uses the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-3 of Appendix I.

5% of the releases from Bouquet Reservoir are assumed to remain as surface flow where Bouquet Creek enters the Basin.

The term "Net inflow from Groundwater" is the difference between stream gains and stream losses arising from groundwater/surface water exchanges in the Santa Clara River and its tributaries.

Total values do not include stormwater generated from in-basin precipitation, which is an internal flow process (and not an inflow to, or outflow from, the basin).

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water inflows.

Table 6.4-4. Estimated Annual Surface Water Outflows from the Basin for the Current Water Budget (Under the 2014 Level of Development and Using 1925-2019 Rainfall)

Surface Water Outflow Component	Minimum	Maximum	Average	Percent of Total
Santa Clara River Non-Storm Outflow at the Western Basin Boundary	26,250	91,300	46,000	16%
Groundwater Recharge from Precipitation	0	103,000	20,600	7%
Groundwater Recharge from Streams	81,000	271,200	126,300	43.5%
ET and Stormwater Outflow	25,300	421,700	97,200	33.5%
Total	148,600	793,800	290,100	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which uses the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-3 of Appendix I.

Subsurface outflow through the thin alluvial material beneath the river at the western boundary of the Basin is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water outflows.

ET = evapotranspiration

Table 6.4-5. Estimated Annual Inflows to Groundwater in the Basin for the Current Water Budget (Under the 2014 Level of Development and Using 1925–2019 Rainfall)

Groundwater Inflow Component	Minimum	Maximum	Average	Percent of Total
Recharge from Precipitation	0	103,000	20,600	11%
Recharge from Streams	81,000	271,200	126,300	68%
Subsurface Inflow Beneath Castaic Dam	1,675	1,680	1,675	1%
Subsurface Inflow Beneath Santa Clara River and Other Tributaries	28,000	29,700	29,000	16%
Septic System Percolation	2,430	2,440	2,435	1%
Recharge of Applied Water	5,750	5,760	5,750	3%
Total	120,700	382,000	185,800	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which uses the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-4 of Appendix I.

Deep percolation from irrigation is the sum for agricultural and municipal lands.

Septic system percolation applies to areas served by public water supplies that do not have public sewer collection systems.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual inflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

6.4.3.2 Current Groundwater Outflows

Table 6.4-6 summarizes the average, minimum, and maximum values of the annual outflows (discharges) of groundwater from the Basin. As was seen in the historical water budget for water years 1925 through 2019 (shown in Table 6.3-6), groundwater discharges to streams are by far the largest source of groundwater outflows in the current water budget, with groundwater pumping being the second-largest outflow from the groundwater system. Annual groundwater withdrawals by phreatophytes are substantially lower than the other groundwater discharge mechanisms.

6.4.3.3 Changes in Groundwater Storage Under Current Conditions

The yellow line on Figure 6.4-2 shows how much the volume of stored groundwater changes progressively over time when simulating the effects of the 2014 level of development and water uses through the historical hydrologic record projected forward in time. Figure 6.4-2 shows that the occurrence of rising versus declining slopes in the modeled cumulative-change curve varies frequently during the 95-year historical period and has a shape that is generally similar to the cumulative-change curve for actual historical conditions during that 95-year period (Figure 6.3-3).

Close inspection of Figures 6.3-3 and 6.4-2 also shows that the downward slope of the cumulative-change curve during the drought period for 1945 through 1965 is greater under historical conditions (Figure 6.3-3) than under the 2014 level of development and water uses (Figure 6.4-2). This difference is attributable to the lesser amount of groundwater pumping from the Alluvial Aquifer under the 2014 land and water uses (38,131 AFY) than the approximately 50,000 AFY of pumping that is estimated to have actually occurred from the Alluvial Aquifer during the historical peak agricultural period.

6.4.4 Summary of Basin Condition Under the Current Water Budget

As with the historical water budget, the current water budget assessment for the 2014 level of development and water use in the Basin indicates that no long-term decline in the volume of stored groundwater would be expected to have arisen if the 2014 level of groundwater pumping had occurred throughout the past 95 years. This observation in turn indicates that the Basin likely would not be in an overdraft condition under a sustained level of pumping at the 2014 level of human demand for groundwater. Figure 6.4-3 shows that non-storm flows in the river during the agricultural period are higher when simulating the current (2014) conditions for development, groundwater pumping, and WRP discharges, compared with non-storm river flows under the actual historical pumping condition (Figure 6.3-4).

Table 6.4-6. Estimated Annual Groundwater Outflows from the Basin for the Current Water Budget (Under the 2014 Level of Development and Using 1925–2019 Rainfall)

Groundwater Outflow Component	Minimum	Maximum	Average	Percent of Total
Groundwater Pumping	49,235	49,340	49,260	26%
Riparian Evapotranspiration	5,000	9,150	7,050	4%
Groundwater Discharge to Streams	83,200	260,450	130,700	70%
Total	139,450	318,800	187,000	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which uses the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-4 of Appendix I.

Groundwater discharge to streams is the combined amount in ephemeral and perennial reaches.

Subsurface outflow through the thin alluvial material beneath the river at the western boundary of the Basin is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

The "percent of total" values are computed using the average values shown in this table.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual outflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

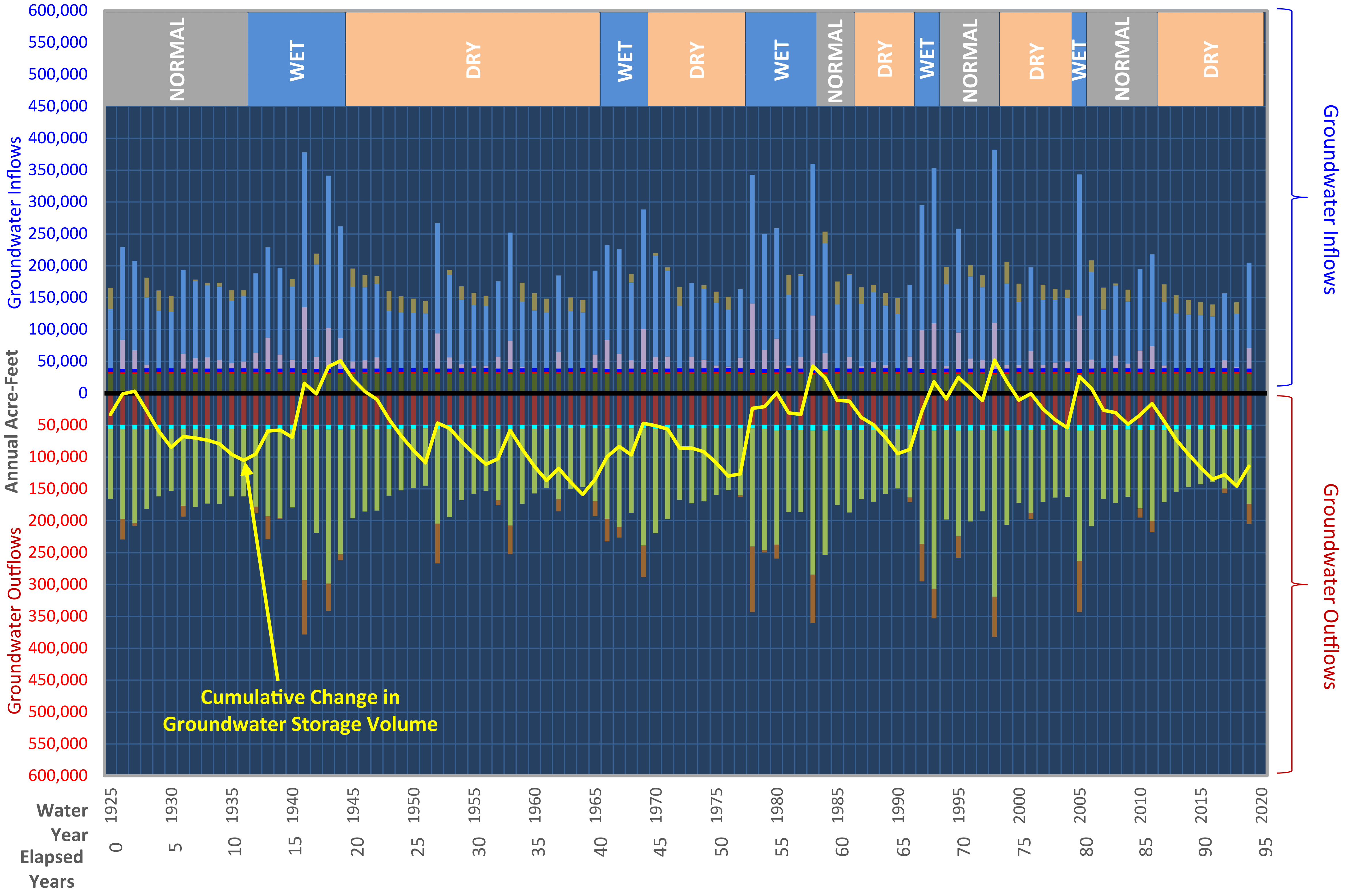

FIGURE 6.4-2

Current Groundwater Budget Under the 2014 Level of Development

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- Stream Gains
- Stream Losses
- Precipitation
- Ag+Muni Irrigation
- Subsurface Inflow in Tributaries
- Septic
- Pumping
- ET
- Groundwater Storage Increase
- Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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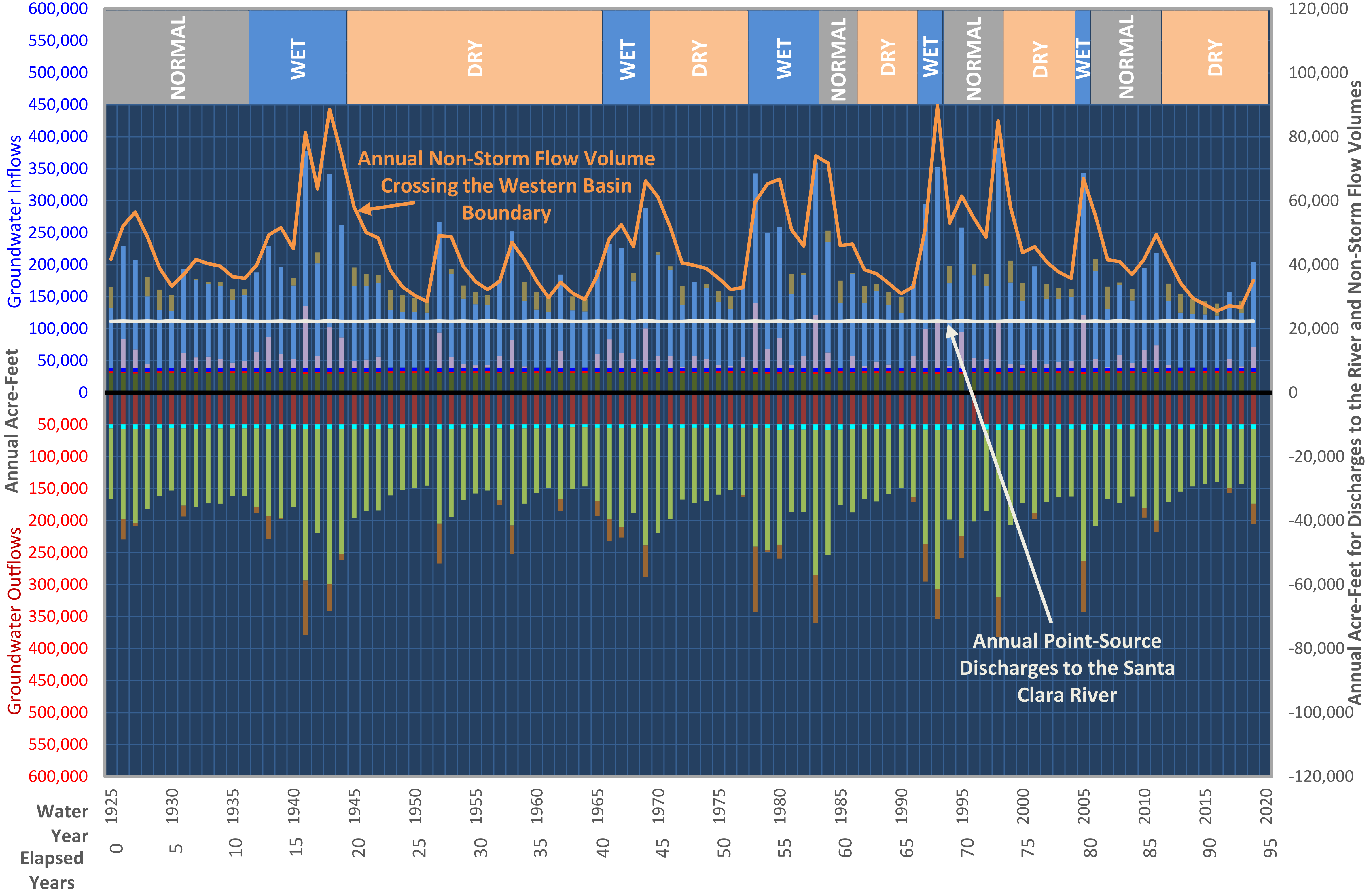

FIGURE 6.4-3

Current Groundwater Budget and Annual Non-Storm Flows at the Western Basin Boundary Under the 2014 Level of Development

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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6.5 Projected Water Budget

As discussed in Section 6.2.2.3, three sets of projected water budgets are developed to quantify the estimated effects of future build-out conditions and climate change in the Basin. Section 6.5.1 presents the details of the water use scenario for these projected water budgets. Sections 6.5.2 through 6.5.4 present the three projected water budgets. Section 6.5.5 summarizes the projected basin conditions, and Section 6.5.6 discusses the uncertainties in the analysis.

6.5.1 Water Use Scenario for Future Projected Conditions

For all three projected water budgets, the water use scenario accounts for full build-out of land uses in the Basin, as identified in the SCAG and OVOV local land-use plans. The SCAG and OVOV full build-out volumes are incorporated into human water demand estimation during preparation of UWMPs for the Basin (KJC et al., 2016; KJ, 2021). The use of groundwater under these land-use plans is based on the existing Basin Operating Plan, which is described in the annual reports for the Basin and in the most recent (2020) and prior (2010 and 2015) UWMPs. The Basin Operating Plan calls for pumping as follows:

	Groundwater Production (AFY)			
	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
Alluvial Aquifer	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus Formation	7,500 to 15,000	15,000 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	**37,500 to 55,000**	**45,000 to 60,000**	**51,000 to 60,000**	**51,000 to 70,000**

Note

AFY = acre-feet per year

The Basin Operating Plan is modeled for future projected conditions as follows:

	Groundwater Production (AFY)			
	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
Alluvial Aquifer	**37,193**	**32,500**	**32,500**	**32,500**
SCV Water, LACWD	30,783	26,090	26,090	26,090
FivePoint	3,459	3,459	3,459	3,459
Pitchess Detention Center	2,082	2,082	2,082	2,082
Sand Canyon Country Club (Robinson Ranch)	369	369	369	369
Small Domestic Pumpers	500	500	500	500
Saugus Formation	**11,100**	**20,000**	**25,000**	**35,000**
SCV Water	9,925	18,825	23,825	33,825
Whittaker-Bermite	500	500	500	500
Valencia Country Club and Vista Valencia Golf Course	675	675	675	675
Total Production	**48,293**	**52,500**	**57,500**	**67,500**

Notes

AFY = acre-feet per year

LACWD = Los Angeles County Waterworks District No. 36, Val Verde

SCV Water = Santa Clarita Valley Water Division

Basin-wide water demand and water usage for the projected future condition is modeled as follows:

	Annual Volume (AFY)			
	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
Municipal Users (SCV Water and LACWD)				
Annual Water Demand	**101,000**	**107,100**	**102,870**	**102,870**
Annual Water Use	**101,000**	**107,100**	**102,870**	**102,870**
Alluvial Aquifer	30,783	26,090	26,090	26,090
Saugus Formation	9,925	18,825	23,825	33,825
Recycled Water	8,961	8,961	8,961	8,961
Imported Water	51,331	53,224	43,994	33,994
Other Water Users (Pumping from the Alluvial Aquifer)				
Annual Water Use	**6,410**	**6,410**	**6,410**	**6,410**
FivePoint	3,459	3,459	3,459	3,459
Pitchess Detention Center	2,082	2,082	2,082	2,082
Sand Canyon Country Club (Robinson Ranch)	369	369	369	369
Small Domestic Pumpers	500	500	500	500
Other Water Users (Pumping from the Saugus Formation)				
Annual Water Use	**1,175**	**1,175**	**1,175**	**1,175**
Whittaker-Bermite	500	500	500	500
Valencia Country Club and Vista Valencia Golf Course	675	675	675	675
Total Groundwater Production				
Total Production	**48,293**	**52,500**	**57,500**	**67,500**
Alluvial Aquifer	37,193	32,500	32,500	32,500
Saugus Formation	11,100	20,000	25,000	35,000

Notes

Consistent with SCV Water's 2020 UWMP, pumping from the Saugus Formation may be higher during the first year of an SWP curtailment for the reasons described in Section 6.5.1.3.

AFY = acre-feet per year

LACWD = Los Angeles County Waterworks District No. 36, Val Verde

SCV Water = Santa Clarita Valley Water Division

In the water budget analyses for projected future conditions, the performance of the Basin is simulated by subjecting the Basin Operating Plan to future full build-out conditions for land and water uses while also (1) simulating a repeat of the 95-year historical hydrologic record (1925 through 2019) and then (2) further adjusting this hydrologic record to account for potential changes in climate at two future time frames (the years 2030 and 2070). The definition of normal versus dry years is governed by (1) local hydrologic (precipitation) conditions and Saugus Formation groundwater production volumes in the case of pumping from the Alluvial Aquifer and (2) the allocation amounts of imported water supplies in the case of pumping from the Saugus Formation. The year-to-year patterns of normal-year and dry-year pumping in the Alluvial Aquifer and the Saugus Formation are shown in Table 6.5-1 and discussed in Section 6.5.1.1 for the Saugus Formation and in Section 6.5.1.2 for the Alluvial Aquifer. The magnitudes of groundwater pumping by SCV Water and other groundwater users are discussed in Section 6.5.1.3, and the generation and use of recycled water is discussed in Section 6.5.1.4.

6.5.1.1 Variations in Normal-Year and Dry-Year Pumping (Saugus Formation)

The Basin Operating Plan draws upon the groundwater storage reserves of the Saugus Formation to augment imported supplies during drought years in the SWP system, then reduces Saugus Formation pumping at other times to facilitate the natural replenishment of those reserves. This operating plan is integral to the water resources plan for SCV that has been described in its 2020 and two prior (2010 and 2015) UWMPs.

As discussed in Section 6.1.1.3 and Section 6.3.2, SCV Water has acquired additional supplies of imported water that can be accessed when SWP supplies are curtailed. Accordingly, estimates of SWP deliveries to SCV Water under existing and future conditions in the SWP (as published by DWR in its biannual DCRs) by themselves do not reflect the full amount of imported supply that is available to SCV Water (from the SWP and other sources). Nonetheless, DWR's most recent DCR (DWR, 2020) was used as the basis for identifying the sequence of normal-year and dry-year pumping from the Saugus Formation in the projected water budget, given that the DCR provides a direct and easy-to-understand mechanism for defining the sequence of SWP availability and hence pumping patterns in the Saugus Formation. Table 6.5-2 shows the relationship of SWP deliveries to the definition of Saugus Formation pumping year types, based on (1) SWP delivery estimates for SCV Water that are published in the Final 2019 DCR for the period of 1922 through 2003 and (2) the actual availability to SCV Water of SWP supplies during the period of 2004 through 2019. As shown in Table 6.5-2, it is estimated that approximately 24 of the past 98 years of the historical record (from 1922 through 2019) could have been characterized as years when Saugus pumping would be at dry-year rates, including four dry-year periods lasting between 3 and 7 years, one dry-year period lasting 2 years, and a single dry year (1977) when the allocation would have been about 11 percent or less and thereby warranted pumping the Saugus Formation at its Dry Year 3 rate. In addition to the 24 dry years, another 12 years would have been transitional (post-drought) years in which pumping would have remained at dry-year rates during the winter and early spring and then would have been returned to normal-year rates in May or June once SWP delivery volumes were better known for the remainder of the calendar year.

6.5.1.2 Variations in Normal-Year and Dry-Year Pumping (Alluvial Aquifer)

The sequence of normal-year and dry-year pumping from the Alluvial Aquifer is shown in Table 6.5-3. The determination of the year type in any given year is based primarily on the amount of rainfall that occurred in the basin during the prior year. A dry year for Alluvial Aquifer pumping is considered to occur when annual rainfall during the prior year is less than 85 percent of the long-term average rainfall.

The year type for the Alluvial Aquifer factors into the geographic distribution of pumping from this aquifer. Two geographic distributions are used in the projected water budget, as shown in Table 6.5-3. A normal-year distribution of pumping occurs when the local hydrology is normal or wet, as long as the Saugus Formation is not being pumped above its normal-year rate. During years when the local hydrology is dry and/or when the Saugus Formation is pumped above its normal-year rate, the geographic distribution of pumping from the Alluvial Aquifer is based on the geographic distribution that occurred in 2014, which was characterized by reducing pumping in the eastern portion of the Alluvial Aquifer (east of the Bouquet Canyon Road crossing of the Santa Clara River) and increasing pumping in the central portion of the Alluvial Aquifer (between the Bouquet Canyon Road bridge crossing and I-5). While the **geographic distribution** of pumping from the Alluvial Aquifer is determined by the year type and by the Saugus pumping rate, the **total volume** of pumping from the Alluvial Aquifer in any given year is based solely on the amount of pumping occurring from the Saugus Formation.

Table 6.5-1. Year Types for Groundwater Pumping (Calendar Years 1925–2019)

Calendar Year	Year Type for Groundwater Pumping from the Alluvial Aquifer	Year Type for Groundwater Pumping from the Saugus Formation
1925	Dry Year 2	Dry Year 2
1926	Dry Year 3	Dry Year 3
1927	Normal	Post-Drought
1928	Normal	Normal
1929	Dry Year 1	Dry Year 1
1930	Dry Year 2	Dry Year 2
1931	Dry Year 3	Dry Year 3
1932	Normal	Dry Year 4
1933	Dry Year 1	Dry Year 5
1934	Normal	Dry Year 6
1935	Dry Year 1	Post-Drought
1936	Dry Year 2	Normal
1937	Normal	Normal
1938	Normal	Normal
1939	Normal	Normal
1940	Dry Year 1	Normal
1941	Normal	Normal
1942	Normal	Normal
1943	Dry Year 1	Normal
1944	Normal	Normal
1945	Normal	Normal
1946	Normal	Normal
1947	Normal	Normal
1948	Dry Year 1	Normal
1949	Dry Year 2	Dry Year 1
1950	Dry Year 3	Post-Drought
1951	Dry Year 4	Normal
1952	Dry Year 5	Normal
1953	Normal	Normal
1954	Dry Year 1	Normal
1955	Dry Year 2	Dry Year 1
1956	Dry Year 3	Post-Drought
1957	Dry Year 4	Normal
1958	Dry Year 5	Normal
1959	Normal	Normal
1960	Dry Year 1	Normal
1961	Dry Year 2	Dry Year 1
1962	Dry Year 3	Post-Drought
1963	Dry Year 4	Normal

Table 6.5-1. Year Types for Groundwater Pumping (Calendar Years 1925–2019)

Calendar Year	Year Type for Groundwater Pumping from the Alluvial Aquifer	Year Type for Groundwater Pumping from the Saugus Formation
1964	Dry Year 5	Normal
1965	Dry Year 6	Normal
1966	Normal	Normal
1967	Dry Year 1	Normal
1968	Normal	Normal
1969	Dry Year 1	Normal
1970	Normal	Normal
1971	Normal	Normal
1972	Dry Year 1	Normal
1973	Dry Year 2	Normal
1974	Dry Year 3	Normal
1975	Dry Year 4	Normal
1976	Dry Year 5	Normal
1977	Dry Year 6	Dry Year 3
1978	Dry Year 7	Post-Drought
1979	Normal	Normal
1980	Normal	Normal
1981	Normal	Normal
1982	Dry Year 1	Normal
1983	Normal	Normal
1984	Normal	Normal
1985	Dry Year 1	Normal
1986	Dry Year 2	Normal
1987	Dry Year 3	Normal
1988	Dry Year 4	Dry Year 1
1989	Dry Year 5	Post-Drought
1990	Dry Year 6	Dry Year 2
1991	Dry Year 7	Dry Year 3
1992	Dry Year 8	Dry Year 4
1993	Normal	Post-Drought
1994	Normal	Dry Year 5
1995	Dry Year 1	Post-Drought
1996	Normal	Normal
1997	Normal	Normal
1998	Dry Year 1	Normal
1999	Normal	Normal
2000	Dry Year 1	Normal
2001	Dry Year 2	Dry Year 1
2002	Dry Year 3	Post-Drought

Table 6.5-1. Year Types for Groundwater Pumping (Calendar Years 1925–2019)

Calendar Year	Year Type for Groundwater Pumping from the Alluvial Aquifer	Year Type for Groundwater Pumping from the Saugus Formation
2003	Dry Year 4	Normal
2004	Dry Year 5	Normal
2005	Normal	Normal
2006	Normal	Normal
2007	Dry Year 1	Normal
2008	Dry Year 2	Dry Year 1
2009	Dry Year 3	Dry Year 2
2010	Dry Year 4	Post-Drought
2011	Normal	Normal
2012	Normal	Normal
2013	Dry Year 1	Normal
2014	Dry Year 2	Dry Year 1
2015	Dry Year 3	Dry Year 2
2016	Dry Year 4	Dry Year 3
2017	Dry Year 5	Post-Drought
2018	Dry Year 6	Normal
2019	Dry Year 7	Normal

Notes

Information is presented on a calendar-year basis, to be consistent with information presented by DWR for SWP delivery reliability (which determines the year type for pumping from the Saugus Formation).

DWR = California Department of Water Resources

SWP = State Water Project

Tan = local dry year, which has a different geographic distribution of pumping than normal years in the case of the Alluvial Aquifer, and which dictates the rate of pumping in the case of the Saugus Formation. The annual pumping volume from the Alluvial Aquifer in any given year is based on the year type for the Saugus Formation.

Blue = year of increased SWP deliveries and a return to normal-year pumping from the Saugus Formation by May or June.

Table 6.5-2. SWP Deliveries and Relationship to Future Saugus Formation Pumping

Historical Calendar Year	Historical SWP Hydrology	SWP Deliveries to SCV Water (Percent of Max. Table A + Article 56 Deliveries)[a]		Saugus Formation Pumping Year Type	
		Existing Conditions	Future Conditions		
1922	Above Normal	49%	47%	Normal	
1923	Below Normal	75%	91%	Normal	
1924	Critical	32%	27%	Dry Year 1	3-Year Dry Period (1924-1926)
1925	Dry	26%	33%	Dry Year 2	
1926	Dry	39%	29%	Dry Year 3	
1927	Wet	53%	57%	Post-Drought	
1928	Above Normal	76%	67%	Normal	
1929	Critical	48%	37%	Dry Year 1	6-Year Dry Period (1929-1934)
1930	Dry	14%	23%	Dry Year 2	
1931	Critical	37%	37%	Dry Year 3	
1932	Dry	29%	14%	Dry Year 4	
1933	Critical	38%	39%	Dry Year 5	
1934	Critical	20%	14%	Dry Year 6	
1935	Below Normal	42%	55%	Post-Drought	
1936	Below Normal	54%	57%	Normal	
1937	Below Normal	52%	57%	Normal	
1938	Wet	79%	66%	Normal	
1939	Dry	88%	82%	Normal	
1940	Above Normal	49%	56%	Normal	
1941	Wet	60%	52%	Normal	
1942	Wet	85%	57%	Normal	
1943	Wet	80%	65%	Normal	
1944	Dry	43%	46%	Normal	
1945	Below Normal	53%	53%	Normal	
1946	Below Normal	73%	65%	Normal	
1947	Dry	56%	52%	Normal	
1948	Below Normal	46%	53%	Normal	
1949	Dry	39%	26%	Dry Year 1	Single Dry Year
1950	Below Normal	48%	51%	Post-Drought	
1951	Above Normal	48%	54%	Normal	
1952	Wet	80%	73%	Normal	
1953	Wet	99%	60%	Normal	
1954	Above Normal	65%	58%	Normal	
1955	Dry	41%	45%	Dry Year 1	Single Dry Year
1956	Wet	47%	55%	Post-Drought	
1957	Above Normal	93%	73%	Normal	
1958	Wet	54%	63%	Normal	
1959	Below Normal	94%	57%	Normal	
1960	Dry	52%	32%	Normal	
1961	Dry	37%	42%	Dry Year 1	Single Dry Year
1962	Below Normal	49%	55%	Post-Drought	
1963	Wet	58%	63%	Normal	
1964	Dry	64%	58%	Normal	
1965	Wet	60%	56%	Normal	
1966	Below Normal	51%	58%	Normal	
1967	Wet	75%	54%	Normal	
1968	Below Normal	99%	85%	Normal	
1969	Wet	58%	58%	Normal	
1970	Wet	74%	67%	Normal	
1971	Wet	77%	50%	Normal	
1972	Below Normal	59%	42%	Normal	
1973	Above Normal	62%	58%	Normal	
1974	Wet	70%	74%	Normal	
1975	Wet	95%	81%	Normal	
1976	Critical	73%	48%	Normal	
1977	Critical	7%	11%	Dry Year 3	Single Critical Dry Year (1977)
1978	Above Normal	42%	56%	Post-Drought	
1979	Below Normal	94%	48%	Normal	
1980	Above Normal	62%	54%	Normal	
1981	Dry	83%	70%	Normal	
1982	Wet	52%	56%	Normal	
1983	Wet	77%	68%	Normal	
1984	Wet	73%	78%	Normal	
1985	Dry	53%	81%	Normal	
1986	Wet	61%	54%	Normal	
1987	Dry	62%	35%	Normal	
1988	Critical	12%	11%	Dry Year 1	7-Year Dry Period (1988-1994)
1989	Dry	50%	55%	Post-Drought	
1990	Critical	13%	14%	Dry Year 2	
1991	Critical	26%	22%	Dry Year 3	
1992	Critical	18%	20%	Dry Year 4	
1993	Above Normal	54%	57%	Post-Drought	
1994	Critical	45%	32%	Dry Year 5	
1995	Wet	51%	56%	Post-Drought	

Table 6.5-2. SWP Deliveries and Relationship to Future Saugus Formation Pumping

Historical Calendar Year	Historical SWP Hydrology	SWP Deliveries to SCV Water (Percent of Max. Table A + Article 56 Deliveries)[a]		Saugus Formation Pumping Year Type	
		Existing Conditions	Future Conditions		
1996	Wet	57%	56%	Normal	
1997	Wet	71%	72%	Normal	
1998	Wet	84%	68%	Normal	
1999	Wet	100%	100%	Normal	
2000	Above Normal	66%	86%	Normal	
2001	Dry	58%	18%	Dry Year 1	Single Dry Year
2002	Dry	41%	43%	Post-Drought	
2003	Above Normal	49%	52%	Normal	
2004	Below Normal / Dry	65%		Normal	
2005	Wet / Above Normal	90%		Normal	
2006	Wet / Wet	100%		Normal	
2007	Dry / Critical	60%		Normal	
2008	Critical	35%		Dry Year 1	2-Year Dry Period (2008-2009)
2009	Dry	40%		Dry Year 2	
2010	Below Normal	50%		Post-Drought	
2011	Wet	80%		Normal	
2012		65%		Normal	
2013		35%		Normal	
2014		5%		Dry Year 1	3-Year Dry Period (2014-2016)
2015		20%		Dry Year 2	
2016		60%		Dry Year 3	
2017		85%		Post-Drought	
2018		35%		Normal	
2019		75%		Normal	

Notes

[a] Delivery values for calendar years 1922 through 2003 are from the document *Technical Addendum to The State Water Project Final Delivery Capability Report 2019* (DWR, August 26, 2020); see Table A-7 for existing conditions and Table B-9 for future (2035) conditions. The percentages for those years are from CALSIM II simulations and reported by DWR for the sum of Table A Water and Article 56 water (the latter of which consists of carryover water from the prior year). Values in calendar years 2004 through 2019 are not simulated by CALSIM II but instead are the percentages of Table A water that were available to SCV Water during those years (excluding Article 56 water). In any given future year, actual deliveries may include carryover water from the prior year (Article 56 deliveries) and/or turnback-pool water.

SCV Water = Santa Clarita Valley Water Agency SWP = State Water Project

Tan = significant curtailment year in the SWP, and therefore a year of increased pumping from the Saugus Formation.

Blue = year of increased SWP deliveries and a return to normal-year pumping from the Saugus Formation by May or June.

Table 6.5-3. Derivation of Year Types for Geographic Distribution of Pumping in the Alluvial Aquifer (Calendar Years 1925–2019)

Calendar Year	Precipitation (inches)	Year Type for Alluvial Aquifer Pumping	Logic	Geographic Distribution of Alluvial Aquifer Pumping
1922	31.07	Normal	Assume normal-year pumping	Historical Normal Years
1923	13.63	Normal	Rainfall is well above normal; assume normal-year pumping	Historical Normal Years
1924	8.01	Dry Year 1	Prior-year rainfall is modestly below normal; drought begins	Historical Dry Year 2014
1925	7.49	Dry Year 2	Prior-year rainfall is below normal	Historical Dry Year 2014
1926	25.53	Dry Year 3	Prior-year rainfall is below normal	Historical Dry Year 2014
1927	23.66	Normal	Prior-year rainfall is well above normal; resume normal-year pumping	Historical Normal Years
1928	11.24	Normal	Prior-year rainfall is above normal; continue normal-year pumping	Historical Normal Years
1929	9.04	Dry Year 1	Prior-year rainfall is modestly below normal; drought begins	Historical Dry Year 2014
1930	13.98	Dry Year 2	Prior-year rainfall is below normal	Historical Dry Year 2014
1931	24.41	Dry Year 3	Prior-year rainfall is below normal	Historical Dry Year 2014
1932	13.73	Normal	Prior-year rainfall is well above normal, but Saugus is pumping at dry-year rates	Historical Dry Year 2014
1933	20.52	Dry Year 1	Prior-year rainfall is modestly below normal; drought begins	Historical Dry Year 2014
1934	18.05	Normal	Prior-year rainfall is modestly above normal, but Saugus is pumping at dry-year rates	Historical Dry Year 2014
1935	12.21	Dry Year 1	Prior-year rainfall is only modestly above normal; dry-year pumping continues	Historical Dry Year 2014
1936	20.47	Dry Year 2	Prior-year rainfall is below normal	Historical Dry Year 2014
1937	17.92	Normal	Prior-year rainfall is modestly above normal; resume normal-year pumping	Historical Normal Years
1938	32.75	Normal	Prior-year rainfall is normal; resume normal-year pumping	Historical Normal Years
1939	11.27	Normal	Prior-year rainfall is substantially above normal; resume normal-year pumping	Historical Normal Years
1940	21.37	Dry Year 1	Prior-year rainfall is modestly below normal; drought begins	Historical Dry Year 2014
1941	42.14	Normal	Prior-year rainfall is modestly above normal; resume normal-year pumping	Historical Normal Years
1942	7.10	Normal	Prior-year rainfall is substantially above normal; resume normal-year pumping	Historical Normal Years
1943	37.03	Dry Year 1	Prior-year rainfall is substantially below normal; drought begins	Historical Dry Year 2014
1944	24.63	Normal	Prior-year rainfall is substantially above normal; resume normal-year pumping	Historical Normal Years
1945	14.56	Normal	Prior-year rainfall is above normal; continue normal-year pumping	Historical Normal Years
1946	21.71	Normal	Prior-year rainfall is slightly below normal; continue normal-year pumping	Historical Normal Years
1947	4.16	Normal	Prior-year rainfall is above normal; continue normal-year pumping	Historical Normal Years
1948	9.13	Dry Year 1	Prior-year rainfall is substantially below normal; drought begins	Historical Dry Year 2014
1949	9.93	Dry Year 2	Prior-year rainfall is below normal	Historical Dry Year 2014
1950	6.84	Dry Year 3	Prior-year rainfall is below normal	Historical Dry Year 2014
1951	12.42	Dry Year 4	Prior-year rainfall is below normal	Historical Dry Year 2014
1952	34.19	Dry Year 5	Prior-year rainfall is below normal	Historical Dry Year 2014
1953	4.88	Normal	Prior-year rainfall is substantially above normal; resume normal-year pumping	Historical Normal Years
1954	15.82	Dry Year 1	Prior-year rainfall is substantially below normal; drought begins	Historical Dry Year 2014
1955	13.91	Dry Year 2	Prior-year rainfall is below normal	Historical Dry Year 2014
1956	14.21	Dry Year 3	Prior-year rainfall is below normal	Historical Dry Year 2014
1957	22.85	Dry Year 4	Prior-year rainfall is below normal	Historical Dry Year 2014
1958	23.14	Dry Year 5	Prior-year rainfall is only modestly above normal; dry-year pumping continues	Historical Dry Year 2014
1959	9.81	Normal	Second year of modestly above normal rainfall; resume normal-year pumping	Historical Normal Years
1960	11.64	Dry Year 1	Prior-year rainfall is substantially below normal; drought begins	Historical Dry Year 2014
1961	8.82	Dry Year 2	Prior-year rainfall is below normal	Historical Dry Year 2014
1962	21.22	Dry Year 3	Prior-year rainfall is below normal	Historical Dry Year 2014
1963	12.79	Dry Year 4	Prior-year rainfall is only modestly above normal; dry-year pumping continues	Historical Dry Year 2014
1964	10.09	Dry Year 5	Prior-year rainfall is below normal	Historical Dry Year 2014
1965	32.28	Dry Year 6	Prior-year rainfall is below normal	Historical Dry Year 2014
1966	14.57	Normal	Prior-year rainfall is substantially above normal; resume normal-year pumping	Historical Normal Years
1967	23.23	Dry Year 1	Prior-year rainfall is modestly below normal; drought begins	Historical Dry Year 2014
1968	6.90	Normal	Second year of modestly above normal rainfall; resume normal-year pumping	Historical Normal Years
1969	32.42	Dry Year 1	Prior-year rainfall is below normal	Historical Dry Year 2014
1970	23.19	Normal	Prior-year rainfall is substantially above normal; resume normal-year pumping	Historical Normal Years
1971	13.75	Normal	Prior-year rainfall is above normal; continue normal-year pumping	Historical Normal Years
1972	4.15	Dry Year 1	Prior-year rainfall is modestly below normal; drought begins	Historical Dry Year 2014
1973	19.79	Dry Year 2	Prior-year rainfall is below normal	Historical Dry Year 2014
1974	18.04	Dry Year 3	Prior-year rainfall is only modestly above normal; dry-year pumping continues	Historical Dry Year 2014
1975	10.92	Dry Year 4	Prior-year rainfall is only modestly above normal; dry-year pumping continues	Historical Dry Year 2014
1976	14.02	Dry Year 5	Prior-year rainfall is below normal	Historical Dry Year 2014
1977	20.87	Dry Year 6	Prior-year rainfall is below normal	Historical Dry Year 2014
1978	42.17	Dry Year 7	Prior-year rainfall is only modestly above normal; dry-year pumping continues	Historical Dry Year 2014
1979	21.47	Normal	Prior-year rainfall is substantially above normal; resume normal-year pumping	Historical Normal Years
1980	24.32	Normal	Prior-year rainfall is above normal; continue normal-year pumping	Historical Normal Years
1981	13.42	Normal	Prior-year rainfall is above normal; continue normal-year pumping	Historical Normal Years
1982	20.20	Dry Year 1	Prior-year rainfall is modestly below normal; drought begins	Historical Dry Year 2014
1983	39.07	Normal	Prior-year rainfall is modestly above normal; resume normal-year pumping	Historical Normal Years
1984	12.86	Normal	Prior-year rainfall is above normal; continue normal-year pumping	Historical Normal Years
1985	8.37	Dry Year 1	Prior-year rainfall is modestly below normal; drought begins	Historical Dry Year 2014
1986	18.02	Dry Year 2	Prior-year rainfall is below normal	Historical Dry Year 2014
1987	14.45	Dry Year 3	Prior-year rainfall is only slightly above normal; dry-year pumping continues	Historical Dry Year 2014
1988	16.92	Dry Year 4	Prior-year rainfall is modestly below normal; drought begins	Historical Dry Year 2014
1989	7.56	Dry Year 5	Prior-year rainfall is below normal	Historical Dry Year 2014
1990	6.98	Dry Year 6	Prior-year rainfall is below normal	Historical Dry Year 2014
1991	17.21	Dry Year 7	Prior-year rainfall is below normal	Historical Dry Year 2014
1992	32.03	Dry Year 8	Prior-year rainfall is near normal; dry-year pumping continues	Historical Dry Year 2014
1993	31.50	Normal	Prior-year rainfall is substantially above normal; resume normal-year pumping	Historical Normal Years
1994	10.27	Normal	Prior-year rainfall is above normal; continue normal-year pumping	Historical Normal Years
1995	29.15	Dry Year 1	Prior-year rainfall is substantially below normal; drought begins	Historical Dry Year 2014
1996	15.79	Normal	Prior-year rainfall is substantially above normal; resume normal-year pumping	Historical Normal Years
1997	7.11	Normal	Prior-year rainfall is near normal; normal-year pumping continues	Historical Normal Years
1998	28.19	Dry Year 1	Prior-year rainfall is substantially below normal; drought begins	Historical Dry Year 2014
1999	8.96	Normal	Prior-year rainfall is substantially above normal; resume normal-year pumping	Historical Normal Years
2000	13.64	Dry Year 1	Prior-year rainfall is substantially below normal; drought begins	Historical Dry Year 2014
2001	18.81	Dry Year 2	Prior-year rainfall is below normal	Historical Dry Year 2014
2002	7.83	Dry Year 3	Prior-year rainfall is only slightly above normal; dry-year pumping continues	Historical Dry Year 2014
2003	15.58	Dry Year 4	Prior-year rainfall is below normal	Historical Dry Year 2014
2004	22.79	Dry Year 5	Prior-year rainfall is below normal	Historical Dry Year 2014
2005	37.15	Normal	Prior-year rainfall is modestly above normal; resume normal-year pumping	Historical Normal Years
2006	13.89	Normal	Prior-year rainfall is substantially above normal; continue normal-year pumping	Historical Normal Years
2007	5.78	Dry Year 1	Prior-year rainfall is modestly below normal; drought begins	Historical Dry Year 2014

Table 6.5-3. Derivation of Year Types for Geographic Distribution of Pumping in the Alluvial Aquifer (Calendar Years 1925–2019)

Calendar Year	Precipitation (inches)	Year Type for Alluvial Aquifer Pumping	Logic	Geographic Distribution of Alluvial Aquifer Pumping
2008	18.21	Dry Year 2	Prior-year rainfall is below normal	Historical Dry Year 2014
2009	11.59	Dry Year 3	Prior-year rainfall is only slightly above normal; dry-year pumping continues	Historical Dry Year 2014
2010	24.32	Dry Year 4	Prior-year rainfall is below normal	Historical Dry Year 2014
2011	16.03	Normal	Prior-year rainfall is modestly above normal; resume normal-year pumping	Historical Normal Years
2012	8.95	Normal	Prior-year rainfall is slightly below normal; normal-year pumping continues	Historical Normal Years
2013	3.75	Dry Year 1	Prior-year rainfall is substantially below normal; drought begins	Historical Dry Year 2014
2014	13.27	Dry Year 2	Prior-year rainfall is below normal	Historical Dry Year 2014
2015	6.06	Dry Year 3	Prior-year rainfall is below normal	Historical Dry Year 2014
2016	13.35	Dry Year 4	Prior-year rainfall is below normal	Historical Dry Year 2014
2017	14.88	Dry Year 5	Prior-year rainfall is below normal	Historical Dry Year 2014
2018	12.68	Dry Year 6	Prior-year rainfall is below normal	Historical Dry Year 2014
2019	23.75	Dry Year 7	Prior-year rainfall is below normal	Historical Dry Year 2014
Average (1925-2019)	**17.26**		**Number of Years with Normal Geographic Distribution**	**31 of 95 Years**
Median (1925-2019)	**14.57**		**Number of Years with 2014 Geographic Distribution**	**64 of 95 Years**
85% of Average	**14.67**			
115% of Average	**19.85**			

Notes

For Alluvial Aquifer pumping, the first dry year occurs when rainfall is below 85% of the median rainfall.

Information in this table is presented on a calendar-year basis, to facilitate comparison with the yearly sequence for the Saugus Formation (in Tables 6.5-1 and 6.5-2).

Tan = local dry year, which has a different geographic distribution of pumping than normal years in the case of the Alluvial Aquifer.
The annual pumping volume from the Alluvial Aquifer in any given year is based on the year type for the Saugus Formation.

Orange = Prior-year rainfall is well above normal, but the geographic distribution of Alluvial Aquifer pumping is the dry-year distribution because the Saugus Formation is pumping at dry-year rates.

6.5.1.3 Projected Groundwater Pumping Volumes and Uses

The primary aspects of water use that are simulated in the groundwater flow model for full build-out conditions in the Basin are (1) groundwater pumping under the Basin Operating Plan; (2) retirement of agricultural lands in the Basin, with the exception of the Disney Corporation; (3) construction of new urban developments as identified in local land-use plans; and (4) recycled water uses and discharges of treated water from WRPs into the Santa Clara River. Table 6.5-4 shows the distribution of pumping by water-use sector for each aquifer and year type, and Table 6.5-5 shows the year-by-year amounts of pumping from the two principal aquifers (the Alluvial Aquifer and the Saugus Formation) in the projected water budget. Specific details regarding the design of the water-use scenario for full build-out conditions are as follows:

- Groundwater pumping from the Alluvial Aquifer during normal years is 37,193 AFY. During years of increased Saugus Formation pumping (as a result of curtailments of SWP supplies), municipal pumping from the Alluvial Aquifer is reduced by 4,693 AFY, which results in 32,500 AFY of total pumping from this aquifer. Additional aspects of Alluvial Aquifer pumping in the projected water budgets are as follows:
    - Consistent with the Newhall Ranch Specific Plan (Impact Sciences, 2003) and other agreements, groundwater pumping from Alluvial Aquifer irrigation wells owned by Newhall Land is reduced by 7,038 AFY. Corresponding adjustments to municipal pumping are shown in Table 6.5-4. These changes in pumping are assumed to involve the decommissioning of some or all of Newhall Land's existing C and E series of wells located along and near the lower portion of the alluvial valley that includes Castaic Creek, to be replaced by pumping from existing and future SCV Water wells.
    - Newhall Land continues pumping, on average, an assumed 3,459 AFY of Alluvial Aquifer groundwater from its B series wells, which are the furthest west of its existing agricultural supply wells. This water is assumed to be conveyed out of the Basin to land parcels owned by Newhall Land in the Piru Basin.
- Groundwater pumping from the Saugus Formation during normal years is 11,100 AFY, which consists of the actual 2014 historical groundwater pumping volume (10,600 AFY) plus an assumed 500 AFY of pumping for containment and treatment of a contaminant plume on the Whittaker-Bermite property (near the mouth of the South Fork Santa Clara River). During the first, second, third and ongoing years of increased Saugus pumping, total pumping from this aquifer is capped at volumes of 20,000 AFY, 25,000 AFY, and 35,000 AFY, respectively, which includes the 500 AFY of site remediation pumping occurring on the Whittaker-Bermite property. If the first year of increased Saugus pumping is a year of an especially significant curtailment in SWP water deliveries, as occurred in 1977, then SCV Water may elect to pump as much as 33,825 AFY from the Saugus Formation during the first year of SWP curtailments (resulting in 35,000 AFY of total pumping from the Saugus Formation) and then reduce Saugus pumping in one or more subsequent years if the curtailment persists. Saugus pumping at a basin-wide rate of 35,000 AFY would include operating at least six new wells, two of which are currently in final design and are awaiting approval from the California Division of Drinking Water.
- Newhall Land's agricultural lands in the Basin are retired, with no further irrigation for agricultural purposes except by the Disney Corporation, which pumps localized Saugus Formation groundwater along the southern margin of the Basin. Irrigation for urban uses occurs inside Newhall Ranch, in four other communities being developed by Newhall Land, and in other currently undeveloped areas identified in local land-use plans for future development.
- The treatment system that is currently treating groundwater pumped from the Whittaker-Bermite property discharges 500 AFY of treated water to the Santa Clara River at its existing outfall, located about 1 mile upstream of the Saugus WRP.

Table 6.5-4. Annual Municipal and Non-Municipal Groundwater Pumping by Water Use Sector for the Current and Projected Water Budgets in the Basin

			Future			
Groundwater Pumpers	**Type of Water Use**	**Current Conditions**	**Normal Years**	**Dry Year 1**	**Dry Year 2**	**Dry Year 3+**
Alluvial Aquifer						
Municipal	Municipal	24,687	30,783	26,090	26,090	26,090
FivePoint	Agricultural	10,497	3,459	3,459	3,459	3,459
Pitchess	Small Public Water System	2,082	2,082	2,082	2,082	2,082
Robinson Ranch	Golf Course	369	369	369	369	369
Domestic	Domestic	500	500	500	500	500
	Subtotal	**38,135**	**37,193**	**32,500**	**32,500**	**32,500**
Saugus Formation						
Municipal	Municipal	9,925	9,925	18,825	23,825	33,825
Valencia Country Club & Vista Valencia	Golf Course	675	675	675	675	675
Whittaker-Bermite	Site Remediation	500	500	500	500	500
	Subtotal	**11,100**	**11,100**	**20,000**	**25,000**	**35,000**
Alluvial Aquifer and Saugus Formation Combined						
	TOTAL	**49,235**	**48,293**	**52,500**	**57,500**	**67,500**

Notes

All values are in units of acre-feet per year (AFY) and are for 365-day years. Values will be higher in leap years.

Municipal supplies are currently provided by SCV Water and Los Angeles County Water Works District 36 (LACWD).

Municipal water demands include all commercial and industrial water uses in the Santa Clarita Valley.

FivePoint is the successor in interest to The Newhall Land and Farming Company. Pitchess refers to the Pitchess Detention Center.

Table 6.5-5. Annual Groundwater Pumping from the Two Principal Aquifers in the 95-Year Model Simulation for the Projected Water Budgets

	Year Type		Alluvial Aquifer Pumping			Saugus Formation Pumping			
Calendar Year	Alluvial Aquifer	Saugus Formation	Municipal Pumping	Pumping by Other Users	Total	Municipal Pumping	Pumping by Other Users	Total	Total Pumping
1925	Dry Year 2	Dry Year 2	26,090	6,410	32,500	23,825	1,175	25,000	57,500
1926	Dry Year 3	Dry Year 3	26,090	6,410	32,500	33,825	1,175	35,000	67,500
1927	Normal	Post-Drought	30,783	6,410	37,193	20,008	1,175	21,183	58,376
1928	Normal	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1929	Dry Year 1	Dry Year 1	26,090	6,410	32,500	18,825	1,175	20,000	52,500
1930	Dry Year 2	Dry Year 2	26,090	6,410	32,500	23,825	1,175	25,000	57,500
1931	Dry Year 3	Dry Year 3	26,090	6,410	32,500	33,825	1,175	35,000	67,500
1932	Normal	Dry Year 4	26,146	6,422	32,568	33,904	1,177	35,081	67,649
1933	Dry Year 1	Dry Year 5	26,090	6,410	32,500	33,825	1,175	35,000	67,500
1934	Normal	Dry Year 6	26,090	6,410	32,500	33,825	1,175	35,000	67,500
1935	Dry Year 1	Post-Drought	30,783	6,410	37,193	20,008	1,175	21,183	58,376
1936	Dry Year 2	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1937	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1938	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1939	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1940	Dry Year 1	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1941	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1942	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1943	Dry Year 1	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1944	Normal	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1945	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1946	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1947	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1948	Dry Year 1	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1949	Dry Year 2	Dry Year 1	26,090	6,410	32,500	18,825	1,175	20,000	52,500
1950	Dry Year 3	Post-Drought	30,783	6,410	37,193	15,867	1,175	17,042	54,235
1951	Dry Year 4	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1952	Dry Year 5	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1953	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1954	Dry Year 1	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1955	Dry Year 2	Dry Year 1	26,090	6,410	32,500	18,825	1,175	20,000	52,500
1956	Dry Year 3	Post-Drought	30,849	6,422	37,271	15,924	1,177	17,101	54,372
1957	Dry Year 4	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1958	Dry Year 5	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1959	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1960	Dry Year 1	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1961	Dry Year 2	Dry Year 1	26,090	6,410	32,500	18,825	1,175	20,000	52,500
1962	Dry Year 3	Post-Drought	30,783	6,410	37,193	15,867	1,175	17,042	54,235
1963	Dry Year 4	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1964	Dry Year 5	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1965	Dry Year 6	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1966	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1967	Dry Year 1	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1968	Normal	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1969	Dry Year 1	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1970	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1971	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1972	Dry Year 1	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1973	Dry Year 2	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1974	Dry Year 3	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1975	Dry Year 4	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1976	Dry Year 5	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1977	Dry Year 6	Dry Year 3	26,090	6,410	32,500	33,825	1,175	35,000	67,500
1978	Dry Year 7	Post-Drought	30,783	6,410	37,193	20,008	1,175	21,183	58,376
1979	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1980	Normal	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1981	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1982	Dry Year 1	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293

Table 6.5-5. Annual Groundwater Pumping from the Two Principal Aquifers in the 95-Year Model Simulation for the Projected Water Budgets

	Year Type		Alluvial Aquifer Pumping			Saugus Formation Pumping			
Calendar Year	Alluvial Aquifer	Saugus Formation	Municipal Pumping	Pumping by Other Users	Total	Municipal Pumping	Pumping by Other Users	Total	Total Pumping
1983	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1984	Normal	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1985	Dry Year 1	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1986	Dry Year 2	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1987	Dry Year 3	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1988	Dry Year 4	Dry Year 1	26,146	6,422	32,568	18,872	1,177	20,049	52,617
1989	Dry Year 5	Post-Drought	30,783	6,410	37,193	15,867	1,175	17,042	54,235
1990	Dry Year 6	Dry Year 2	26,090	6,410	32,500	23,825	1,175	25,000	57,500
1991	Dry Year 7	Dry Year 3	26,090	6,410	32,500	33,825	1,175	35,000	67,500
1992	Dry Year 8	Dry Year 4	26,146	6,422	32,568	33,904	1,177	35,081	67,649
1993	Normal	Post-Drought	30,783	6,410	37,193	20,008	1,175	21,183	58,376
1994	Normal	Dry Year 5	26,090	6,410	32,500	33,825	1,175	35,000	67,500
1995	Dry Year 1	Post-Drought	30,783	6,410	37,193	20,008	1,175	21,183	58,376
1996	Normal	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
1997	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1998	Dry Year 1	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
1999	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
2000	Dry Year 1	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
2001	Dry Year 2	Dry Year 1	26,090	6,410	32,500	18,825	1,175	20,000	52,500
2002	Dry Year 3	Post-Drought	30,783	6,410	37,193	15,867	1,175	17,042	54,235
2003	Dry Year 4	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
2004	Dry Year 5	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
2005	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
2006	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
2007	Dry Year 1	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
2008	Dry Year 2	Dry Year 1	26,146	6,422	32,568	18,872	1,177	20,049	52,617
2009	Dry Year 3	Dry Year 2	26,090	6,410	32,500	23,825	1,175	25,000	57,500
2010	Dry Year 4	Post-Drought	30,783	6,410	37,193	20,008	1,175	21,183	58,376
2011	Normal	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
2012	Normal	Normal	30,849	6,422	37,271	9,952	1,177	11,129	48,400
2013	Dry Year 1	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
2014	Dry Year 2	Dry Year 1	26,090	6,410	32,500	18,825	1,175	20,000	52,500
2015	Dry Year 3	Dry Year 2	26,090	6,410	32,500	23,825	1,175	25,000	57,500
2016	Dry Year 4	Dry Year 3	26,146	6,422	32,568	33,904	1,177	35,081	67,649
2017	Dry Year 5	Post-Drought	30,783	6,410	37,193	20,008	1,175	21,183	58,376
2018	Dry Year 6	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
2019	Dry Year 7	Normal	30,783	6,410	37,193	9,925	1,175	11,100	48,293
AVERAGE (1925-2019)			**29,662**	**6,413**	**36,075**	**14,987**	**1,175**	**16,162**	**52,237**

Notes

All values are in units of acre-feet per year (AFY). Values are for calendar years; hence the groundwater pumping volumes shown in this table differ from the values shown in Appendix I, which use water years to present pumping volumes and other water budget values.

Municipal supplies are currently provided by SCV Water and Los Angeles County Water Works District 36 (LACWD).
Municipal water demands include all commercial and industrial water uses in the Santa Clarita Valley.

Other users are FivePoint (The Newhall Land and Farming Company), the Pitchess Detention Center, and Sand Canyon Country Club, which all pump from the Alluvial Aquifer; Valencia County Club, Vista Valencia Golf Course, and the groundwater pumping/treatment system on the Whittaker-Bermite property, all of which pump from the Saugus Formation; and small private domestic well owners, who pump primarily from the Alluvial Aquifer but may also pump small quantities of water from adjoining bedrock units.

6.5.1.4 Generation and Use of Recycled Water

Table 6.5-6 shows the details of all point discharges to the Santa Clara River. Wastewater flows into local WRPs total to 30,300 AFY in the projected water budget, as defined in a human water demand modeling forecast conducted by Maddaus (2019). This study estimates the amount of indoor water use savings that will arise from the implementation of plumbing codes and conservation program measures through the projected build-out year of 2050 in the Basin. The plumbing codes and conservation measures accounted for in the study reduce indoor water use to 50 gallons per capita per day (gpcpd) by the year 2030, per state requirements in legislation that was passed in 2018 (Senate Bill 606 and Assembly Bill 1668). The demand modeling forecast for the Basin uses 50 gpcpd as the indoor water use rate for new developments and also accounts for how existing housing stock will experience increased efficiencies in indoor water uses as (1) remodeling projects occur under the new plumbing code, and (2) existing appliances and plumbing fixtures are replaced by new and more efficient units. Of the 30,300 AFY of flows that will occur into local WRPs under the forecasts from the 2019 study, approximately 21,000 AFY is discharged to the Santa Clara River and 9,300 AFY becomes recycled water supply. During the winter months, a small portion of the treated water that is discharged to the Santa Clara River from local WRPs is estimated to come from the future Newhall WRP, which will be located about 0.5 mile upstream of (east of) the western basin boundary. More recent updates to the full build-out water demand estimates (for the 2020 UWMP; see KJ, 2021) have slightly reduced the forecasted amount of indoor use and flows into the WRPs, which has reduced the amount of recycled water to 8,961 AFY; these updated projections do not reduce the amount of WRP discharges (approximately 21,000 AFY) to the river.

6.5.2 Projected Water Budget without Climate Change

6.5.2.1 Surface Water Budget

Figure 6.5-1 displays the year-by-year projected surface water budget without climate change. See also Table I-5 in Appendix I for detailed calculations.

Projected Imported Supplies

The amounts of imported and other water supplies in the projected water budget are displayed in Table 6.5-7 for normal years, a single dry year (labeled as Dry Year 1 in the table), and multiple dry years (Dry Year 2 and Dry Year 3+ in the table). The magnitudes of imported water are the amounts that meet the human water demands listed in the table after accounting for the other supply amounts that are specified in the projected water budget. The human water demands are obtained from the 2020 UWMP (KJ, 2021); see the values for the year 2050 in Tables 7-2, 7-3, and 7-4 of the 2020 UWMP. Table 6.5-8 shows these values for each year in the 95-year groundwater flow model simulations that were used to construct the projected water budgets.[39]

The imported water volumes presented in the 2020 UWMP (KJ, 2021) (and which are displayed in Tables 6.5-7 and 6.5-8) are less than the amount of combined imported supply that is available from (1) the SWP system and (2) the additional imported supplies that have been secured to date by SCV Water (which were discussed in Section 6.4.2.1). Table 6.5-9 shows the available amounts of each water supply source for normal years, single dry years, and multiple dry years, and compares the total supply to the human demands for water under full-build-out conditions in the Santa Clarita Valley.

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[39] Table 6.5-8 identifies the first year after a dry year or dry period as being a “post-drought” year. This year type was included in the projected water budget because, operationally, the end of a dry period often is not known until the spring season arrives. Until then, municipal pumping remains at dry-year levels, then will return to normal-year levels typically by May or June.

Table 6.5-6. Annual Point Discharges to the Santa Clara River for the Projected Water Budgets in the Basin

		Future			
Source	Current Conditions	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3+
Saugus WRP	5,004	5,004	5,004	5,004	5,004
Valencia WRP	16,813	15,514	15,514	15,514	15,514
Subtotal	**21,817**	**20,518**	**20,518**	**20,518**	**20,518**
Newhall WRP	0	480	480	480	480
Subtotal	**21,817**	**20,998**	**20,998**	**20,998**	**20,998**
Whittaker-Bermite	500	500	500	500	500
TOTAL	**22,317**	**21,498**	**21,498**	**21,498**	**21,498**

Note

All values are in units of acre-feet per year (AFY) and are for 365-day years. Values will be higher in leap years.

Table 6.5-7. Annual Municipal and Non-Municipal Water Supplies and Demands in Normal and Dry Years for the Projected Water Budgets

	Municipal Users				Other Users	Total	
Year Type	**Local Groundwater**	**Imported Water**	**Recycled Water**	**Total**	**Local Groundwater**	**Local Groundwater**	**Demand**
Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
Dry Year 1	44,915	53,224	8,961	107,100	7,585	52,500	114,685
Dry Year 2	49,915	43,994	8,961	102,870	7,585	57,500	110,455
Dry Year 3+	59,915	33,994	8,961	102,870	7,585	67,500	110,455
Average (1925-2019)	44,649	48,365	8,966	101,980	7,588	52,237	109,568

Notes

Normal-year and dry-year values are in units of acre-feet per year (AFY) and are for 365-day years. Values will be higher in leap years.

Average values for 1925-2019 include leap years. Hence the average values for recycled water and local groundwater are slightly higher than shown for normal and dry years.

Municipal supplies are currently provided by SCV Water and Los Angeles County Water Works District 36 (LACWD).
Municipal water demands include all commercial and industrial water uses in the Santa Clarita Valley.

Other users are FivePoint (The Newhall Land and Farming Company), the Pitchess Detention Center, and Sand Canyon Country Club, which all pump from the Alluvial Aquifer; Valencia County Club, Vista Valencia Golf Course, and the groundwater pumping/treatment system on the Whittaker-Bermite property, all of which pump from the Saugus Formation; and small private domestic well owners, who pump primarily from the Alluvial Aquifer but may also pump small quantities of water from adjoining bedrock units.

Total demand by municipal users in normal years (101,000 AFY), single-dry years (107,100 AFY), and multiple-dry years (102,870 AFY) is for Year 2050, as shown in Tables 7-2, 7-3, and 7-4 of the 2020 Urban Water Management Plan (KJ, 2021), and is the demand with the plumbing code and active conservation.

Table 6.5-8. Annual Municipal and Non-Municipal Water Demands and Supplies in the 95-Year Model Simulation for the Projected Water Budgets

		Municipal Users				Other Users	Total	
Calendar Year	Year Type	Local Groundwater	Imported Water	Recycled Water	Total	Local Groundwater	Local Groundwater	Demand
1925	Dry Year 2	49,915	43,994	8,961	102,870	7,585	57,500	110,455
1926	Dry Year 3	59,915	33,994	8,961	102,870	7,585	67,500	110,455
1927	Post-Drought	50,791	42,183	8,961	101,935	7,585	58,376	109,520
1928	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1929	Dry Year 1	44,915	53,224	8,961	107,100	7,585	52,500	114,685
1930	Dry Year 2	49,915	43,994	8,961	102,870	7,585	57,500	110,455
1931	Dry Year 3	59,915	33,994	8,961	102,870	7,585	67,500	110,455
1932	Dry Year 4	60,050	34,060	8,980	103,090	7,599	67,649	110,689
1933	Dry Year 5	59,915	33,994	8,961	102,870	7,585	67,500	110,455
1934	Dry Year 6	59,915	33,994	8,961	102,870	7,585	67,500	110,455
1935	Post-Drought	50,791	42,183	8,961	101,935	7,585	58,376	109,520
1936	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1937	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1938	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1939	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1940	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1941	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1942	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1943	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1944	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1945	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1946	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1947	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1948	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1949	Dry Year 1	44,915	53,224	8,961	107,100	7,585	52,500	114,685
1950	Post-Drought	46,650	46,324	8,961	101,935	7,585	54,235	109,520
1951	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1952	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1953	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1954	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1955	Dry Year 1	44,915	53,224	8,961	107,100	7,585	52,500	114,685
1956	Post-Drought	46,773	46,400	8,980	102,153	7,599	54,372	109,752
1957	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1958	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1959	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1960	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1961	Dry Year 1	44,915	53,224	8,961	107,100	7,585	52,500	114,685
1962	Post-Drought	46,650	46,324	8,961	101,935	7,585	54,235	109,520
1963	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1964	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1965	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1966	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1967	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1968	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1969	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1970	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1971	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1972	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1973	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1974	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1975	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1976	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1977	Dry Year 3	59,915	33,994	8,961	102,870	7,585	67,500	110,455
1978	Post-Drought	50,791	42,183	8,961	101,935	7,585	58,376	109,520
1979	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1980	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1981	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1982	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1983	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585

Table 6.5-8. Annual Municipal and Non-Municipal Water Demands and Supplies in the 95-Year Model Simulation for the Projected Water Budgets

		Municipal Users				Other Users	Total	
Calendar Year	**Year Type**	**Local Groundwater**	**Imported Water**	**Recycled Water**	**Total**	**Local Groundwater**	**Local Groundwater**	**Demand**
1984	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1985	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1986	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1987	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1988	Dry Year 1	45,018	53,332	8,980	107,330	7,599	52,617	114,929
1989	Post-Drought	46,650	46,324	8,961	101,935	7,585	54,235	109,520
1990	Dry Year 2	49,915	43,994	8,961	102,870	7,585	57,500	110,455
1991	Dry Year 3	59,915	33,994	8,961	102,870	7,585	67,500	110,455
1992	Dry Year 4	60,050	34,060	8,980	103,090	7,599	67,649	110,689
1993	Post-Drought	50,791	42,183	8,961	101,935	7,585	58,376	109,520
1994	Dry Year 5	59,915	33,994	8,961	102,870	7,585	67,500	110,455
1995	Post-Drought	50,791	42,183	8,961	101,935	7,585	58,376	109,520
1996	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
1997	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1998	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
1999	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
2000	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
2001	Dry Year 1	44,915	53,224	8,961	107,100	7,585	52,500	114,685
2002	Post-Drought	46,650	46,324	8,961	101,935	7,585	54,235	109,520
2003	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
2004	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
2005	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
2006	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
2007	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
2008	Dry Year 1	45,018	53,332	8,980	107,330	7,599	52,617	114,929
2009	Dry Year 2	49,915	43,994	8,961	102,870	7,585	57,500	110,455
2010	Post-Drought	50,791	42,183	8,961	101,935	7,585	58,376	109,520
2011	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
2012	Normal	40,801	51,435	8,980	101,216	7,599	48,400	108,815
2013	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
2014	Dry Year 1	44,915	53,224	8,961	107,100	7,585	52,500	114,685
2015	Dry Year 2	49,915	43,994	8,961	102,870	7,585	57,500	110,455
2016	Dry Year 3	60,050	34,060	8,980	103,090	7,599	67,649	110,689
2017	Post-Drought	50,791	42,183	8,961	101,935	7,585	58,376	109,520
2018	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
2019	Normal	40,708	51,331	8,961	101,000	7,585	48,293	108,585
AVERAGE	**1925-2019**	**44,649**	**48,365**	**8,966**	**101,980**	**7,588**	**52,237**	**109,568**

Notes

All values are in units of acre-feet per year (AFY). Values are for calendar years; hence the groundwater pumping volumes shown in this table differ from the values shown in Appendix I, which use water years to present pumping volumes and other water budget values.

Municipal supplies are currently provided by SCV Water and Los Angeles County Water Works District 36 (LACWD).
Municipal water demands include all commercial and industrial water uses in the Santa Clarita Valley.

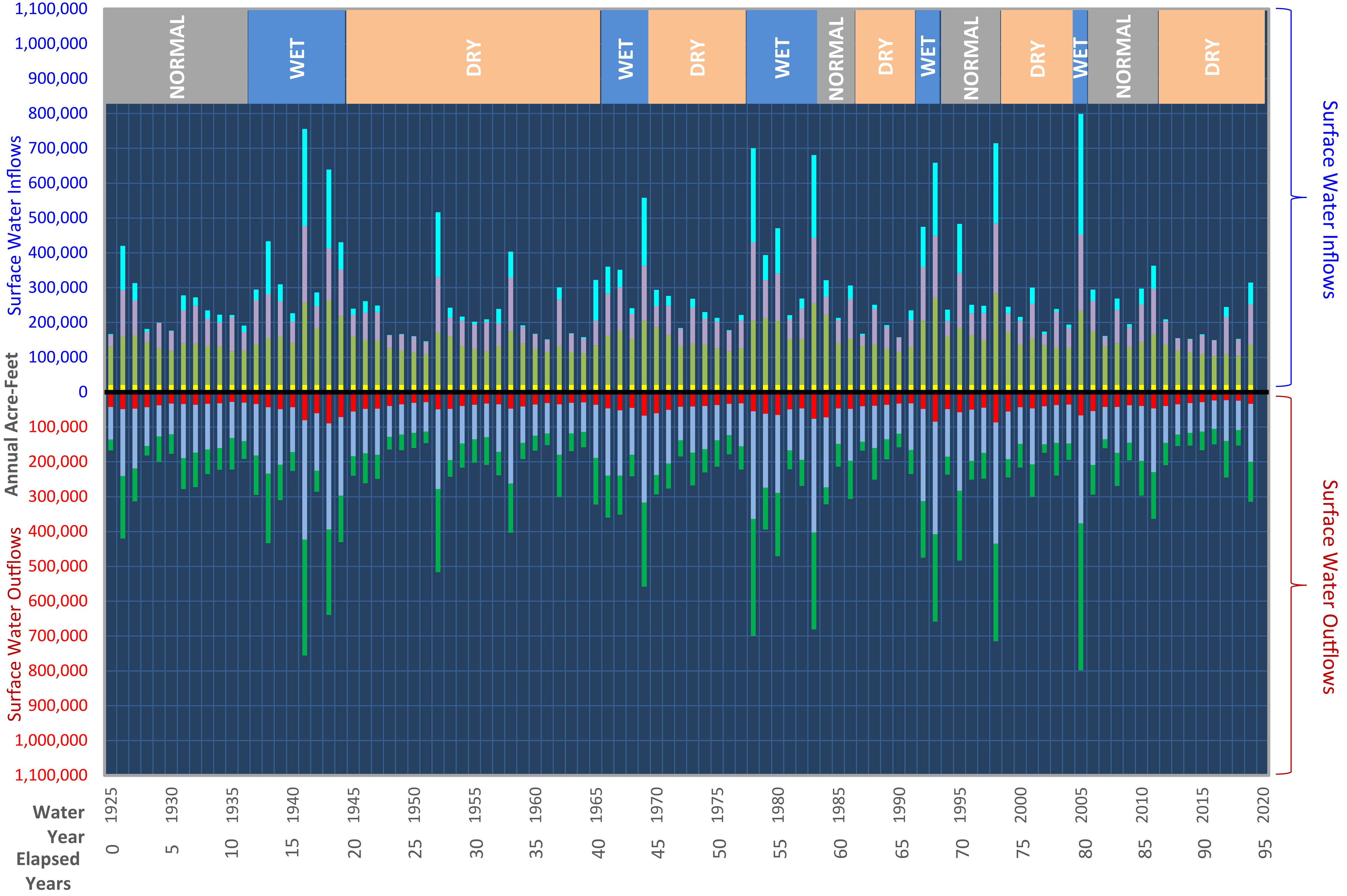
Values of total demand by municipal users in normal years (101,000 AFY in non-leap years), in single-dry years (107,100 AFY in non-leap years), and in multiple-dry years (102,870 AFY in non-leap years) are for Year 2050, as shown in Tables 7-2, 7-3, and 7-4 of the 2020 Urban Water Management Plan (KJ, 2021), and represent the demand with the plumbing code and active conservation.

Other users are FivePoint (The Newhall Land and Farming Company), the Pitchess Detention Center, and Sand Canyon Country Club, which all pump from the Alluvial Aquifer; Valencia County Club, Vista Valencia Golf Course, and the groundwater pumping/treatment system on the Whittaker-Bermite property, all of which pump from the Saugus Formation; and small private domestic well owners, who pump primarily from the Alluvial Aquifer but may also pump small quantities of water from adjoining bedrock units.

FIGURE 6.5-1

Projected Surface Water Budget Under Full Build-out Conditions Without Climate Change

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan



LEGEND

- ▨ Precipitation
- ▨ Stream Inflows
- ▨ Point-Source Flows to Streams
- ▨ Net Inflow from Groundwater
- 🟥 Non-Storm Flow at County Line
- 🟩 ET and Storm Outflows
- ▨ Groundwater Recharge from Streams and Rainfall

NOTES
This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
ET: evapotranspiration

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This comparison uses the supply and demand details presented for the year 2050 in Tables 7-2, 7-3, and 7-4 of the 2020 UWMP (KJ, 2021). For SWP water, the estimates of imported water supplies are based on the 2019 DCR for the SWP system (DWR, 2020), which was the basis for incorporating uncertainties about future SWP deliveries into the reliability planning portion of the 2020 UWMP. As shown in Table 6.5-9, under full build-out conditions, the available supplies exceed the human water demand estimates by an estimated 11,258 AFY in normal years, by an estimated 12,498 AFY in single dry years, and by an estimated 25,488 AFY during a multiple-dry-year period.

As discussed in Section 6.1.6.2, SCV Water's 2020 UWMP contains the most current water supply and demand values for full build-out (Year 2050) conditions. The UWMP incorporates (1) DWR's most current estimates of future SWP delivery capability as outlined in the 2019 DCR (DWR, 2020) and (2) the Basin Operating Plan for its groundwater supply analyses. The projected water budgets that have been developed to support preparation of the GSP use the Basin Operating Plan for the Basin. Additionally, because the 2017 *Water Supply Reliability Plan Update* (Clemm and KJC, 2017) and a recent draft update to that plan (Geosyntec, 2021) found that SCV Water's Basin Operating Plan and its portfolio of imported water supplies can fully and reliably meet the Year 2050 full build-out water demands in SCV Water's service area, the Basin Operating Plan is therefore simulated in all three of the projected water budget scenarios described in this section (no climate change, 2030 climate change, and 2070 climate change).

Projected Local Surface Water Inflows

Table 6.5-10 summarizes the average, minimum, and maximum values of the annual surface inflows to the Basin in the projected water budget without climate change. (See Table I-5 in Appendix I for detailed calculations.) These inflows are the same as for the current water budget for the 2014 level of development (shown in Table 6.4-6), with the exception of the discharge volumes from the Valencia WRP, the addition of discharges from the future Newhall WRP, and minor differences in the amount of groundwater upwelling (discharge) to streams.

Projected Surface Water Outflows

Table 6.5-11 summarizes the average, minimum, and maximum values of the annual surface outflows from the Basin for the projected water budget without climate change. (See Table I-5 in Appendix I for detailed calculations.) Non-storm surface water flows crossing the western basin boundary[40] show a wider range historically (11,300 AFY to 100,000 AFY) than under the projected water budget (22,600 AFY to 89,400 AFY), but the average values are similar (44,900 AFY historically and 44,400 AFY projected), which suggests that the constant nature of the point discharges to the river from one year to the next tempers the variability in these non-storm flows compared with the highly variable point discharges of the past. Total annual surface water outflows for the projected water budget without climate change (averaging 289,000 AFY) are slightly higher than under the actual historical conditions for the Basin (an average of 274,100 AFY, as shown in Table 6.3-4). This is primarily because of an increase in the amount of groundwater recharge from streams that arises as a result of a greater 95-year volume of WRP discharges to the Santa Clara River during the future 95-year simulation period than the 95-year volume that occurred historically (from 1925 through 2019).

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[40] As discussed in Section 6.3.2.3 for the historical water budget, the non-storm flows in the Santa Clara River at the western basin boundary under the projected water budget include the amount of subsurface outflow that occurs within a thin veneer of alluvium that is present at the western basin boundary, which comprises the western boundary of the groundwater flow model.

Table 6.5-9. Annual Municipal Water Supply and Demand Comparisons for Municipal Water Use in Year 2050 (From the 2020 UWMP)

Year Type	SWP and Related Sources[(a)]	Banking and Exchange Programs[(b)]	Total Imported Water Supply[(c)]	Local Groundwater	Recycled Water	Total Municipal Supply	Total Municipal Demand[(d)]	Total Municipal Supply Minus Total Municipal Demand
Normal Year	62,107	0	62,107	41,190	8,961	112,258	101,000	11,258
Single Dry Year	22,047	29,950	51,997	58,640	8,961	119,598	107,100	12,498
Multiple Dry-Year Period	37,727	29,950	67,677	51,720	8,961	128,358	102,870	25,488

Notes

All values are in units of acre-feet per year (AFY), are on a calendar-year basis, and are for 365-day years. Values will be higher in leap years.

Values are for the year 2050 and are from Tables 7-2, 7-3, and 7-4 in the 2020 Urban Water Management Plan (UWMP) (KJ, 2021).

(a) Related sources are listed in Tables 7-2, 7-3, and 7-4 of the 2020 UWMP (KJ, 2021) under the "Imported Water" row of each table and consist of flexible storage accounts, Buena Vista-Rosedale, Nickel Water-Newhall Land, and Yuba Accord water.

(b) Banking and exchange programs are listed in Tables 7-2, 7-3, and 7-4 of the 2020 UWMP (KJ, 2021) and consist of Rosedale-Rio Bravo Bank, Semitropic Bank, Semitropic-Newhall Land Bank, Antelope Valley East Kern (AVEK) Water Agency Exchange, and United Water Conservation District (UWCD) Exchange.

(c) The total imported water supply is the sum of the prior two columns.

(d) Total demand by municipal users is the demand that accounts for the plumbing code and active conservation.

SWP = State Water Project

UWMP = Urban Water Management Plan

Table 6.5-10. Estimated Annual Surface Water Inflows to the Basin for the Projected Water Budget (Using 1925–2019 Rainfall Without Climate Change)

Surface Water Inflow Component	Minimum	Maximum	Average	Percent of Total
In-Basin Precipitation	27,400	224,500	87,600	30%
Stormwater Generated from In-Basin Precipitation	25,100	135,800	67,000	---
Stream Inflow (Santa Clara River)	0	37,850	5,170	2%
Stream Inflow (Releases from Castaic Lake/Lagoon)	200	197,500	20,050	7%
Stream Inflow (Releases from Bouquet Reservoir)	110	110	110	0.04%
Stream Inflow (Other Santa Clara River Tributaries)	0	148,400	24,150	8%
Discharges to Santa Clara River from Saugus WRP	5,005	5,020	5,010	2%
Discharges to Santa Clara River from Valencia WRP and Newhall WRP	15,995	16,055	16,000	6%
Discharges to Santa Clara River from Groundwater Treatment Systems	500	501	500	0.2%
Groundwater Discharge to Streams	81,550	262,850	130,450	45%
Total	146,200	798,400	289,000	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which uses the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-5 of Appendix I.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

5% of the releases from Bouquet Reservoir are assumed to remain as surface flow where Bouquet Creek enters the Basin.

The term "Net inflow from Groundwater" is the difference between stream gains and stream losses arising from groundwater/surface water exchanges in the Santa Clara River and its tributaries.

Total values do not include stormwater generated from in-basin precipitation, which is an internal flow process (and not an inflow to, or outflow from, the basin).

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water inflows.

WRP = water reclamation plant

Table 6.5-11. Estimated Annual Surface Water Outflows from the Basin for the Projected Water Budget (Using 1925–2019 Rainfall Without Climate Change)

Surface Water Outflow Component	Minimum	Maximum	Average	Percent of Total
Santa Clara River Non-Storm Outflow at the Western Basin Boundary	22,600	89,400	44,400	15.5%
Groundwater Recharge from Precipitation	0	103,000	20,600	7%
Groundwater Recharge from Streams	81,350	275,100	127,300	44%
ET and Stormwater Outflow	24,500	421,850	96,800	33.5%
Total	146,200	798,400	289,000	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which uses the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-5 of Appendix I.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Subsurface outflow through the thin alluvial material beneath the river at the western boundary of the Basin is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water outflows.

ET = evapotranspiration

6.5.2.2 Groundwater Budget

Figures 6.5-2 and 6.5-3 display the year-by-year projected groundwater budget without climate change. See also Table I-6 in Appendix I for detailed calculations.

Projected Groundwater Inflows

Table 6.5-12 summarizes the average, minimum, and maximum values of the annual inflows to groundwater in the Basin for the projected water budget without climate change. (See Table I-6 in Appendix I for detailed calculations.) Compared with historical groundwater inflows (Table 6.3-5), the primary difference in groundwater inflows under the projected water budget is the constant amounts of recharge from septic systems and irrigation in urbanized areas and the elimination of agricultural irrigation return flows. Differences in the amount of recharge from stream leakage also occur, because of differences at various locations in the ephemeral and perennial reaches of the Santa Clara River. Recharge from streams is also higher because of timing differences between large natural inflows to Castaic Lake (which are used in the projected water budget) and the later controlled releases during its early operating years (which are used in the historical water budget). These changes occur despite the omission of periodic historical releases of SWP water in the projected water budget.

Projected Groundwater Outflows

Table 6.5-13 summarizes the average, minimum, and maximum values of the annual outflows of groundwater from the Basin for the projected water budget without climate change. (See Table I-6 in Appendix I for detailed calculations.) Compared with historical groundwater outflows (Table 6.3-6), the average projected water budget shows higher groundwater pumping rates but similar rates of phreatophyte (riparian) ET and groundwater discharges to streams. Average groundwater pumping (52,190 AFY) is 18,030 AFY higher than in the historical water budget (34,160 AFY) and appears to be partly compensated for by a 14,050 AFY increase in average groundwater recharge under projected conditions (118,500 AFY on average) compared with historical conditions (174,450 AFY on average).

Projected Changes in Groundwater Storage

The yellow line on Figure 6.5-2 shows how much the volume of stored groundwater changes progressively over time when simulating the effects of the full build-out level of development and water uses through the historical hydrologic record projected forward in time. Figure 6.5-2 shows that the cumulative-change curve for groundwater storage that is calculated by the numerical groundwater flow model for the projected water budget has a shape that is generally similar to the shape of the cumulative-change curve for actual historical conditions (see Figure 6.3-3) during that same 95-year period. The occurrence of rising versus declining slopes in the modeled cumulative-change curve for projected conditions varies frequently during the 95-year historical period, as is the case for historical conditions. Accordingly, as was indicated by the water budgets for historical conditions and the 2014 level of development, the water budget assessment for the full build-out level of development and water use in the Basin indicates that a chronic long-term decline (i.e., a continual year-to-year decline) in the volume of stored groundwater is not expected to arise from increased future development or from the increased pumping that will occur in the future under the Basin Operating Plan. The Basin is anticipated to remain in a sustainable condition with respect to the SGMA criterion of chronic lowering of groundwater levels and not be in an overdraft condition as a result of future development and associated groundwater uses. The combined influence of full build-out conditions and climate change is examined next, in Sections 6.5.3 and 6.5.4.

Table 6.5-12. Estimated Annual Groundwater Inflows to the Basin for the Projected Water Budget (Using 1925–2019 Rainfall Without Climate Change)

Groundwater Inflow Component	Minimum	Maximum	Average	Percent of Total
Recharge from Precipitation	0	103,000	20,600	11%
Recharge from Streams	81,350	275,100	127,300	68%
Subsurface Inflow Beneath Castaic Dam	1,675	1,680	1,675	1%
Subsurface Inflow Beneath Santa Clara River and Other Tributaries	28,000	29,700	29,000	15%
Septic System Percolation	2,430	2,440	2,435	1%
Recharge of Applied Water	7,485	7,500	7,490	4%
Total	122,750	387,700	188,500	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which uses the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-6 of Appendix I.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Deep percolation from irrigation is the sum for agricultural and municipal lands.

Septic system percolation applies to areas served by public water supplies that do not have public sewer collection systems.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual inflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

Table 6.5-13. Estimated Annual Groundwater Outflows from the Basin for the Projected Water Budget (Using 1925–2019 Rainfall Without Climate Change)

Groundwater Outflow Component	Minimum	Maximum	Average	Percent of Total
Groundwater Pumping	48,295	67,650	52,190	27%
Riparian Evapotranspiration	5,825	9,215	7,220	4%
Groundwater Discharge to Streams	81,550	262,850	130,450	69%
Total	138,275	321,200	189,850	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which uses the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-6 of Appendix I.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Groundwater discharge to streams is the combined amount in ephemeral and perennial reaches.

Subsurface outflow through the thin alluvial material beneath the river at the western boundary of the Basin is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual outflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

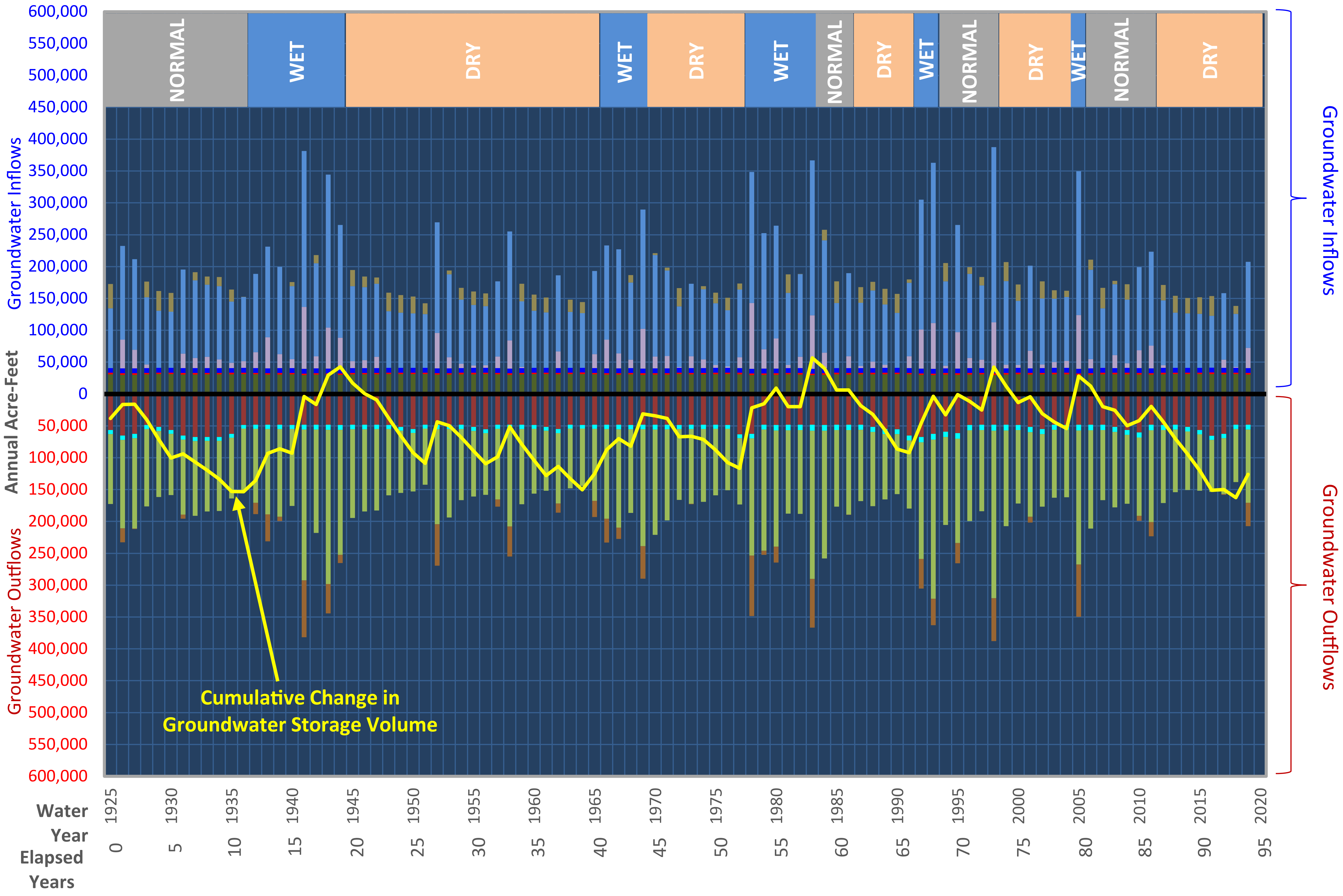

FIGURE 6.5-2

Projected Groundwater Budget Under Full Build-out Conditions Without Climate Change

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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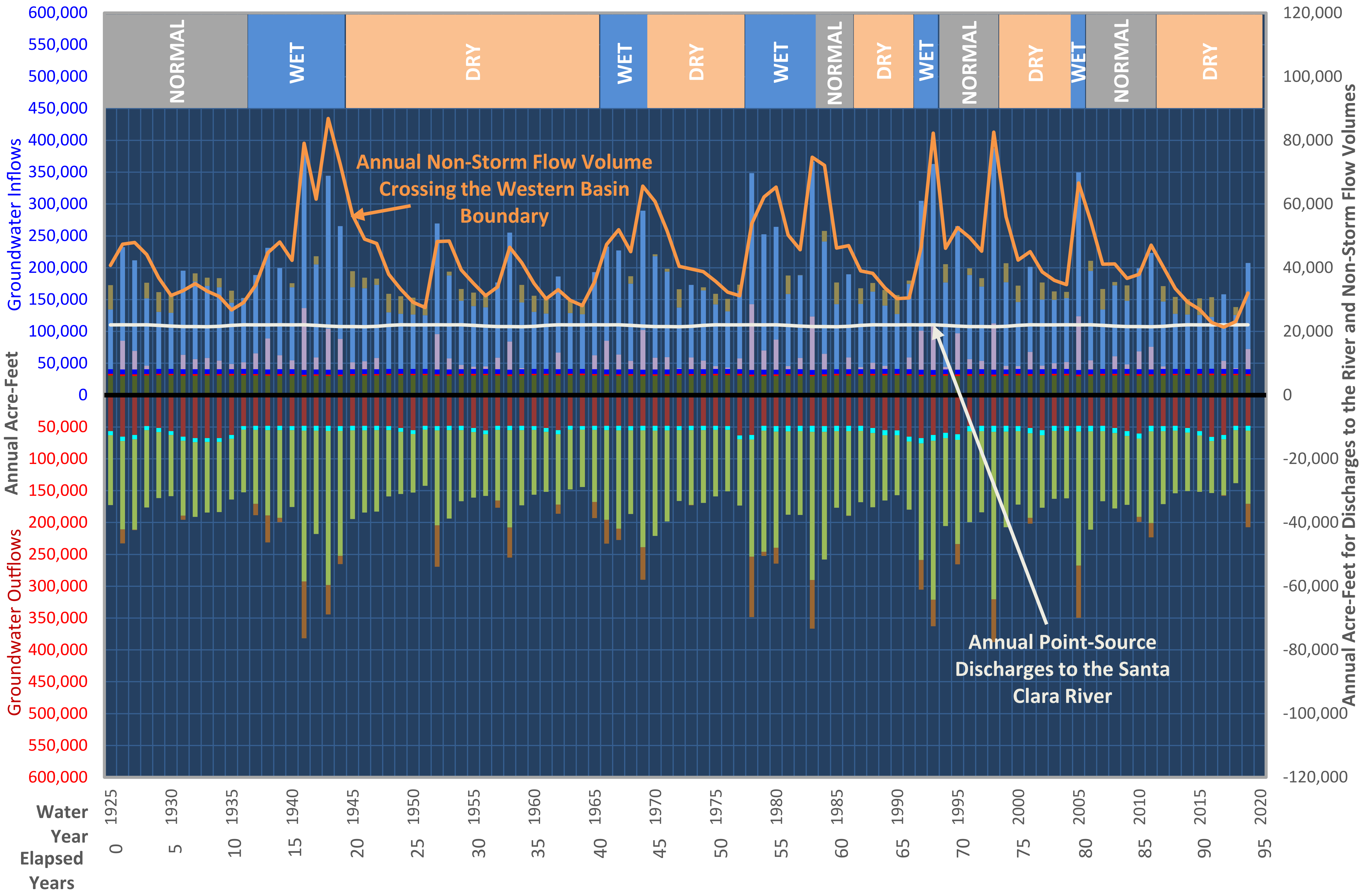

FIGURE 6.5-3

Projected Groundwater Budget and Annual Non-Storm Flows at the Western Basin Boundary Under Full Build-out Conditions Without Climate Change

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

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6.5.3 Projected 20-Year Water Budget (Year 2042 Conditions)

As DWR discusses in its BMP for water budget development (DWR, 2016), the climate change analysis is a process in which variability in the historical climatic record is preserved while the magnitudes of events are increased or decreased based on projected changes in precipitation and air temperature, as obtained from global climate model outputs that have been downscaled to localized areas such as the Basin. This approach is used because it is impossible to know the actual precipitation and air temperatures in the year 2042, which is the end of the 20-year period for achieving sustainability under SGMA (based on the planned submittal in early 2022 of the GSP for the Basin). As a result, the projected water budgets for year 2042 conditions apply the 2030 climate-change factors to the historical (1925 through 2019) climate record while simulating full build-out of land and water uses. Output for the water budget is displayed in figures and tables as being for the period 1925 through 2019, even though the water budget is for year 2042 conditions.

6.5.3.1 Surface Water Budget for Year 2042 Conditions

Figure 6.5-4 displays the year-by-year projected surface water budget for year 2042 conditions. See also Table I-7 in Appendix I for detailed calculations.

Projected Imported Supplies

Projected imported supplies for the Year 2042 water budget are the same as for the projected water budget without climate change. See the discussion of projected imported supplies in Section 6.5.2.1 for details.

Projected Local Surface Water Inflows

Table 6.5-14 summarizes the average, minimum, and maximum values of the annual surface inflows to the Basin for the Year 2042 water budget. (See Table I-7 in Appendix I for detailed calculations.) These inflows are the same as for the projected water budget without climate change (see Table 6.5-10), with the exception of stormwater generation and stream inflows in the Santa Clara River and its tributaries (including Castaic Creek inflows), all of which are directly varied by DWR's climate change factors for 2030. Additionally, the net inflow of groundwater to streams changes as the result of the aquifer system's response to climate-change influences. The net effect of these changes during the 95-year historical hydrologic period projected forward in time is an average surface water inflow of 279,800 AFY under 2030 climate change, compared with an average 289,000 AFY in the projected surface water budget without climate change (a difference of approximately 9,200 AFY, or 3.3 percent).

Projected Surface Water Outflows

Table 6.5-15 summarizes the average, minimum, and maximum values of the annual surface outflows from the Basin for the Year 2042 water budget. (See Table I-7 in Appendix I for detailed calculations.) Each of the four surface outflow terms are slightly smaller under 2030 climate change than without climate change (see Table 6.5-11). Total surface water outflows are equal to total surface water inflows because there is no reservoir storage in the Basin.[41]

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[41] As discussed in Section 6.3.2.3 for the historical water budget, the non-storm flows in the Santa Clara River at the western basin boundary under the projected water budgets include the amount of subsurface outflow that occurs within a thin veneer of alluvium that is present at the western basin boundary, which comprises the western boundary of the groundwater flow model.

Table 6.5-14. Estimated Annual Surface Water Inflows to the Basin for the Year 2042 Projected Water Budget (Using 1925–2019 Rainfall With 2030 Climate Change Factors)

Surface Water Inflow Component	Minimum	Maximum	Average	Percent of Total
In-Basin Precipitation	27,450	221,600	86,800	31%
Stormwater Generated from In-Basin Precipitation	23,950	135,900	67,500	---
Stream Inflow (Santa Clara River)	0	35,700	4,900	2%
Stream Inflow (Releases from Castaic Lake/Lagoon)	185	186,300	18,900	7%
Stream Inflow (Releases from Bouquet Reservoir)	110	110	110	0.04%
Stream Inflow (Other Santa Clara River Tributaries)	0	140,400	22,100	8%
Discharges to Santa Clara River from Saugus WRP	5,005	5,020	5,010	2%
Discharges to Santa Clara River from Valencia WRP and Newhall WRP	15,995	16,055	16,000	6%
Discharges to Santa Clara River from Groundwater Treatment Systems	500	501	500	0.2%
Groundwater Discharge to Streams	79,350	253,300	125,500	45%
Total	145,100	757,000	279,800	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which applies climate-change factors to the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-7 of Appendix I.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

5% of the releases from Bouquet Reservoir are assumed to remain as surface flow where Bouquet Creek enters the Basin.

The term "Net inflow from Groundwater" is the difference between stream gains and stream losses arising from groundwater/surface water exchanges in the Santa Clara River and its tributaries.

Total values do not include stormwater generated from in-basin precipitation, which is an internal flow process (and not an inflow to, or outflow from, the basin).

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water inflows.

WRP = water reclamation plant

Table 6.5-15. Estimated Annual Surface Water Outflows from the Basin for the Year 2042 Projected Water Budget (Using 1925–2019 Rainfall With 2030 Climate Change Factors)

Surface Water Outflow Component	Minimum	Maximum	Average	Percent of Total
Santa Clara River Non-Storm Outflow at the Western Basin Boundary	20,950	84,750	42,050	15%
Groundwater Recharge from Precipitation	0	98,700	19,250	7%
Groundwater Recharge from Streams	80,300	269,400	123,600	44%
ET and Stormwater Outflow	24,200	401,550	94,850	34%
Total	145,100	757,000	279,800	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which applies climate-change factors to the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-7 of Appendix I.

Subsurface outflow through the thin alluvial material beneath the river at the western boundary of the Basin is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water outflows.

ET = evapotranspiration

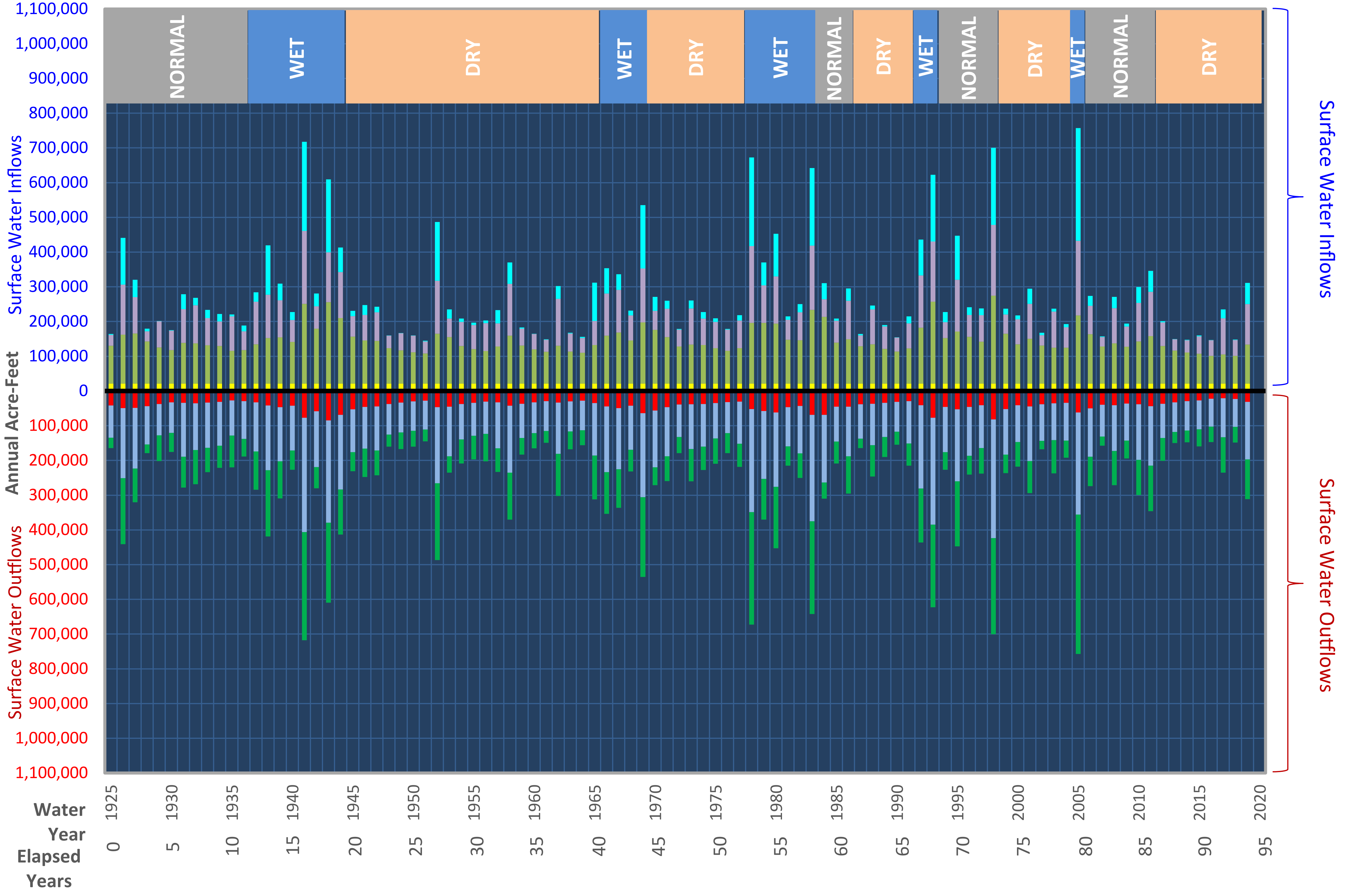


FIGURE 6.5-4

Projected Surface Water Budget for Year 2042 Conditions (Full Build-out Conditions With 2030 Average Climate Change)

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟪 Precipitation
- 🟦 Stream Inflows
- 🟦 Point-Source Flows to Streams
- 🟩 Net Inflow from Groundwater
- 🟥 Non-Storm Flow at County Line
- 🟩 ET and Storm Outflows
- 🟦 Groundwater Recharge from Streams and Rainfall

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
ET: evapotranspiration

GSI Water Solutions, Inc.

6.5.3.2 Groundwater Budget for Year 2042 Conditions

Figures 6.5-5 and 6.5-6 display the year-by-year projected groundwater budget for Year 2042 conditions. See also Table I-8 in Appendix I for detailed calculations.

Projected Groundwater Inflows

Table 6.5-16 summarizes the average, minimum, and maximum values of the annual inflows to groundwater in the Basin for the Year 2042 water budget (with DWR's 2030 climate change factors). (See Table I-8 in Appendix I for detailed calculations.) These inflows are the same as for the projected water budget without climate change (see Table 6.5-12), except for small reductions in deep percolation from stormwater and from precipitation falling directly within the Basin. The net effect of these changes during the 95-year historical hydrologic period is an average groundwater inflow of 183,550 AFY under the 2030 climate change scenario, compared with 188,500 AFY in the projected groundwater budget without climate change (see Table 6.5-12), which is a difference of 4,950 AFY, or 2.7 percent.

Projected Groundwater Outflows

Table 6.5-17 summarizes the average, minimum, and maximum values of the annual outflows from groundwater in the Basin for the Year 2042 water budget (with DWR's 2030 climate change factors). (See Table I-8 in Appendix I for detailed calculations.) Groundwater pumping is the same as for the projected water budget without climate change (see Table 6.5-13), while riparian ET increases slightly and groundwater discharge to streams decreases slightly using DWR's 2030 climate change factors. The average groundwater outflow is 185,100 AFY under 2030 climate change, which is 4,750 AFY (2.6 percent) lower than the 189,850 AFY of outflow that occurs in the projected groundwater budget without climate change (see Table 6.5-13).

Projected Changes in Groundwater Storage

The yellow line on Figure 6.5-5 shows how much the volume of stored groundwater changes progressively over time when simulating the combined effects of (1) 2030 climate change and (2) full build-out land and water uses through the historical hydrologic record projected forward in time. As with the cumulative-change plots for groundwater storage that were discussed previously for historical and current conditions (Figures 6.3-3 and 6.4-2), the cumulative-change plots for groundwater storage under Year 2042 conditions (Figure 6.5-5) show that the occurrence of rising versus declining slopes in the cumulative-change curve varies frequently during the 95-year historical period and that the cumulative-change curve under Year 2042 conditions has a shape generally similar to the cumulative-change curves for the groundwater budgets discussed previously. Accordingly, the water budget assessment for Year 2042 conditions indicates that (1) the combined effects of increased future development, (2) the increased pumping that will occur in the future under the Basin Operating Plan, and (3) 2030 climate change are not likely to create a chronic long-term decline in the volume of stored groundwater. The Basin is anticipated to remain in a sustainable condition with respect to the SGMA criterion of avoiding chronic lowering of groundwater levels and not being in an overdraft condition as a result of future development, associated groundwater uses, and the influences of 2030 climate change.

Table 6.5-16. Estimated Annual Groundwater Inflows to the Basin for the Year 2042 Projected Water Budget (Using 1925–2019 Rainfall With 2030 Climate Change Factors)

Groundwater Inflow Component	Minimum	Maximum	Average	Percent of Total
Recharge from Precipitation	0	98,700	19,250	10.5%
Recharge from Streams	80,300	269,400	123,600	67.3%
Subsurface Inflow Beneath Castaic Dam	1,675	1,680	1,675	1%
Subsurface Inflow Beneath Santa Clara River and Other Tributaries	28,100	29,700	29,100	16%
Septic System Percolation	2,430	2,440	2,435	1%
Recharge of Applied Water	7,485	7,500	7,490	4%
Total	121,600	381,700	183,550	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which applies climate-change factors to the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-8 of Appendix I.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Deep percolation from irrigation is the sum for agricultural and municipal lands.

Septic system percolation applies to areas served by public water supplies that do not have public sewer collection systems.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual inflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

Table 6.5-17. Estimated Annual Groundwater Outflows from the Basin for the Year 2042 Projected Water Budget (Using 1925–2019 Rainfall With 2030 Climate Change Factors)

Groundwater Outflow Component	Minimum	Maximum	Average	Percent of Total
Groundwater Pumping	48,295	67,650	52,190	28%
Riparian Evapotranspiration	6,000	9,450	7,400	4%
Groundwater Discharge to Streams	79,350	253,300	125,500	68%
Total	135,000	311,000	185,100	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which applies climate-change factors to the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-8 of Appendix I.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Groundwater discharge to streams is the combined amount in ephemeral and perennial reaches.

Subsurface outflow through the thin alluvial material beneath the river at the western boundary of the Basin is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual outflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

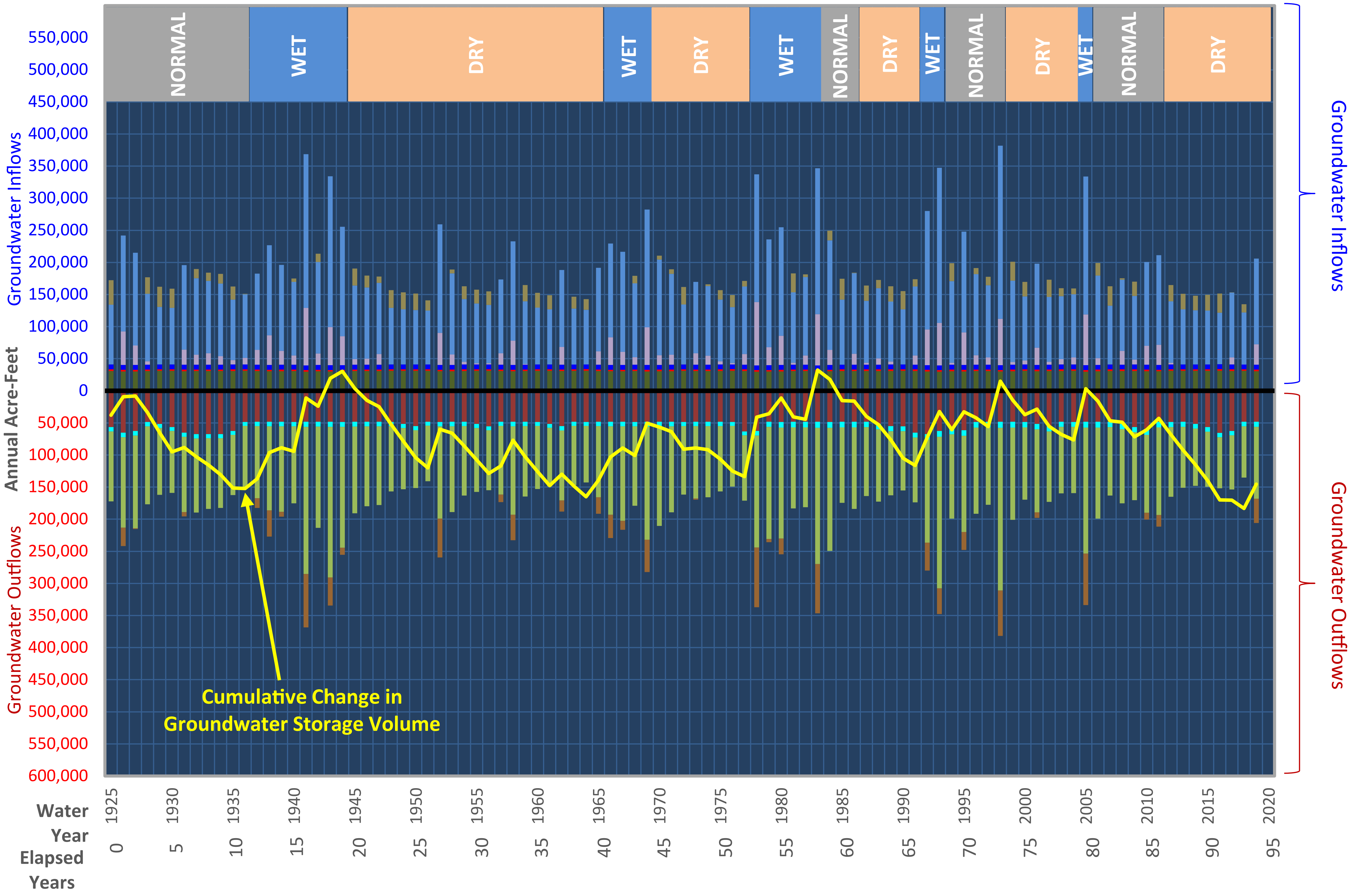


FIGURE 6.5-5

Projected Groundwater Budget For Year 2042 Conditions (Full Build-out Conditions With 2030 Average Climate Change)

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

NOTES

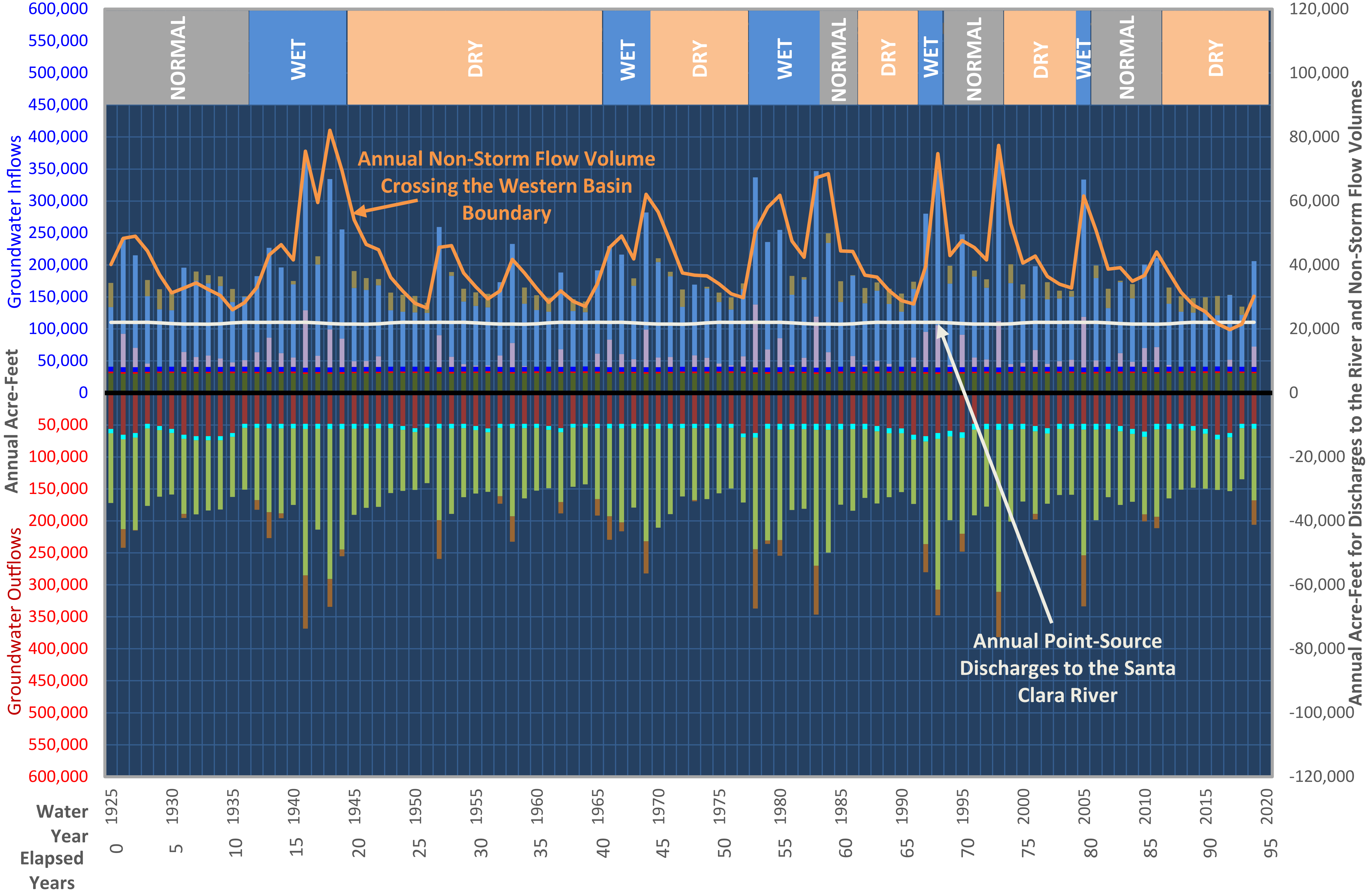
This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

FIGURE 6.5-6

Projected Groundwater Budget and Annual Non-Storm Flows at the Western Basin Boundary for Year 2042 Conditions (Full Build-out Conditions With 2030 Average Climate Change)

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan



LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

GSI Water Solutions, Inc.

6.5.4 Projected 50-Year Water Budget (Year 2072 Conditions)

As DWR discusses in its BMP for water budget development (DWR, 2016), the climate change analysis is a process in which variability in the historical climatic record is preserved while the magnitudes of events are increased or decreased based on projected changes in precipitation and air temperature, as obtained from global climate model outputs that have been downscaled to localized areas such as the Basin. This approach is used because it is impossible to know what precipitation and air temperatures will actually be in the year 2072, which is the end of the 50-year planning horizon for the projected water budget. As a result, the projected water budgets for Year 2072 conditions apply the 2070 climate-change factors to the historical (1925 through 2019) climate record while simulating full build-out of land and water uses. Output for the water budget is displayed in figures and tables as being for the period 1925 through 2019, even though the water budget is for Year 2072 conditions.

6.5.4.1 Surface Water Budget for Year 2072 Conditions

Figure 6.5-7 displays the year-by-year projected surface water budget for Year 2072 conditions. See also Table I-9 in Appendix I for detailed calculations.

Projected Imported Supplies

Projected imported supplies for the Year 2072 water budget are the same as for the projected water budget without climate change. See the discussion of projected imported supplies in Section 6.5.2.1 for details.

Projected Local Surface Water Inflows

Table 6.5-18 summarizes the average, minimum, and maximum values of the annual surface inflows to the Basin for the Year 2072 water budget. (See Table I-9 in Appendix I for detailed calculations.) These inflows are the same as for the projected water budget without climate change (see Table 6.5-10), with the exception of stormwater generation and stream inflows in the Santa Clara River and its tributaries (including Castaic Creek inflows), all of which are directly varied by DWR’s climate change factors for 2070. Additionally, the net inflow of groundwater to streams changes as the result of the aquifer system’s response to climate-change influences. The net effect of these decreases during the 95-year historical hydrologic period projected forward in time is an average surface water inflow of 269,400 AFY under 2070 climate change, compared with an average 289,000 AFY in the projected surface water budget without climate change (a difference of approximately 19,600 AFY, or 7.3 percent).

Projected Surface Water Outflows

Table 6.5-19 summarizes the average, minimum, and maximum values of the annual surface outflows from the Basin for the Year 2072 water budget. (See Table I-9 in Appendix I for detailed calculations.) Each of the four surface outflow terms are somewhat smaller under 2070 climate change than without climate change (see Table 6.5-11). Total surface water outflows are equal to total surface water inflows because there is no reservoir storage in the Basin.[42]

6.5.4.2 Groundwater Budget for Year 2072 Conditions

Figures 6.5-8 and 6.5-9 display the year-by-year projected groundwater budget for Year 2072 conditions. See also Table I-10 in Appendix I for detailed calculations.

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[42] As discussed in Section 6.3.2.3 for the historical water budget, the non-storm flows in the Santa Clara River at the western basin boundary under the projected water budgets include the amount of subsurface outflow that occurs within a thin veneer of alluvium that is present at the western basin boundary, which comprises the western boundary of the groundwater flow model.

Table 6.5-18. Estimated Annual Surface Water Inflows to the Basin for the Year 2072 Projected Water Budget (Using 1925–2019 Rainfall With 2070 Climate Change Factors)

Surface Water Inflow Component	Minimum	Maximum	Average	Percent of Total
In-Basin Precipitation	24,400	233,000	86,300	32%
Stormwater Generated from In-Basin Precipitation	20,675	138,150	68,350	---
Stream Inflow (Santa Clara River)	0	33,700	4,600	2%
Stream Inflow (Releases from Castaic Lake/Lagoon)	175	175,800	17,850	7%
Stream Inflow (Releases from Bouquet Reservoir)	110	110	110	0.04%
Stream Inflow (Other Santa Clara River Tributaries)	0	150,200	19,900	7%
Discharges to Santa Clara River from Saugus WRP	5,005	5,020	5,010	2%
Discharges to Santa Clara River from Valencia WRP and Newhall WRP	15,995	16,055	16,000	6%
Discharges to Santa Clara River from Groundwater Treatment Systems	500	501	500	0.2%
Groundwater Discharge to Streams	76,000	238,300	119,100	44%
Total	140,600	716,800	269,400	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which applies climate-change factors to the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-9 of Appendix I.
This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

5% of the releases from Bouquet Reservoir are assumed to remain as surface flow where Bouquet Creek enters the Basin.

The term "Net inflow from Groundwater" is the difference between stream gains and stream losses arising from groundwater/surface water exchanges in the Santa Clara River and its tributaries.

Total values do not include stormwater generated from in-basin precipitation, which is an internal flow process (and not an inflow to, or outflow from, the basin).

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water inflows.

WRP = water reclamation plant

Table 6.5-19. Estimated Annual Surface Water Outflows from the Basin for the Year 2072 Projected Water Budget (Using 1925–2019 Rainfall With 2070 Climate Change Factors)

Surface Water Outflow Component	Minimum	Maximum	Average	Percent of Total
Santa Clara River Non-Storm Outflow at the Western Basin Boundary	19,300	81,200	39,100	15%
Groundwater Recharge from Precipitation	0	106,100	17,950	7%
Groundwater Recharge from Streams	78,650	258,800	118,450	44%
ET and Stormwater Outflow	21,750	391,750	93,850	35%
Total	140,600	716,800	269,400	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which applies climate-change factors to the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-9 of Appendix I.

Subsurface outflow through the thin alluvial material beneath the river at the western boundary of the Basin is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

The total values shown at the bottom of this table are not equal to the sum of the individual terms because the minimum, maximum, and average values occur in different years for each of the individual surface water outflows.

ET = evapotranspiration

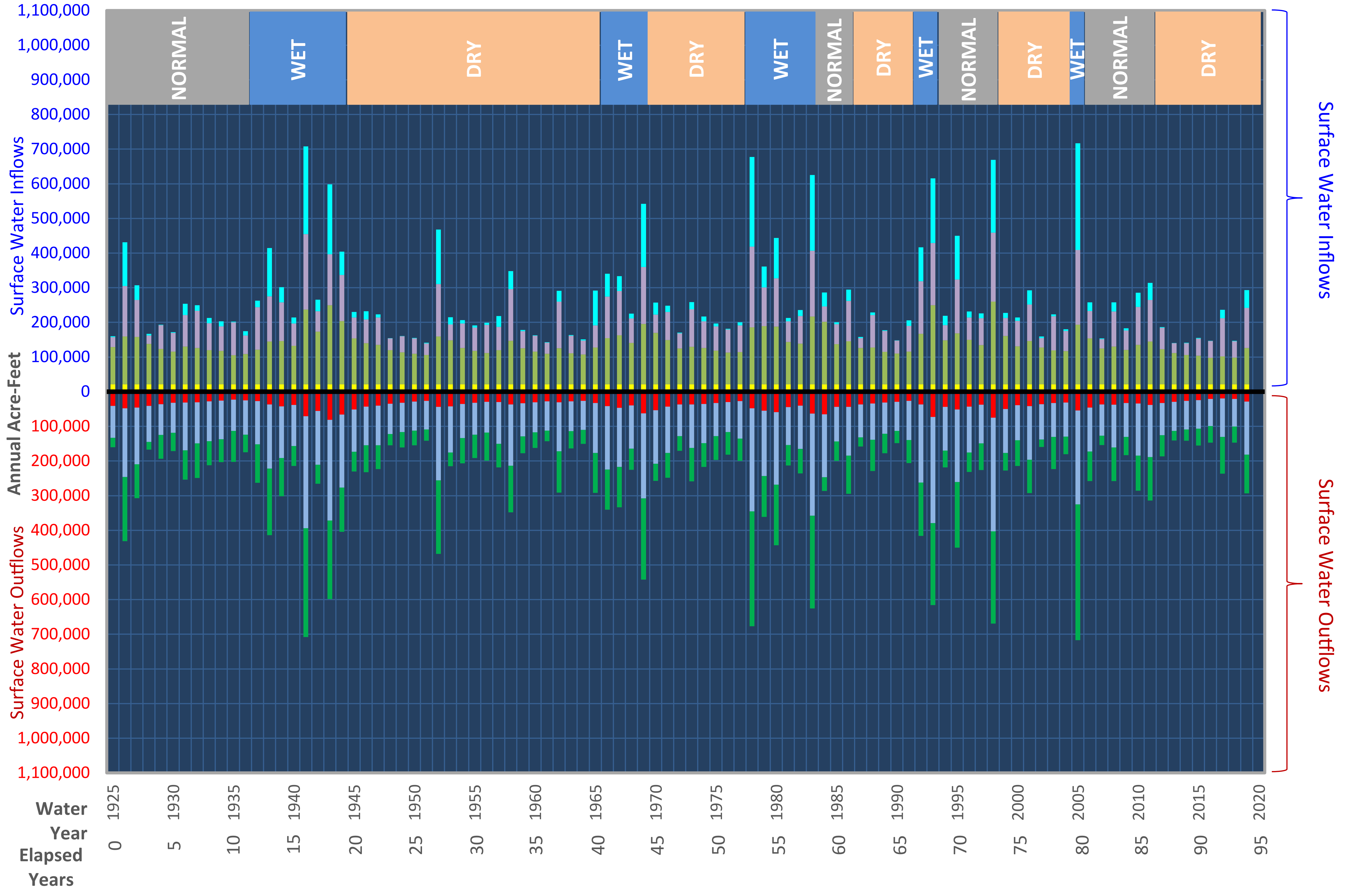


FIGURE 6.5-7

Projected Surface Water Budget for Year 2072 Conditions (Full Build-out Conditions With 2070 Average Climate Change)

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟪 Precipitation
- 🟦 Stream Inflows
- 🟦 Point-Source Flows to Streams
- 🟩 Net Inflow from Groundwater
- 🟥 Non-Storm Flow at County Line
- 🟩 ET and Storm Outflows
- 🟦 Groundwater Recharge from Streams and Rainfall

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
ET: evapotranspiration

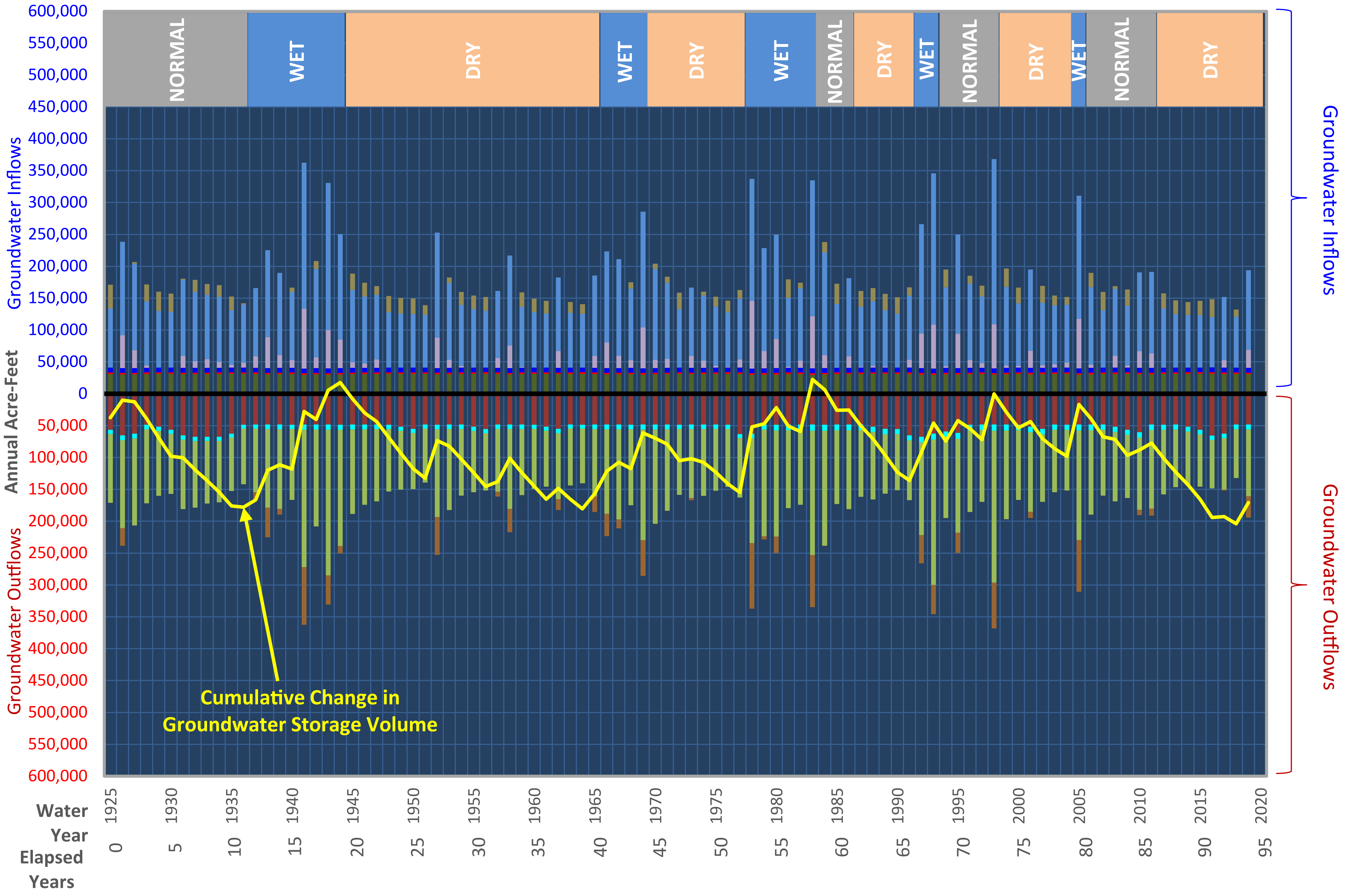


FIGURE 6.5-8

Projected Groundwater Budget For Year 2072 Conditions (Full Build-out Conditions With 2070 Average Climate Change)

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan

LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

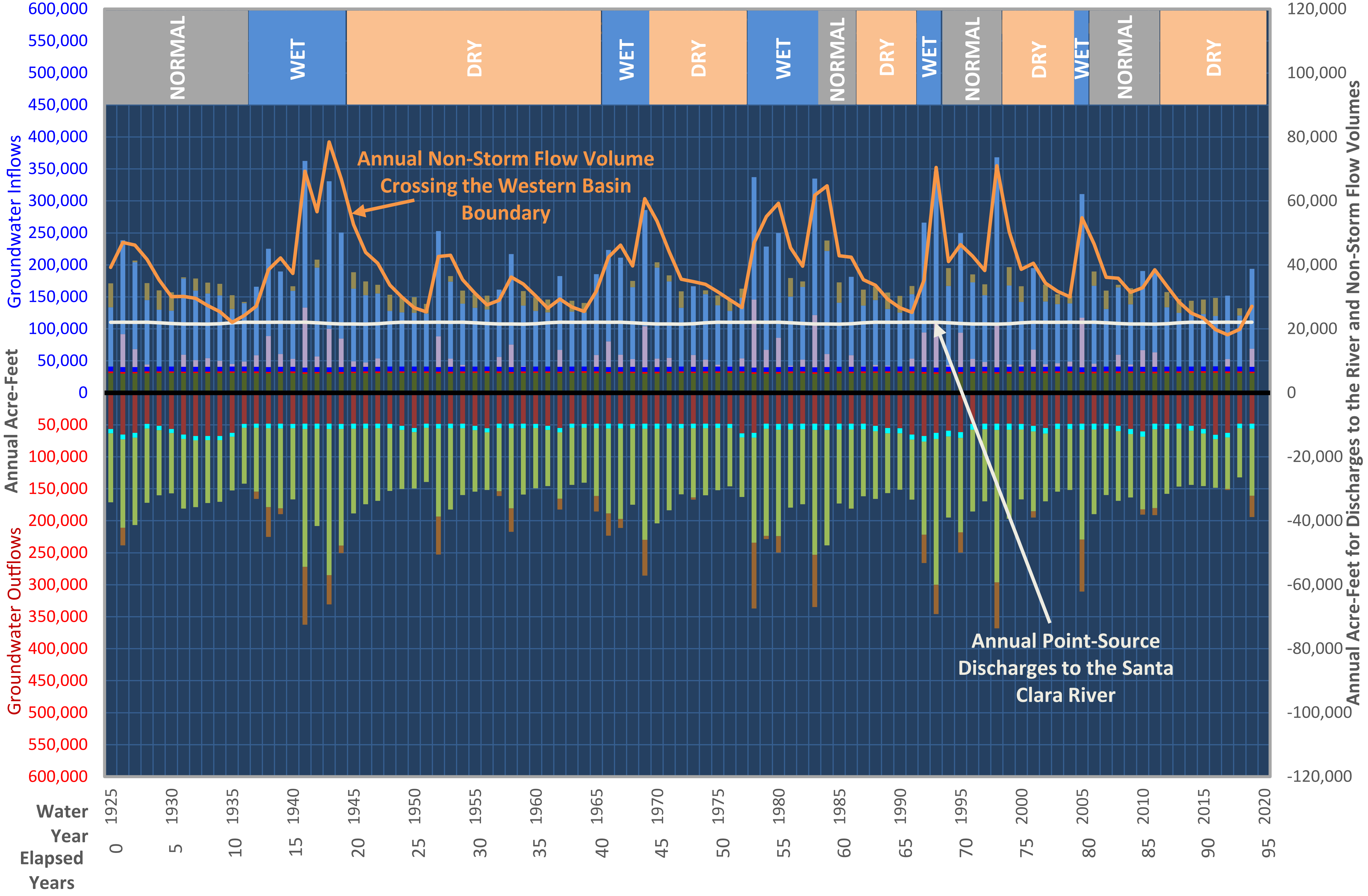
NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

FIGURE 6.5-9

Projected Groundwater Budget and Annual Non-Storm Flows at the Western Basin Boundary for Year 2072 Conditions (Full Build-out Conditions With 2070 Average Climate Change)

Santa Clara River Valley
East Groundwater Subbasin
Groundwater Sustainability Plan



LEGEND

- 🟩 Stream Gains
- 🟦 Stream Losses
- 🟪 Precipitation
- 🟦 Ag+Muni Irrigation
- 🟩 Subsurface Inflow in Tributaries
- 🟥 Septic
- 🟥 Pumping
- 🟦 ET
- 🟫 Groundwater Storage Increase
- 🟫 Groundwater Storage Reduction

NOTES

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.
Ag: agriculture
Muni: municipal
ET: evapotranspiration

Projected Groundwater Inflows

Table 6.5-20 summarizes the average, minimum, and maximum values of the annual inflows to groundwater in the Basin for the Year 2072 water budget (with DWR's 2070 climate change factors). (See Table I-10 in Appendix I for detailed calculations.) These inflows are the same as for the projected water budget without climate change (see Table 6.5-12), except for reductions in deep percolation from stormwater and from precipitation falling directly within the Basin. The net effect of these changes during the 95-year historical hydrologic period projected forward in time is an average groundwater inflow of 177,100 AFY under 2070 climate change compared with 188,500 AFY in the projected groundwater budget without climate change (see Table 6.5-12), which is a difference of 11,400 AFY, or 6.4 percent.

Projected Groundwater Outflows

Table 6.5-21 summarizes the average, minimum, and maximum values of the annual outflows from groundwater in the Basin for the Year 2072 water budget (with DWR's 2070 climate change factors). (See Table I-10 in Appendix I for detailed calculations.) Groundwater pumping is the same as for the projected water budget without climate change (see Table 6.5-13), while riparian ET increases by 380 AFY and groundwater discharge to streams decreases by 11,350 AFY under 2070 climate change. The average groundwater outflow is 178,900 AFY under 2070 climate change, which is 10,950 AFY (6.0 percent) lower than the 189,850 AFY of outflow that occurs in the projected groundwater budget without climate change (see Table 6.5-13).

Projected Changes in Groundwater Storage

The yellow line on Figure 6.5-8 shows how much the volume of stored groundwater changes progressively over time when simulating the combined effects of (1) 2070 climate change and (2) full build-out land and water uses through the historical hydrologic record projected forward in time. As with the cumulative change plots for groundwater budgets discussed previously (Figures 6.3-3, 6.4-2, and 6.5-5), the cumulative-change plots for groundwater storage under Year 2072 conditions (Figure 6.5-8) shows that (1) the occurrence of rising versus declining slopes in the cumulative-change curve calculated by the numerical groundwater flow model varies frequently during the 95-year historical period, and (2) the cumulative-change curve under Year 2072 conditions has a shape that is generally similar to the cumulative-change curves for the groundwater budgets discussed previously. Accordingly, the water budget assessment for Year 2072 conditions indicates that the combined effects of increased future development, the increased pumping that will occur in the future under the Basin Operating Plan, and 2070 climate change are not likely to create a chronic long-term decline in the volume of stored groundwater. The Basin is anticipated to remain in a sustainable condition with respect to the SGMA criterion of avoiding chronic lowering of groundwater levels and not being in an overdraft condition as a result of future development, associated groundwater uses, and the influences of 2070 climate change.

Table 6.5-20. Estimated Annual Groundwater Inflows to the Basin for the Year 2072 Projected Water Budget (Using 1925–2019 Rainfall With 2070 Climate Change Factors)

Groundwater Inflow Component	Minimum	Maximum	Average	Percent of Total
Recharge from Precipitation	0	106,100	17,950	10%
Recharge from Streams	78,650	258,800	118,450	67%
Subsurface Inflow Beneath Castaic Dam	1,675	1,680	1,675	1%
Subsurface Inflow Beneath Santa Clara River and Other Tributaries	28,100	29,700	29,100	16.5%
Septic System Percolation	2,430	2,440	2,435	1.5%
Recharge of Applied Water	7,480	7,490	7,485	4%
Total	120,000	368,100	177,100	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which applies climate-change factors to the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-10 of Appendix I.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Deep percolation from irrigation is the sum for agricultural and municipal lands.

Septic system percolation applies to areas served by public water supplies that do not have public sewer collection systems.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual inflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

Table 6.5-21. Estimated Annual Groundwater Outflows from the Basin for the Year 2072 Projected Water Budget (Using 1925–2019 Rainfall With 2070 Climate Change Factors)

Groundwater Outflow Component	Minimum	Maximum	Average	Percent of Total
Groundwater Pumping	48,295	67,650	52,190	29%
Riparian Evapotranspiration	6,050	9,750	7,600	4%
Groundwater Discharge to Streams	76,000	238,300	119,100	67%
Total	132,200	300,200	178,900	100%

Notes

All values are in units of acre-feet per year (AFY) and are for the 95-year model simulation period (which applies climate-change factors to the historical rainfall record of water years 1925 through 2019). Percentages are calculated from the average values. All values are rounded from the statistics calculated in Table I-10 of Appendix I.

This projected water budget is developed by projecting the 1925-2019 historical hydrology forward in time.

Groundwater discharge to streams is the combined amount in ephemeral and perennial reaches.

Subsurface outflow through the thin alluvial material beneath the river at the western boundary of the Basin is accounted for as outflow in the surface water budget because the historical and current stream gages are located further downstream where bedrock is thought to be at or just beneath the river channel, which causes most if not all subsurface water at the western basin boundary to appear in the river upstream of those gages.

For the minimum and maximum values, the total values shown in this table are not equal to the sum of the individual outflow terms because the minimum values of the individual terms occur in different years, and similarly for the maximum values.

6.5.5 Summary of Basin Conditions Under the Projected Water Budgets

The projected water budgets show that the cumulative change curve for groundwater storage may shift slightly downward with the onset of slightly reduced precipitation and greater ET in the Basin. However, as with the historical and current water budgets, the three projected water budgets for the Basin indicate that chronic long-term declines in the volume of stored groundwater are not expected to occur in the future under (1) the pattern of wet/normal/dry year fluctuations observed during the past 95 years and (2) the influence of climate change on the magnitudes of precipitation and streamflows during that 95-year period. This observation in turn indicates (1) the Basin is not likely to be in an overdraft condition under a sustained level of pumping at the full-build-out level of human demand for groundwater, even under the average climate change scenarios for 2030 and 2070; and (2) the operating plan for the Basin's groundwater resources is expected to continue maintaining a condition that does not create an overdraft condition (chronic long-term declines in groundwater levels) in the future.

Figures 6.5-3, 6.5-6, and 6.5-9 show that the projected annual non-storm flow volumes across the western basin boundary are expected to fluctuate according to precipitation patterns but otherwise show no discernible long-term trends in the future. This occurs in part because of the year-to-year uniformity in WRP discharge volumes to the river that is expected to occur once the Basin is fully built out. A 2019 study (Maddaus, 2019) estimated that under full build-out conditions in the Basin, future inflows to local WRPs will rise to 30,300 AFY, with approximately 21,000 AFY of this inflow becoming treated water that will be discharged to the river, with the remaining 9,300 AFY available as recycled water supply for urban irrigation uses. More recent updates to the full build-out water demand estimates (for the 2020 UWMP; see KJ, 2021) have slightly reduced the forecasted amount of indoor use and flows into the WRPs, which has reduced the amount of recycled water to 8,961 AFY; this updated projection does not reduce the amount of WRP discharges (approximately 21,000 AFY) to the river.

6.5.6 Uncertainties

The uncertainties in the projected water budgets fall into four categories:

- **Data and quantification methods**, including how the basin responds and how well the numerical groundwater flow model of the Basin represents the responses (i.e., a discussion of the model's calibration quality, plus the model's limitations/uncertainties as discussed in Appendix G, the model development report [GSI, 2021])
- **Future water demands, water uses, and WRP discharges to the river**
- **Restrictions in the availability of future imported supplies** (restrictions that are minimized because of the breadth of SCV Water's imported water supply portfolio, SCV Water's past and ongoing investments in banked supply sources outside the Basin, and SCV Water's use of water exchanges with neighboring water districts)
- **Climate change and future cycles of wet/normal/dry year conditions**

Estimating the effects of future climate changes and changes in land use and human water demands 20 and 50 years into the future is challenging and full of uncertainties. The uncertainty of data and quantification methods is described and addressed in Section 6.3.5. The three other uncertainties listed above pertain to topics that have been examined and defined in detail in the following:

- Local land-use plans (SCAG, OVOV, and the Newhall Ranch Specific Plan)
- Local water-use plans (the 2020 UWMP; see KJ, 2021)

- A local water supply reliability study (Clemm and KJC, 2017) that was conducted after the 2015 UWMP was completed[43] and was recently updated (Geosyntec, 2021) in support of the 2020 UWMP
- A recent study of indoor water uses and the resulting inflows to local WRPs under full build-out conditions in the Basin (Maddaus, 2019)
- Past and recent DCRs for the SWP system (DWR, 2015 and 2020)
- Climate change studies by DWR, which has provided local climate-change factors for the GSP development team's use in developing the projected water budgets for the Basin

Accordingly, these references provide the best possible estimates of most aspects of future build-out, human water demands, water supply availability, and climate-change conditions. Nonetheless, certain assumptions have been required to develop the projected water budgets—primarily the (1) amount of pumping by private groundwater users and (2) future volumes of WRP flows to be discharged to the river versus used as recycled water supply for urban irrigation purposes. Additionally, a close examination of DWR's climate-change factors for precipitation and reference ET was conducted to develop modifications to the precipitation-recharge relationship that is used by the groundwater flow model to define recharge from local precipitation and stormwater inflows under future climate-change influences. Through these efforts, sufficient planning and climate-change analysis has occurred to date such that reasonable assumptions regarding these uncertainties can be made for the purposes of developing the projected water budgets. If future planning indicates that the amounts of these or other specified inflow terms to the Basin are likely to differ from the values presented in these projected water budgets, then the new estimates can be incorporated into modeling and water budget analyses during the GSP implementation period for the purpose of developing updated projected water budgets.

6.6 Basin Yield Estimate

The basin yield for a groundwater basin is the average annual volume of pumping that can occur on a long-term basis without creating a chronic (i.e., continual) year-over-year lowering of groundwater levels and reduction in groundwater storage volumes. Basin yield is generally considered equal to the average replenishment rate of the aquifer from natural and artificial recharge sources. ET and basin outflow are also factored into replenishment rates. If pumping exceeds recharge on a long-term basis, the basin yield of a groundwater basin can be estimated to be equal to the average amount of historical pumping minus the change in storage under the observed historical conditions.

Basin yield is not the same as sustainable yield. As defined by SGMA, sustainable groundwater management avoids the occurrence of an undesirable result. An undesirable result is one or more of the following effects:

- Chronic water level declines in the aquifer system[44]
- Significant and unreasonable reductions in groundwater storage

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[43] As discussed in Section 6.3.2.1, CLWA (SCV Water's predecessor agency) prepared a Water Supply Reliability Report Update in 2017 that demonstrated the ability of CLWA's imported water supply portfolio to meet supplemental water demands fully and reliably within CLWA's service area. The reliability study incorporated the groundwater operating plan and analyzed CLWA's imported water portfolio through 2050 build-out using the historical hydrologic conditions that have been recorded for nearly a century in the region. The report demonstrated full reliability under 2015 UWMP assumptions. The report also concluded that, even with a significant reduction in SWP reliability, the full demands within the service area can be met without exceeding the groundwater operating plan. A recent draft update of the Water Supply Reliability Plan (Geosyntec, 2021) reached the same conclusions—specifically, that, with planned investments, there would be a supply surplus that would greatly exceed any projected shortfalls, as long as the remaining supply capacity in the Saugus Formation and/or in specific water banks is fully developed.

[44] A chronic decline means a decline that continues and progresses over time, with groundwater levels and groundwater storage volumes not achieving a long-term equilibrium condition.

- Significant and unreasonable degradation of water quality
- Seawater intrusion
- Significant and unreasonable land subsidence that interferes with surface land uses
- Depletion of interconnected surface water that has significant and unreasonable adverse impacts on beneficial uses of surface water, including impacts to GDEs

Defining the annual groundwater withdrawal volume that constitutes the basin yield volume for a groundwater basin provides a starting point for later establishing sustainability criteria through the consideration of each of the six sustainability indicators (undesirable results) listed above. As discussed in Sections 8 and 9 of the GSP, undesirable results arising from pumping in the groundwater basin have not been identified to date and are not expected to occur under the Basin Operating Plan—given that the operating plan is expected to not create a chronic decline in groundwater levels, a reduction of groundwater in storage, nor significant and unreasonable depletion of surface water. These conditions will be monitored and evaluated under the monitoring program described in Section 7 of the GSP, along with monitoring of the two other sustainability indicators that are pertinent in the Basin (degraded groundwater quality and land subsidence). If undesirable results are identified in the future, then the GSP will include projects and management actions to return the Basin to a sustainable condition. Because undesirable results are not expected to occur, the basin yield volume of at least 52,200 AFY is numerically equivalent to the sustainable yield of the Basin (and potentially might be higher).

The water budgets presented in this section identify that conditions indicative of groundwater overdraft have not been observed historically and are not likely to occur during the 50-year planning horizon for SGMA (through the year 2072) under the Basin's existing Basin Operating Plan and under future full build-out conditions (which are expected to occur by 2050). The lack of overdraft conditions is indicated by the cumulative-change-in-storage curves for the historical, current, and projected (2042 and 2072) groundwater budgets, which show a lack of chronic declines in groundwater storage volumes during the 95-year historical hydrologic record through which each level of groundwater pumping demand has been evaluated. In particular, the 2042 and 2072 projected water budgets indicate that the combination of a changing climate and full build-out of the Basin are unlikely to create chronic declines in the Basin's groundwater resources over long periods (i.e., no repeated lowering of groundwater levels and groundwater storage volumes is expected to occur from one period to the next when viewed on a multi-decadal scale). As with the historical record, short-term periods of lowered groundwater storage volumes are likely to occur in the future in tandem with local droughts that are prolonged (as occurred from 1945 through 1965) and/or local droughts that are particularly intense (i.e., with substantially below-normal precipitation, as occurred from 2012 through 2016).

Historical observations are consistent with the finding from the water budget analyses of the absence of an overdraft condition to date in the groundwater system. Modeling analyses of the historical water budget indicate that the period of peak groundwater pumping from the Alluvial Aquifer during the Basin's peak agricultural years did not create year-over-year continued and sustained chronic declines in groundwater levels that could not be recovered once agricultural lands began to be retired (starting in the 1960s). Since that time, the municipal water providers have pumped groundwater from the Alluvial Aquifer at rates that have not created a condition of chronic reductions in groundwater levels and groundwater storage in the Basin's groundwater system, as indicated by (1) water level data that are presented in the annual water reports for the Basin, including the 2019 annual report (LSCE, 2020), and (2) modeling analyses of historical basin conditions.

Given that the historical, current, and projected water budgets indicate that the Basin's operating plan for its local groundwater resources does not produce chronic and sustained declines in groundwater storage volumes or groundwater levels in the aquifer system on a long-term basis, the basin yield volume for the

Basin is likely higher than the average pumping rate simulated in the projected water budget for full build-out conditions. Table 6.6-1 compares the annual groundwater pumping volumes that were modeled for the projected water budget with the annual pumping volumes for the Basin that are specified in the Basin Operating Plan. As discussed in a prior detailed study (LSCE and GSI, 2009), the Basin Operating Plan calls for maximizing the use of Alluvial Aquifer groundwater and imported water during years of normal or above-normal availability of those supplies, limiting the use of Saugus Formation groundwater during those periods, and temporarily increasing Saugus Formation pumping during years when imported SWP water supplies are significantly curtailed. The Basin Operating Plan calls for total groundwater production from the Basin ranging from a limit of 55,000 AFY during normal years (locally and with respect to SWP water availability) to a limit of 70,000 AFY during years that are characterized by both locally dry conditions and a multi-year curtailment of SWP water. The average annual pumping volume in the numerical groundwater flow model simulations of full build-out conditions was 52,200 AFY and pumping during each multiple-year dry-year period was simulated at rates of up to 67,500 AFY.

The projected water budgets described in Section 6.5 indicate that if the Basin continues to be operated conjunctively as was modeled for full build-out conditions (i.e., if Saugus Formation pumping is low except during periods of significant curtailments of SWP water), then the Basin can be expected to not be in overdraft, and hence to remain in a sustainable condition with respect to the SGMA criterion of avoiding chronic water level declines in the aquifer system. The results of the projected water budget analyses also indicate that, pursuant to the Basin Operating Plan, the Basin can be pumped at an annual rate of at least 67,500 AFY for multiple dry years without causing chronic water level declines. The number of consecutive dry years that the Basin can be pumped at or above 67,500 AFY without causing chronic water level declines has not been tested or determined. Thus, it is prudent to consider the basin yield volume for the Basin to be at least 52,200 AFY, based on the long-term average amount of pumping in the projected water budget.

Table 6.6-1. Annual Groundwater Pumping for the Basin Operating Plan and the Projected Water Budgets

Year Type	Modeled Groundwater Pumping for the Projected Water Budgets	Pumping Ranges Specified in the Basin Operating Plan
Normal	48,300	37,500 to 55,000
Dry Year 1	52,500	45,000 to 60,000
Dry Year 2	57,500	51,000 to 60,000
Dry Year 3+	67,500	51,000 to 70,000
Modeled Average for Projected Water Budgets	52,200	

Notes

Normal-year and dry-year values are in units of acre-feet per year (AFY) and are for 365-day years. Values will be higher in leap years.

The modeled average of 52,200 AFY is for the 95-year time period that is simulated in the numerical groundwater flow model, and is rounded from values presented in other tables and in Appendix I.

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7. Monitoring Networks

7.1 Introduction

This section evaluates existing monitoring programs in the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin) and incorporate elements of existing monitoring programs into a GSP monitoring network and program to be consistent with SGMA regulations and presents a recommended GSP monitoring program.

7.2 Existing Monitoring Programs

Existing monitoring programs considered relevant to monitoring of sustainability indicators were evaluated to identify monitoring sites and historical data that can be utilized in the development of a monitoring network for this GSP. Existing monitoring programs in the Basin that relate to sustainability indicators include efforts conducted by the following entities and agencies:

- Santa Clarita Valley Water Agency (SCV Water) groundwater elevation and quality monitoring programs (reported in the Santa Clarita Valley Water Report)
- County of Los Angeles Waterworks District 36 groundwater production well monitoring
- County of Los Angeles Flood Control District Groundwater Elevation monitoring
- Los Angeles County Department of Public Works (LACDPW) and U.S. Geological Survey (USGS) streamflow monitoring
- CASGEM – Santa Clara River Valley Basin – Santa Clara River Valley East
- University NAVSTAR Consortium (UNAVCO) Plate Boundary Observatory
- California Drinking Water Watch
- Department of Toxic Substances Control (Whittaker-Bermite)
- Santa Clarita Valley Water Agency Salt and Nutrient Management Plan monitoring
- Santa Clarita Valley Sanitation District of Los Angeles County (SCVSD)

The focus of the monitoring program evaluation will be on existing monitoring programs conducted by the agencies listed above. Short-term monitoring such as programs under the purview of the Regional Water Quality Control Boards will not be discussed, as those efforts are concerned with items outside the scope of Groundwater Sustainability Agencies (GSAs) in the monitoring of sustainability indicators under the SGMA regulations.

Previous reports on monitoring programs such as the Salt and Nutrient Management Plan (GSSI, 2016) and the Santa Clarita Valley Water Report (LSCE, 2020), have summarized existing monitoring programs in the Basin. The purpose of this section is to identify components of existing monitoring programs that can be utilized for GSP development and implementation based on the six sustainability indicators for which monitoring is identified in the SGMA regulations. Brief summaries of each program are provided below.

7.2.1 Santa Clarita Valley Water Agency: Basin Groundwater Monitoring

The Santa Clarita Valley Water Agency (SCV Water) collects water level measurements from production and observation wells within the Basin. These monitoring efforts were described in the *Groundwater Management Plan, Santa Clara River Valley Groundwater Basin, East Subbasin, Los Angeles County, California* (LSCE, 2003), and monitoring results have been reported in the annual Santa Clarita Valley Water

Report that has been prepared every year since 1999. See LSCE (2020) for the most recent annual report, which documents basin groundwater conditions and water uses in the Santa Clarita Valley during the year 2019. Currently, SCV Water's monitoring network includes 53 municipal wells, 10 irrigation wells, and two observation wells (see Table 7-1). Measurements of groundwater elevations conform to standards stated in SGMA regulations § 352.4, however, the accuracy of some of the reference point elevations are to the nearest foot rather than to the nearest tenth of a foot, consistent with SGMA regulations and best management practices (BMPs). The BMP guidance states that historically, water level measurements have been collected on a semi-annual to quarterly basis and recommends that monitoring continue at the same frequency. However, an official schedule has not been developed. In recent years, most of the monitored wells have had water levels measured on a monthly basis. The spatial distribution of SCV Water's current groundwater level monitoring network is displayed in Figure 7-1.

Table 7-1. SCV Annual Report Water Level Monitoring Network

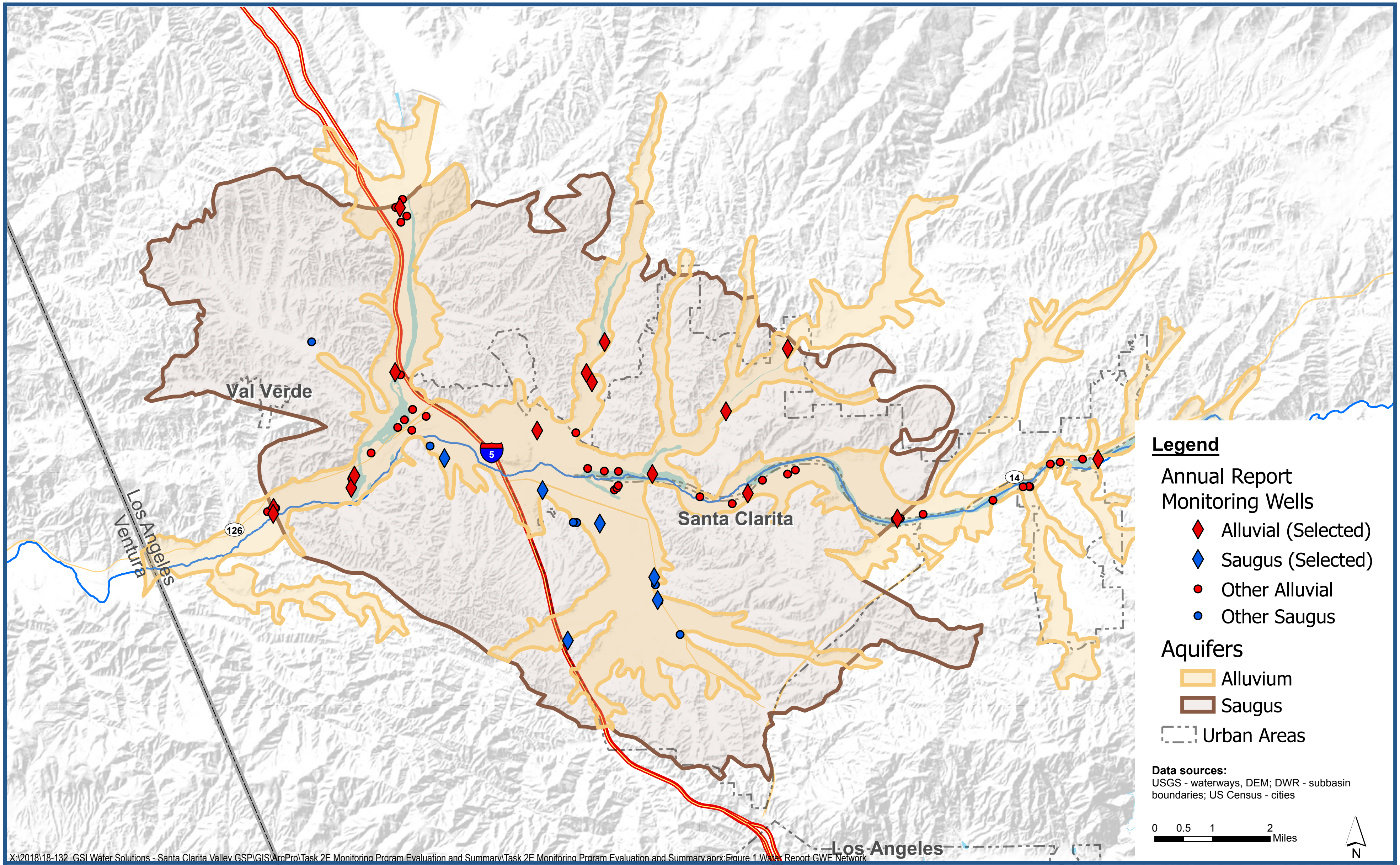
Well Name	Depth (ft bgs)	Reference Point Elevation (ft asl)	Latitude	Longitude	Aquifer	Well Use	Water Level/ Quality Network
NWD-Castaic 2	120	1135	34.492868	-118.614793	Alluvial	MUN	Yes/Yes
SCWD-Clark	160	1253	34.440422	-118.51665	Alluvial	MUN	Yes/Yes
SCWD-Guida	116	1342	34.455905	-118.497607	Alluvial	MUN	Yes/Yes
SCWD-N. Oaks Central	244	1391	34.412772	-118.465123	Alluvial	MUN	Yes/Yes
VWD-D	142	1035.617	34.4515184	-118.617003	Alluvial	MUN	Yes/Yes
VWD-Q2	170	1166.641	34.424925	-118.539325	Alluvial	MUN	Yes/Yes
VWD-U4	135	1242.795	34.4196891	-118.510433	Alluvial	MUN	Yes/Yes
VWD-W9	160	1174.995	34.450584	-118.558871	Alluvial	MUN	Yes/Yes
NWD-12	1340	1204	34.393227	-118.538274	Saugus	MUN	Yes/Yes
VWD-160	2000	1102.083	34.4213	-118.572743	Saugus	MUN	Yes/Yes
VWD-W11	180	1208.253	34.4583091	-118.553181	Alluvial	MUN	Yes/Yes
VWD-201	1690	1152	34.4127002	-118.555486	Saugus	MUN	Yes/Yes
VWD-206	2060	1059	34.4297323	-118.602348	Saugus	MUN	Yes/Yes
VWD-159	1950	1291	34.3834173	-118.565787	Saugus	IRR	Yes/No
NLF-B10	142	896	34.416345	-118.654631	Alluvial	IRR	Yes/No
NLF-C4	148	951	34.422612	-118.630799	Alluvial	IRR	Yes/No
NLF-W5	265	1155	34.448255	-118.557233	Alluvial	IRR	Yes/No
NWD-Pinetree 1	235	1583.5	34.426846	-118.40386	Alluvial	MUN	Yes/Yes
VWD-I	171	1089	34.436308	-118.574092	Alluvial	MUN	Yes/Yes
NWD-11	1136	1188	34.398992	-118.539234	Saugus	MUN	Yes/No
VWD-E15	160	1022.957	34.4420904	-118.611842	Alluvial	MUN	Yes/Yes
VWD-S8	220	1143.355	34.4257389	-118.5496	Alluvial	MUN	Yes/Yes
VWD-T7	No Data	1211.08	34.4190488	-118.524976	Alluvial	MUN	Yes/Yes
VWD-205	1950	1148.531	34.4131026	-118.563544	Saugus	MUN	Yes/Yes

Well Name	Depth (ft bgs)	Reference Point Elevation (ft asl)	Latitude	Longitude	Aquifer	Well Use	Water Level/ Quality Network
NWD-Castaic 1	310	1129	34.489194	-118.614561	Alluvial	MUN	Yes/Yes
NWD-Castaic 7	No Data	1149	34.49292794	-118.616072	Alluvial	MUN	Yes/Yes
NWD-Pinetree 5	No Data	1597	34.42695067	-118.408591	Alluvial	MUN	Yes/Yes
SCWD-Honby	202	1280	34.424401	-118.498265	Alluvial	MUN	Yes/Yes
SCWD-Lost Canyon 2	310	1532	34.420205	-118.424712	Alluvial	MUN	Yes/Yes
SCWD-Lost Canyon 2A	252	1532	34.420332	-118.425014	Alluvial	MUN	Yes/Yes
SCWD-Mitchell #5A	360	1486	34.416997	-118.436016	Alluvial	MUN	Yes/Yes
SCWD-Mitchell #5B	164	1486	34.416997	-118.436016	Alluvial	MUN	Yes/Yes
SCWD-N. Oaks East	150	1391	34.412814	-118.464233	Alluvial	MUN	Yes/Yes
SCWD-N. Oaks West	136	1387	34.412589	-118.465772	Alluvial	MUN	Yes/Yes
SCWD-Sand Canyon	250	1525	34.420241	-118.426799	Alluvial	MUN	Yes/Yes
SCWD-SantaClara	160	1289	34.42538	-118.49586	Alluvial	MUN	Yes/Yes
SCWD-Sierra	175	1417	34.413762	-118.457296	Alluvial	MUN	Yes/Yes
SCWD-Valley Center	133	1256	34.42296	-118.50591	Alluvial	MUN	Yes/Yes
VWD-N	280	1131.558	34.4210879	-118.550912	Alluvial	MUN	Yes/Yes
VWD-N7	200	1131.606	34.4215732	-118.550156	Alluvial	MUN	Yes/Yes
VWD-N8	210	1133.314	34.4221711	-118.549702	Alluvial	MUN	Yes/Yes
VWD-S6	220	1127.164	34.4265943	-118.558928	Alluvial	MUN	Yes/Yes
VWD-S7	210	1128.645	34.4258737	-118.553892	Alluvial	MUN	Yes/Yes
VWD-U6	175	1230.6	34.4171894	-118.515197	Alluvial	MUN	Yes/Yes
VWD-W10	190	1130.285	34.4356123	-118.562372	Alluvial	MUN	Yes/Yes
LA36-19	2120	No Data	34.45945	-118.64221	Saugus	MUN	Yes/No
NWD-13	1300	1194	34.397092	-118.538908	Saugus	MUN	Yes/Yes
VWD-207	1220	1035.74	34.4328289	-118.606697	Saugus	MUN	Yes/Yes
NWD-Pinetree 3	146	1560	34.426279	-118.415378	Alluvial	MUN	Yes/Yes
NWD-07	994	1250	34.384496	-118.531647	Saugus	MUN	Yes/No
NLF-B14	No Data	904	34.41778	-118.65383	Alluvial	IRR	Yes/No

Well Name	Depth (ft bgs)	Reference Point Elevation (ft asl)	Latitude	Longitude	Aquifer	Well Use	Water Level/ Quality Network
NLF-B16	No Data	898	34.41691045	-118.656344	Alluvial	IRR	Yes/No
NLF-C10	No Data	956	34.42487028	-118.630607	Alluvial	IRR	Yes/No
NLF-E	180	1024	34.450829	-118.615362	Alluvial	IRR	Yes/No
NLF-G3	No Data	1002	34.43687414	-118.612169	Alluvial	IRR	Yes/No
NLF-X3	161	1014	34.440306	-118.607767	Alluvial	IRR	Yes/No
NWD-Castaic 4	203	1129	34.490718	-118.612751	Alluvial	MUN	Yes/No
NWD-Castaic 6	142	No Data	34.494919	-118.613978	Alluvial	MUN	Yes/No
NWD-Pinetree 4	185	1552.5	34.425847	-118.418405	Alluvial	MUN	Yes/No
VWD-All. Mon. Well	190	1152	34.4125844	-118.555505	Alluvial	OBS	Yes/No
VWD-E14	150	1000	34.43951	-118.61437	Alluvial	MUN	Yes/No
VWD-E16	170	996	34.43762	-118.61644	Alluvial	MUN	Yes/No
VWD-E17	150	983	34.4313	-118.62463	Alluvial	MUN	Yes/Yes
NWD-10	1555	1204	34.392909	-118.537921	Saugus	MUN	Yes/No
VWD-205M	1956	1142	34.4130384	-118.562501	Saugus	OBS	Yes/No

Notes

ft bgs = feet below ground surface   ft asl = feet above sea level



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Santa Clarita Valley Water Agency
Annual Groundwater Level Monitoring Network

Santa Clara River Valley East Subbasin
Groundwater Sustainability Plan

Figure 7-1

SCV Water also monitors groundwater quality in the Basin as part of municipal water supply permitting requirements and for other purposes. The groundwater quality constituents of most concern that are presently monitored by SCV Water are volatile organic compounds, perchlorate, total dissolved solids (TDS), and per- and polyfluoroalkyl substances (PFAS). These constituents are discussed in the Annual Water Report (see LSCE, 2020). Other water quality constituents that are monitored include boron, chloride, nitrate, and sulfate, among other general minerals and trace elements. The network of wells regularly sampled for groundwater quality includes 33 Alluvial Aquifer wells and eight Saugus Formation wells. Water quality data for wells in the network are collected on varying schedules as required by California State Water Resources Control Board (SWRCB) Division of Drinking Water. The groundwater quality monitoring network is displayed in Figure 7-2. Wells within each aquifer have been selected as representative of aquifer conditions in each of the two primary aquifers in the Basin (the Alluvial Aquifer and the Saugus Formation). Well depth and location information, and aquifer designation for the wells commonly used for groundwater quality sampling are presented in Table 7-1.

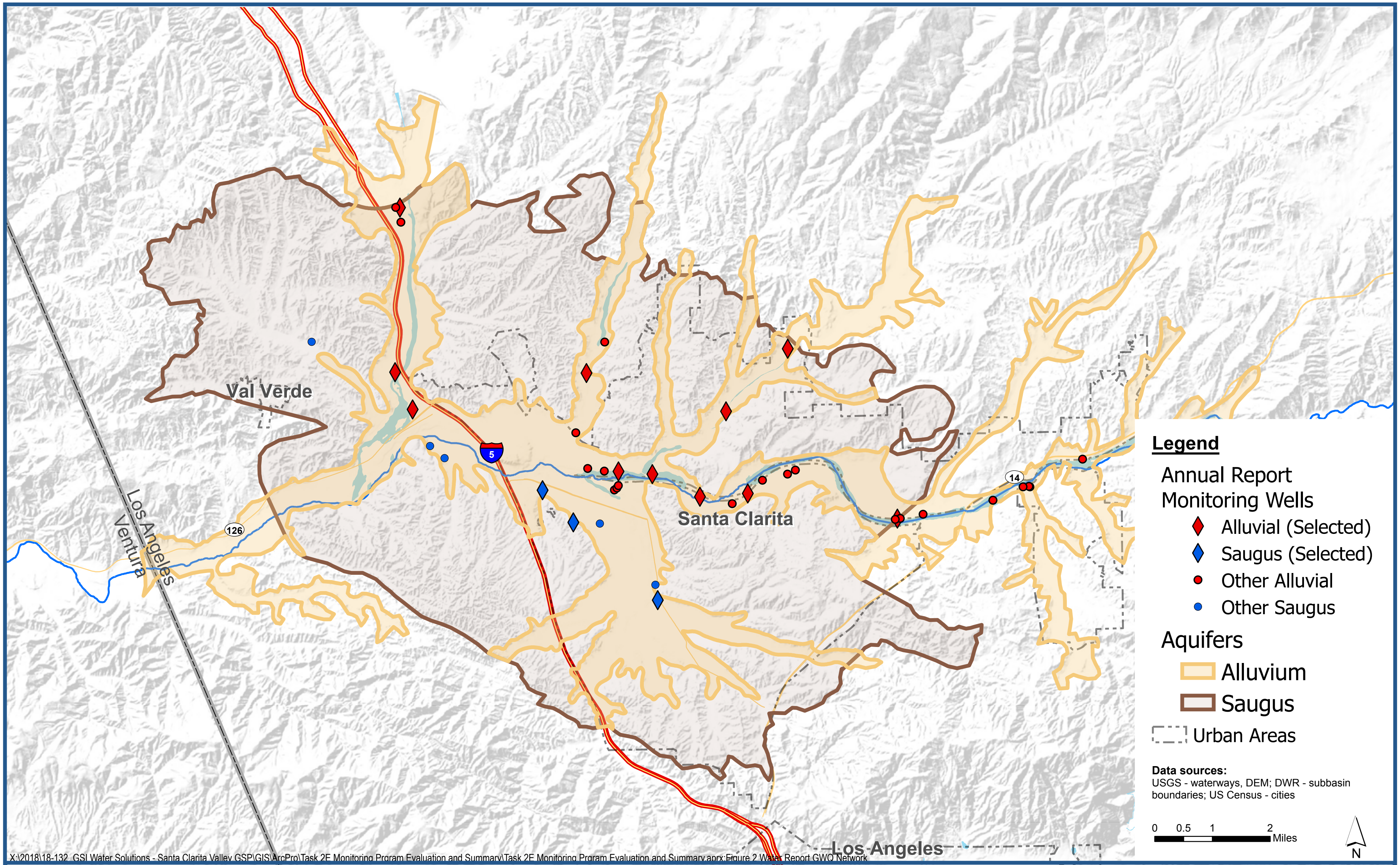
7.2.2 Los Angeles County Department of Public Works and USGS Streamflow Monitoring

The Annual Water Report (LSCE, 2020) includes data on streamflow conditions in the Santa Clara River Valley that are collected by the Los Angeles County Department of Public Works (LACDPW) and streamflow data collected on the Santa Clara River downstream of the Basin by the USGS. The locations of stream gaging sites are presented in Figure 7-3.

Three stations are monitored on the Santa Clara River – the upstream Capra Road Railroad Crossing gage (LACDPW station F93C-R), the Old Road Bridge gage immediately west of Interstate 5 (LACDPW/USGS gage F92C-R), and the downstream Santa Clara River at Piru gage in Ventura County (USGS station 11109000). The upstream and downstream gaging stations are located just outside of the boundaries of the Basin, and the Capra stream gage is located 0.8 miles upstream of the basin boundary and the Piru gage is located 3.5 miles downstream of the basin boundary. A stream gage was formerly located approximately 0.75 mile downstream of the western basin boundary (the “County Line” gage station 11108500); this gage operated from October 1952 until it was decommissioned in October 1996.

Streamflow at Capra Road Railroad Crossing (station F93C-R) is measured at 5-minute intervals, with records beginning in February 2002. Streamflow at Old Road Bridge (station F92C-R) is measured using a continuous water stage recorder. Data from these and all other gages in LACDPW’s stream gaging network are reported annually by LACDPW in the form of mean daily discharge for all days of the year; maximum, minimum, and mean daily flows for each individual water year; and the dates and rates of peak instantaneous flow during each individual water year. Streamflow at the Santa Clara River at Piru (station 11109000) is measured at 2-hour intervals, with records beginning in October 1996 and is available online from the USGS in the form of daily average flow and monthly flow statistics.

The Old Road Bridge gage appears to be well-maintained and to have provided a reliable data set in recent years, although at low flows such as those seen throughout water years 2013 through 2019 much of the data set has been flagged as consisting of estimated values. The data during this recent low-flow period show small fluctuations in these low-flow readings and daily differences on the order of a few hundredths to a tenth of a cubic foot per second (cfs) between successive days, which suggests that the gage is a potentially useful candidate for monitoring low flows in the Santa Clara River in the middle of the Basin. It is important to note that this gage is approximately 0.5 mile upstream of the Valencia Water Reclamation Plant, which is the primary source of dry weather streamflows in the western portion of the Basin.



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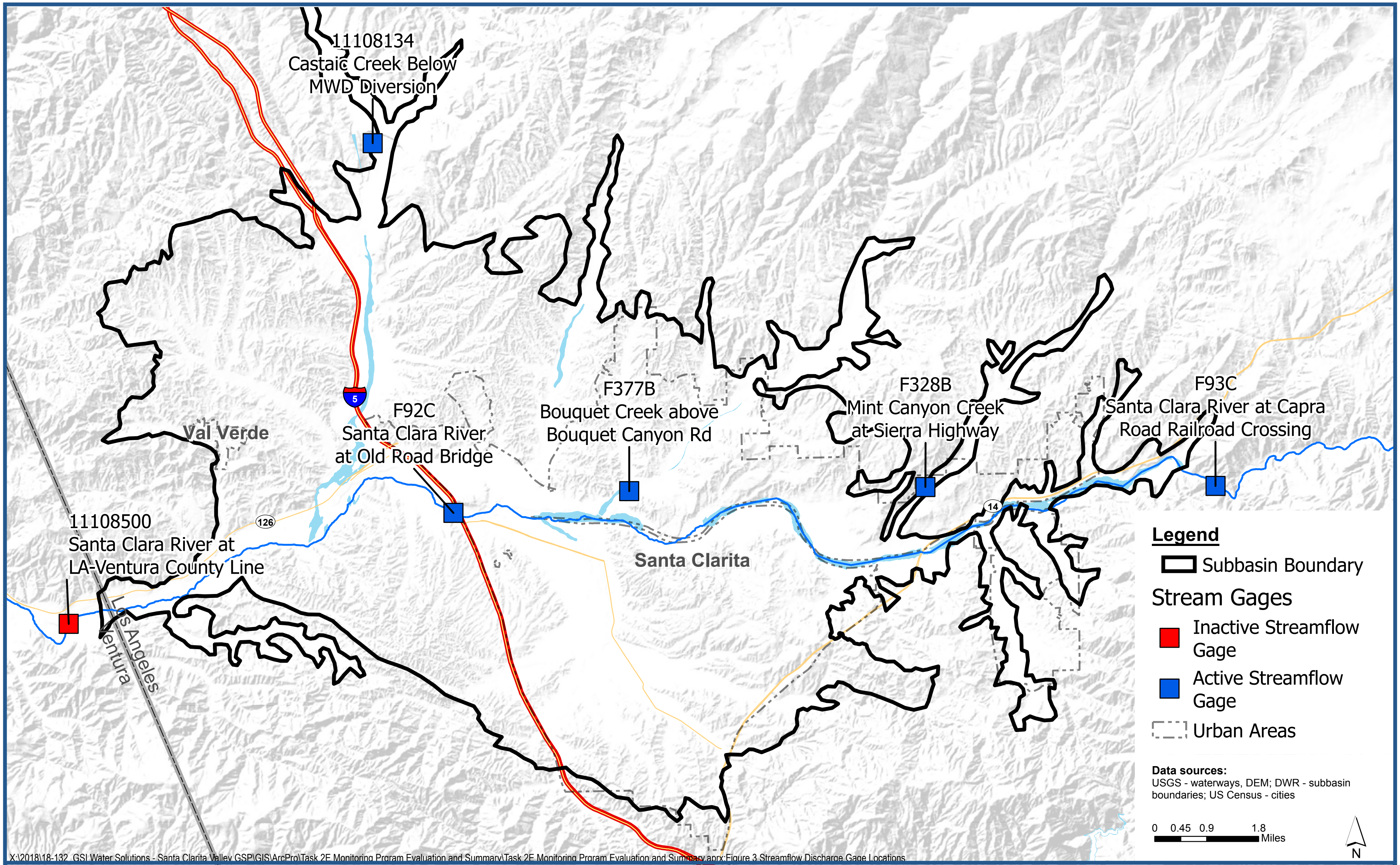
Santa Clarita Valley Water Agency
Annual Report Groundwater Quality Monitoring Network

Santa Clara River Valley East Subbasin
Groundwater Sustainability Plan

Figure 7-2



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Streamflow Gage Locations

Santa Clara River Valley East Subbasin
Groundwater Sustainability Plan

Figure 7-3

LACDPW also monitors streamflows at two locations on tributaries to the Santa Clara River: station F328-R in Mint Canyon and station F377-R in Bouquet Canyon. These gages are located on ephemeral streams that flow only in response to storm events.

Streamflow releases into Castaic Creek from Castaic Lagoon are also reported on a daily and monthly basis by the California Department of Water Resources (DWR). However, no streamflow gaging station is currently active on Castaic Creek.

Point-source discharges occur into the Santa Clara River by SCVSD from the Saugus and Valencia Water Reclamation Plants (WRPs) and by Whittaker-Bermite at a National Pollutant Discharge Elimination System (NPDES)-permitted outfall located 1 mile upstream of the outfall for the Saugus WRP. Periodic discharges of pumped groundwater by SCV Water also have occurred in the past to stormwater outfalls leading to the Santa Clara River. Monthly and annual records of the volumes of these discharges are maintained by the agencies conducting these discharges and will continue to be collected, compiled, and analyzed in tandem with streamflow measurement data.

7.2.3 California Statewide Groundwater Elevation Monitoring Program (CASGEM)

The CASGEM program[45] was established in 2009, and SCV Water has been providing groundwater elevation data to the state program since 2011.

Similar to the annual Santa Clarita Valley Water Report, this program has monitored groundwater elevations from wells completed in the Alluvial Aquifer and Saugus Formation. The CASGEM program reports water levels on a semi-annual basis with measurements in the winter or spring to represent seasonal high water levels, and one measurement in the late summer or fall to represent seasonal low water levels. The CASGEM program is administered by DWR; the system provides a statewide repository for groundwater level data. Local agencies function as “Monitoring Entities,” and are responsible for reporting data on the CASGEM Portal. The CASGEM monitoring network is presented in Figure 7-4, which represents monitoring locations for each of the aquifers in the Basin. The CASGEM program includes a primary CASGEM network and additional voluntary sites. Construction and location information for each of these wells is presented in Table 7-2.

Monitoring sites from the CASGEM program can be used to monitor groundwater elevations and groundwater storage. The CASGEM network also provides the necessary construction details that are required for GSP monitoring wells.

7.2.4 Division of Drinking Water

The California Division of Drinking Water’s (DDW’s) Drinking Water Watch is a public web portal to view public water systems location, facilities, sources, and water quality data (https://sdwis.waterboards.ca.gov/PDWW/). A public water system is defined as piped water for human consumption that has at least 15 service connections or regularly serves 25 or more people daily for at least 60 days out of the year. There are 11 public water systems in the Basin (see Figure 7-5). Additional information on each of these systems is provided in Table 7-3. The Water Watch web portal provides water quality results based on a schedule set by DDW. The analytes measured and sampling frequency are provided in Table 7-4.

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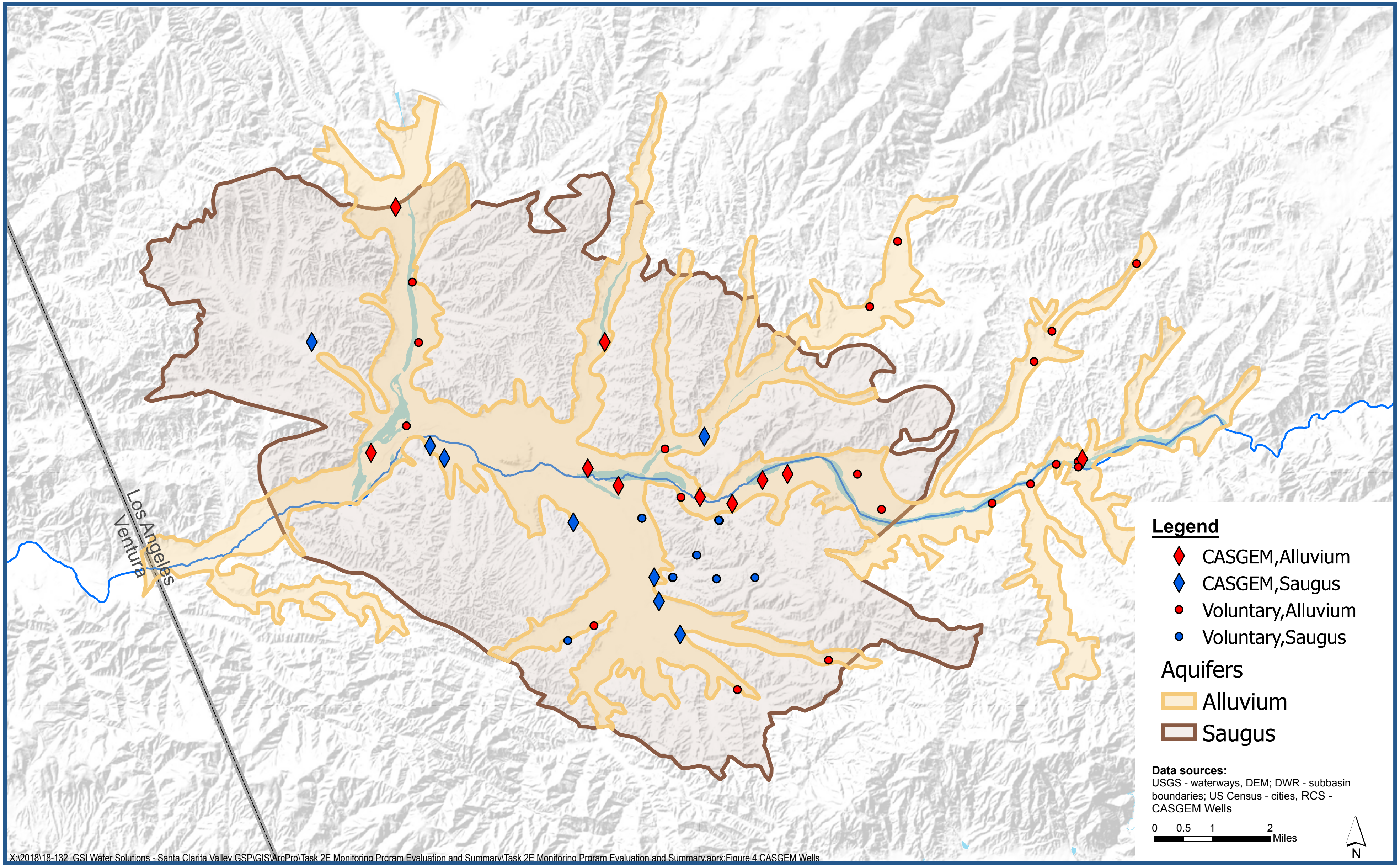
[45] The CASGEM portal is available at https://www.casgem.water.ca.gov/OSS/(S(x2c43om5moplmx0zovlg3auc))/Default.aspx?ReturnUrl=/oss). (Accessed June 12, 2021).

Information from California Drinking Water Watch on public water systems provides an existing source of historical water quality measurements and future water quality sampling that can be used for GSP monitoring. The site also provides information that can be used for identifying beneficial uses and users of groundwater and total water use for GSP annual reporting.



Data sources:
USGS - waterways, DEM; DWR - subbasin boundaries; US Census - cities, RCS - CASGEM Wells

X:\2018\18-132_GSI Water Solutions - Santa Clarita Valley GSP\GIS\ArcPro\Task 2E Monitoring Prgram Evaluation and Summary\Task 2E Monitoring Prgram Evaluation and Summary.aprx:Figure 4 CASGEM Wells

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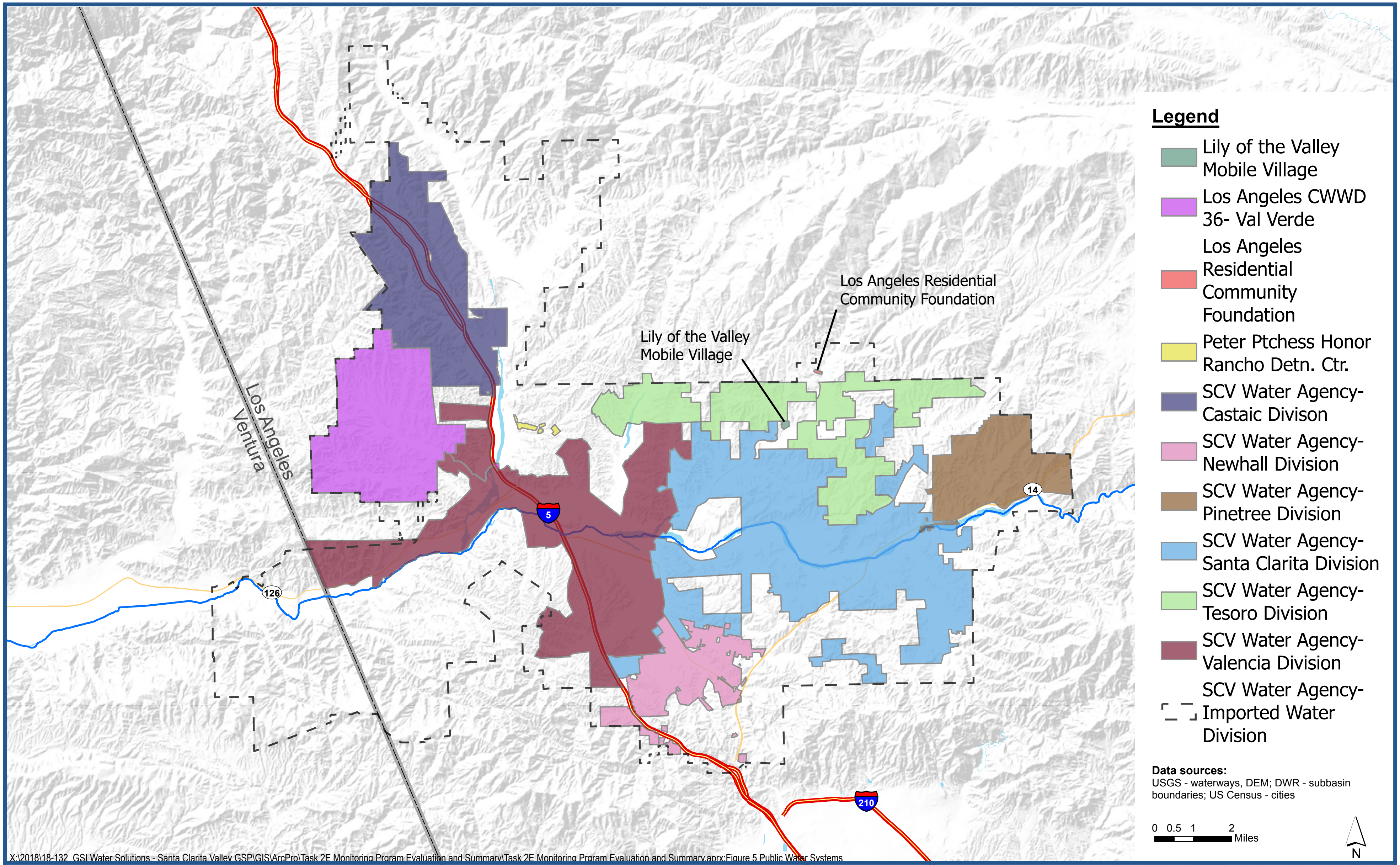
Santa Clara River Valley - East Subbasin
CASGEM Monitoring Network

Santa Clara River Valley East Subbasin
Groundwater Sustainability Plan

Figure 7-4



Data sources:
USGS - waterways, DEM; DWR - subbasin boundaries; US Census - cities

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Consulting Engineers

East Subbasin Division of Drinking Water Public Water Systems

Santa Clara River Valley East Subbasin
Groundwater Sustainability Plan

Figure 7-5

Table 7-2. CASGEM Monitoring Network

Well No./Name	State Well No.	Well Owner	GSE (ft asl)	RP Description	GSE (ft asl)	Well Use	Well Status	Well Completion Type	Total Depth of Casing (ft)	Aquifer	Voluntary Reporting?	Perforation Interval (ft bgs)
36-19	04N017W03J00S	LACCWD	1238	2-in pipe	1234	Residential	Active	Single Well	2120	Saugus	No	400-1250 1850-2100
NCWD 10	04N16W34A003S	NCWD	ND	ND	1211	Residential	Inactive	Single Well	1556	Saugus	No	780 - 1544
NCWD 11	04N16W27J003S	NCWD	ND	ND	1195	Residential	Inactive	Single Well	1500	Saugus	No	200 - 1075
NCWD 7	04N16W35L001S	NCWD	ND	ND	1255	Residential	Inactive	Single Well	994	Saugus	No	520-528 622-664 720-726 874-974
NCWD Castaic 7	05N17W25D007S	NCWD	1149	ND	1146	Residential	Active	Single Well	150	Alluvium	No	70 - 140
NCWD Pinetree 5	ND	NCWD	1597	ND	1589	Residential	Active	Single Well	160	Alluvium	No	70 - 130
SCWD Lombardi	04N16W13D001S	SCWC	ND	ND	1240	Irrigation	Active	Single Well	ND	Saugus	No	ND
SCWD Honby	04N15W18N003S	SCWC	ND	ND	1282	Residential	Active	Single Well	202	Alluvium	No	50 -202
SCWD Valley Center	04N16W13S001S	SCWC	ND	ND	1262	Residential	Active	Single Well	135	Alluvium	No	90 -125
VWC 205M	ND	VWC	1149.68	Sounding Tube	1148	Observation	Active	Single Well	1956	Saugus	No	820 - 1936
VWC 206	04N16W21L001S	VWC	1061.04	Sounding Tube	1059	Residential	Active	Single Well	2130	Saugus	No	490 - 2100
VWC 207	04N16W18E001S	VWC	1039.73	Sounding Tube	1036	Residential	Active	Single Well	1220	Saugus	No	507 - 1199
VWC E-17	04N17W14J001S	VWC	985.74	Sounding Tube	993	Residential	Active	Single Well	150	Alluvium	No	73 - 113
VWC N-8	04N16W22C012S	VWC	1135.61	Sounding Tube	1135	Residential	Active	Single Well	210	Alluvium	No	120 - 190
VWC S6	04N16W16Q004S	VWC	1128.91	Sounding Tube	1129	Residential	Active	Single Well	220	Alluvium	No	130 - 195
VWC T-7	04N16W23H002S	VWC	1212.38	Sounding Tube	1203	Residential	Active	Single Well	140	Alluvium	No	82 - 115
VWC U-6	04N16W24E001S	VWC	1233.2	Sounding Tube	1232	Residential	Active	Single Well	176	Alluvium	No	103 - 146
VWC W-11	04N16W03M001S	VWC	1210.51	Sounding Tube	1171	Residential	Active	Single Well	180	Alluvium	No	110 - 155
5841	04N16W34L001S	LACCWD	1227.4	ND	1230	Unknown	Unknown	Single Well	160	Alluvium	Yes	140-150
5882	03N16W01M001S	LACCWD	1311.4	2-in pipe	1312	Unknown	Unknown	Single Well	127	Alluvium	Yes	ND
5912A	03N15W06A001S	LACCWD	1447.2	1.5-in pipe	1447	Unknown	Unknown	Single Well	ND	Alluvium	Yes	ND
6986	04N17W13C002S	LACCWD	986	top of casing	987	Irrigation	Unknown	Single Well	148	Alluvium	Yes	24 - 128
6994	04N17W01J001S	LACCWD	1045.9	2-in pipe	1053.9	Irrigation	Unknown	Single Well	120	Alluvium	Yes	50 - 100
7066D	04N16W06P001S	LACCWD	1200	ND	1186	Unknown	Unknown	Single Well	116	Alluvium	Yes	ND
7123B	04N15W05B001S	LACCWD	1483.5	1.5-in pipe	1482	Irrigation	Unknown	Single Well	110	Alluvium	Yes	ND
7127D	04N15W20B001S	LACCWD	1331.6	4-in pipe vault	1331.4	Observation	Unknown	Single Well	154	Alluvium	Yes	126 - 147
7138D	04N15W21N007S	LACCWD	1392.5	top of casing	1392	Residential	Unknown	Single Well	132	Alluvium	Yes	53 - 115
7140B	05N15W28G001S	LACCWD	1627	1.5-in pipe	1625	Unknown	Unknown	Single Well	ND	Alluvium	Yes	ND
7168C	04N15W22J001S	LACCWD	1484	ND	1498	Unknown	Unknown	Single Well	262	Alluvium	Yes	ND
7174D	04N15W11B002S	LACCWD	1703	2-in pipe	1703	Residential	Unknown	Single Well	145	Alluvium	Yes	59 - 73 109 - 145
7178D	04N15W23F005S	LACCWD	1552.5	2-in pipe	1552	Unknown	Unknown	Single Well	127	Alluvium	Yes	ND
7184C	04N15W02J002S	LACCWD	1737	2-in pipe	1735	Unknown	Unknown	Single Well	ND	Alluvium	Yes	ND

Well No./Name	State Well No.	Well Owner	GSE (ft asl)	RP Description	GSE (ft asl)	Well Use	Well Status	Well Completion Type	Total Depth of Casing (ft)	Aquifer	Voluntary Reporting?	Perforation Interval (ft bgs)
7187B	04N15W14R003S	LACCWD	1570.5	2-in pipe	1560	Residential	Unknown	Single Well	146	Alluvium	Yes	50 - 135
7197D	04N15W13P002S	LACCWD	1579	2-in pipe	1577	Residential	Unknown	Single Well	132	Alluvium	Yes	50 - 130
7197G	04N15W13Q004S	LACCWD	1602.5	2-in pipe	1595	Residential	Unknown	Single Well	235	Alluvium	Yes	50 - 210
7212E	05N14W31F004S	LACCWD	1951	2-in pipe	1950	Residential	Unknown	Single Well	ND	Alluvium	Yes	ND
Robinson Ranch	ND	Private	1583	2-in pipe	1571	Irrigation	Active	Single Well	ND	Alluvium	Yes	ND
VWC 159	04N16W33L001S	VWC	1293.47	Sounding Tube	1293	Irrigation	Active	Single Well	1950	Saugus	Yes	662 - 1900
WHR 17	05N17W36H001S	WHR	ND	ND	1090	Unknown	Unknown	Single Well	130	Alluvium	Yes	70 - 125
CW-22A	ND	Whittaker-Bermite	1441.03	top of casing	1438.5	Observation	Unknown	Single Well	345	Saugus	Yes	325 - 340
CW22B	ND	Whittaker-Bermite	1441.74	top of casing	1439.2	Observation	Unknown	Single Well	480	Saugus	Yes	455 - 475
CW-22C	ND	Whittaker-Bermite	1441.46	top of casing	1438.9	Observation	Unknown	Single Well	754	Saugus	Yes	560 -580
MW-10	ND	Whittaker-Bermite	1537.49	top of casing	1535.99	Observation	Unknown	Single Well	697.5	Saugus	Yes	677.5 -697.5
CW-21A	ND	Whittaker-Bermite	1328.3	top of casing	1326.18	Observation	Unknown	Single Well	300	Saugus	Yes	240 - 250
CW-21B	ND	Whittaker-Bermite	1328.9	top of casing	1326.23	Observation	Unknown	Single Well	325	Saugus	Yes	310 - 320
CW-21C	ND	Whittaker-Bermite	1328.51	top of casing	1326.39	Observation	Unknown	Single Well	435	Saugus	Yes	420 - 430
CW-21D	ND	Whittaker-Bermite	1328.72	top of casing	1326.59	Observation	Unknown	Single Well	525	Saugus	Yes	485 - 495
11-MW-01	ND	Whittaker-Bermite	1236.83	top of casing	1229	Observation	Unknown	Single Well	54	Alluvium	Yes	21 - 51
11-MW-02	ND	Whittaker-Bermite	1236.83	top of casing	1231	Observation	Unknown	Single Well	83	Alluvium	Yes	70 - 80
11-MW-03	ND	Whittaker-Bermite	1235.83	top of casing	1233.8	Observation	Unknown	Single Well	150	Saugus	Yes	128 -138
11-MW-04	ND	Whittaker-Bermite	1236.84	top of casing	1231.4	Observation	Unknown	Single Well	110	Saugus	Yes	94 - 104
AL-12A	ND	Whittaker-Bermite	1165.63	top of casing	1165.89	Observation	Unknown	Single Well	82	Alluvium	Yes	60 - 80
AL-12B	ND	Whittaker-Bermite	1165.57	top of casing	1165.89	Observation	Unknown	Single Well	193	Alluvium	Yes	180 - 190
OS-MW-02A	ND	Whittaker-Bermite	1188.1	top of casing	1188.04	Observation	Unknown	Single Well	64	Alluvium	Yes	53 - 63
OS-MW-02B	ND	Whittaker-Bermite	1187.88	top of casing	1187.3	Observation	Unknown	Single Well	200	Alluvium	Yes	70 - 80
SG1-HSU1	ND	Whittaker-Bermite	1165.6	top of casing	1165.89	Observation	Unknown	Single Well	300	Saugus	Yes	265 - 285

Well No./Name	State Well No.	Well Owner	GSE (ft asl)	RP Description	GSE (ft asl)	Well Use	Well Status	Well Completion Type	Total Depth of Casing (ft)	Aquifer	Voluntary Reporting?	Perforation Interval (ft bgs)
OS-MW-05A	ND	Whittaker-Bermite	1198.2	top of casing	1198.6	Observation	Unknown	Single Well	148	Saugus	Yes	130 - 145
OS-MW-05B	ND	Whittaker-Bermite	1198.36	top of casing	1198.7	Observation	Unknown	Single Well	198	Saugus	Yes	185 - 195
OS-MW-05C	ND	Whittaker-Bermite	1198.48	top of casing	1198.8	Observation	Unknown	Single Well	473	Saugus	Yes	335 - 350
OS-MW-05D	ND	Whittaker-Bermite	1198.73	top of casing	1199	Observation	Unknown	Single Well	563	Saugus	Yes	550 -560

Notes

ft = feet

ft bgs = feet below ground surface

ft asl = feet above sea level

Table 7-3. Basin Public Water Systems

Water System No.	Water System Name	Primary Source	Service Connections	Population Served	Active Well Count
1910250	SCV Water - Pinetree Division	State Water Project	(57 AG) (5 CM) (2740 RS)	9247	4
1900046	Peter Pitchess Detention Center	Groundwater	1952 CM	7000	5
1910017	SCV Water - Santa Clarita Division	State Water Project	(1110 AG) (906 CM) (24 IN) (29741 RS)	127992	13
1910048	SCV Water - Imported	Surface Water	26 RS	258652	2
1910096	SCV Water - Newhall Division	State Water Project	(117 AG) (364 CM) (5 IN) (3324 RS)	12573	2
1910247	SCV Water - Castaic Division	State Water Project	(44 AG) (91 CM) (1 IN) (1779 RS)	6376	5
1910240	SCV Water - Valencia Division	State Water Project	(1340 AG) (895 CM) (380 IN) (RS 27529)	98603	17
1910185	Los Angeles CWWD 36 - Val Verde	State Water Project	(18 CM) (1331 RS)	5173	1
1900913	Lily of the Valley Mobile Village	Groundwater	182 CB	495	1
1900062	Los Angeles Residential Community – Foundation	Groundwater	22 CB	184	0
1910255	SCV Water - Tesoro Division	State Water Project	(71 AG) (9 CM) (1090 RS)	3861	0

Notes

AG = Agricultural CB = Combined CM = Commercial IN = Industrial PP = Power Production RS = Residential

Table 7-4. DDW Water Quality Analytes

Analyte Name	Unit	Maximum Contaminant Level	Detection Level for Purpose of Reporting	Sampling Interval (months)
Bicarbonate alkalinity	mg/L	0	0	36
Calcium	mg/L	0	0	36
Carbonate alkalinity	mg/L	0	0	36
Chloride	mg/L	500	0	36
Color	Colorimetric	15	0	36
Copper	µg/L	1000	50	36
Foaming agents (MBAS)	mg/L	0.5	0	36
Hardness (total) as CACO3	mg/L	0	0	36
Hydroxide alkalinity	mg/L	0	0	36
Iron	µg/L	300	100	36
Magnesium	mg/L	0	0	36
Manganese	µg/L	50	20	36
Odor threshold @ 60 C	TON	3	1	36
pH, laboratory	pH unit	0	0	36
Silver	µg/L	100	10	36
Sodium	mg/L	0	0	36
Specific conductance	µs/cm	1600	0	36
Sulfate	mg/L	500	0.5	36
Total dissolved solids	mg/L	1000	0	36
Turbidity, laboratory	NTU	5	0.1	36
Zinc	µg/L	5000	50	36
Aluminum	µg/L	1000	50	36
Antimony	µg/L	6	6	36
Arsenic	µg/L	10	2	36
Barium	µg/L	1000	100	36
Beryllium	µg/L	4	1	36
Cadmium	µg/L	5	1	36
Chromium (total)	µg/L	50	10	36
Cyanide	µg/L	150	100	36
Fluoride (F) (natural-source)	mg/L	2	0.1	36
Mercury	µg/L	2	1	36
Nickel	µg/L	100	10	36
Perchlorate	µg/L	6	4	12
Selenium	µg/L	50	5	36
Thallium	µg/L	2	1	36

Analyte Name	Unit	Maximum Contaminant Level	Detection Level for Purpose of Reporting	Sampling Interval (months)
Nitrate (as N)	mg/L	10	0.4	12
Nitrite (as N)	mg/L	1	0.4	36
Gross alpha	pCi/L	15	3	108
Uranium (pCi/L)	pCi/L	20	1	72
1,1,1-trichloroethane	µg/L	200	0.5	12
1,1,2,2-tetrachloroethane	µg/L	1	0.5	12
1,1,2-trichloroethane	µg/L	5	0.5	12
1,1-dichloroethane	µg/L	5	0.5	12
1,1-dichloroethylene	µg/L	6	0.5	12
1,2,4-trichlorobenzene	µg/L	5	0.5	12
1,2-dichlorobenzene	µg/L	600	0.5	12
1,2-dichloroethane	µg/L	0.5	0.5	12
1,2-dichloropropane	µg/L	5	0.5	12
1,3-dichloropropene (total)	µg/L	0.5	0.5	12
1,4-dichlorobenzene	µg/L	5	0.5	12
Benzene	µg/L	1	0.5	12
Carbon tetrachloride	µg/L	0.5	0.5	12
Cis-1,2-dichloroethylene	µg/L	6	0.5	12
Dichloromethane	µg/L	5	0.5	12
Ethyl benzene	µg/L	300	0.5	12
Methyl-tert-butyl-ether (MTBE)	µg/L	13	3	12
Monochlorobenzene	µg/L	70	0.5	12
Styrene	µg/L	100	0.5	12
Tetrachloroethylene	µg/L	5	0.5	12
Toluene	µg/L	150	0.5	12
Trans-1,2-dichloroethylene	µg/L	10	0.5	12
Trichloroethylene	µg/L	5	0.5	12
Trichlorofluoromethane freon 11	µg/L	150	5	12
Trichlorotrifluoroethane (freon 113)	µg/L	1200	10	12
Vinyl chloride	µg/L	0.5	0.5	12
Xylenes (total)	µg/L	1750	0.5	12
1,2,3-trichloropropane (1,2,3-TCP)	µg/L	0.005	0.005	33
2,3,7,8-TCDD (dioxin)	pg/L	30	5	36
2,4,5-TP (silvex)	µg/L	50	1	36
2,4-D	µg/L	70	10	36

Analyte Name	Unit	Maximum Contaminant Level	Detection Level for Purpose of Reporting	Sampling Interval (months)
Alachlor	µg/L	2	1	36
Atrazine	µg/L	1	0.5	33
Bentazon	µg/L	18	2	36
Benzo (a) pyrene	µg/L	0.2	0.1	36
Carbofuran	µg/L	18	5	36
Chlordane	µg/L	0.1	0.1	36
Dalapon	µg/L	200	10	36
Di(2-ethylhexyl) adipate	µg/L	400	5	36
Di(2-ethylhexyl) phthalate	µg/L	4	3	36
Dibromochloropropane (DBCP)	µg/L	0.2	0.01	33
Dinoseb	µg/L	7	2	36
Diquat	µg/L	20	4	36
Endothall	µg/L	100	45	36
Endrin	µg/L	2	0.1	36
Ethylene dibromide (EDB)	µg/L	0.05	0.02	33
Glyphosate	µg/L	700	25	36
Heptachlor	µg/L	0.01	0.01	36
Heptachlor Epoxide	µg/L	0.01	0.01	36
Hexachlorobenzene	µg/L	1	0.5	36
Hexachlorocyclopentadiene	µg/L	50	1	36
Lindane	µg/L	0.2	0.2	36
Methoxychlor	µg/L	30	10	36
Molinate	µg/L	20	2	36
Oxamyl	µg/L	50	20	36
Pentachlorophenol	µg/L	1	0.2	36
Picloram	µg/L	500	1	36
Polychlorinated biphenyls, total, as DCB	µg/L	0.5	0.5	36
Simazine	µg/L	4	1	33
Toxaphene	µg/L	3	1	36

Notes

µg/L = microgram per liter
mg/L = milligram per liter
pg/L = picogram per liter

µS/cm = microsiemen per centimeter
NTU = Nephelometric Turbidity Unit

DDW= Division of Drinking Water
pCi/L = picocurie per liter

7.2.5 Subsidence Monitoring

7.2.5.1 UNAVCO Plate Boundary Observatory for Land Surface Elevation Monitoring

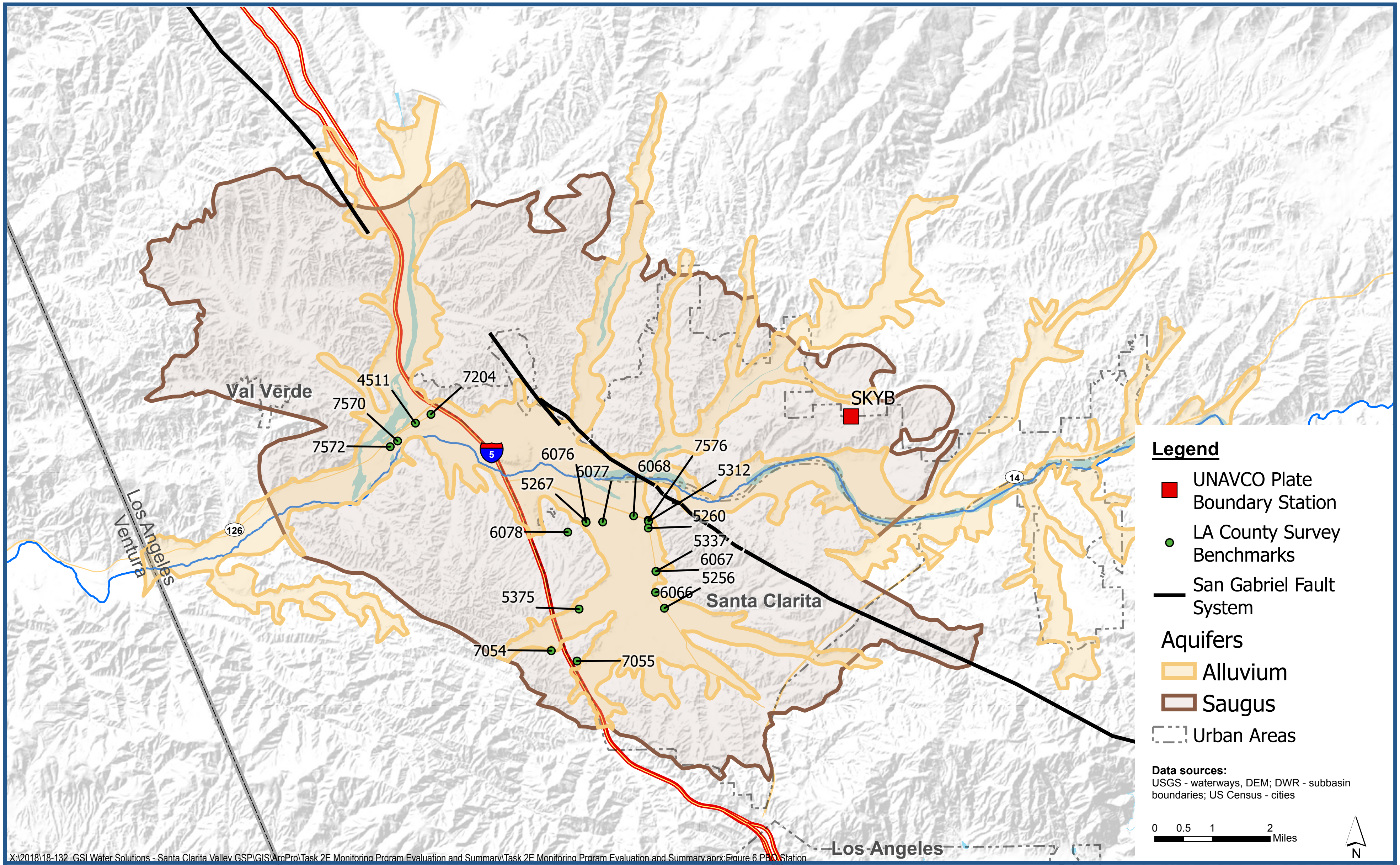
UNAVCO is a university-governed consortium with a focus on geodesy. Geodesy is the name for the collection of scientific disciplines focused on accurately measuring and representing earth's surface. UNAVCO has installed many global positioning system (GPS) monitoring stations throughout California—including one in the Basin—that monitor the movement of Earth's tectonic plates horizontally and vertically. The vertical component of these stations can be utilized to monitor subsidence or changes to land surface elevations due to extraction of fluids (such as water and petroleum) or to tectonic factors. The one UNAVCO station in the Basin, named SKYB, is displayed on Figure 7-6, located north of the San Gabriel fault and separated from the main area of the Basin where municipal pumping occurs. The station has collected daily GPS measurements since February 2000. The measurements are accurate to the nearest 0.01 millimeter (mm) (0.00003 ft), which exceeds SGMA accuracy requirements for subsidence. The data provided by the UNAVCO monitoring station provides data related to changes in land surface elevations in the Saugus Formation in the vicinity of the monitoring station.

7.2.5.2 California Department of Water Resources European Space Agency Interferometric Synthetic Aperture Radar (InSAR)

Subsidence data are also provided by the Department of Water Resources SGMA Data viewer. The TRE Altamira InSAR Dataset from the European Space Agency contains vertical displacement data from June 2015 through September 2019 and will likely have additional time series data in the future. These data were collected by the European Space Agency Sentinel-1A satellite and processed by TRE Altamira. The data set covers more than 200 groundwater basins across the state at a resolution of approximately 100 square meters (almost 1,100 square feet). The data accuracy report for InSAR data (Towill, Inc., 2020) states that "InSAR data accurately models change in ground elevation to an accuracy tested to be 16 mm (0.62 inches) at 95% confidence." Vertical displacement for subsets of time to parse out the inelastic component of subsidence (typically winter to winter comparisons) can be conducted at additional cost if not part of the annual report.

7.2.5.3 Los Angeles County Department of Public Works Benchmark Surveys

LACDPW has a network of over 100 benchmarks in the Basin as part of a larger survey network in Los Angeles County. LACDPW surveys these benchmarks approximately every 6 years. The last survey in the Basin was conducted in 2018. Selected benchmarks in the central area of the Basin in the vicinity of the former Whittaker-Bermite facility are presented in Figure 7-6. This is an area of the Basin that has been identified (LSCE, 2021) as having the potential for subsidence in the future. Land surface elevation data from these benchmarks are measured using the NAVD88 vertical datum required by DWR and date back to 1995. These selected benchmark locations will be utilized as part of a subsidence monitoring network, pending LACDPW approval.



Data sources: USGS - waterways, DEM; DWR - subbasin boundaries; US Census - cities

X:\2018\18-132 GSI Water Solutions - Santa Clarita Valley GSP\GIS\ArcPro\Task 2E Monitoring Program Evaluation and Summary\Task 2E Monitoring Program Evaluation and Summary.aprx:Figure 6 PBO Station

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UNAVCO Plate Boundary Observatory Station and LA County Survey Benchmarks

Santa Clara River Valley East Subbasin
Groundwater Sustainability Plan

Figure 7-6

7.2.6 Water Quality Monitoring

7.2.6.1 California Department of Toxic Substances Control (Whittaker-Bermite Facility)

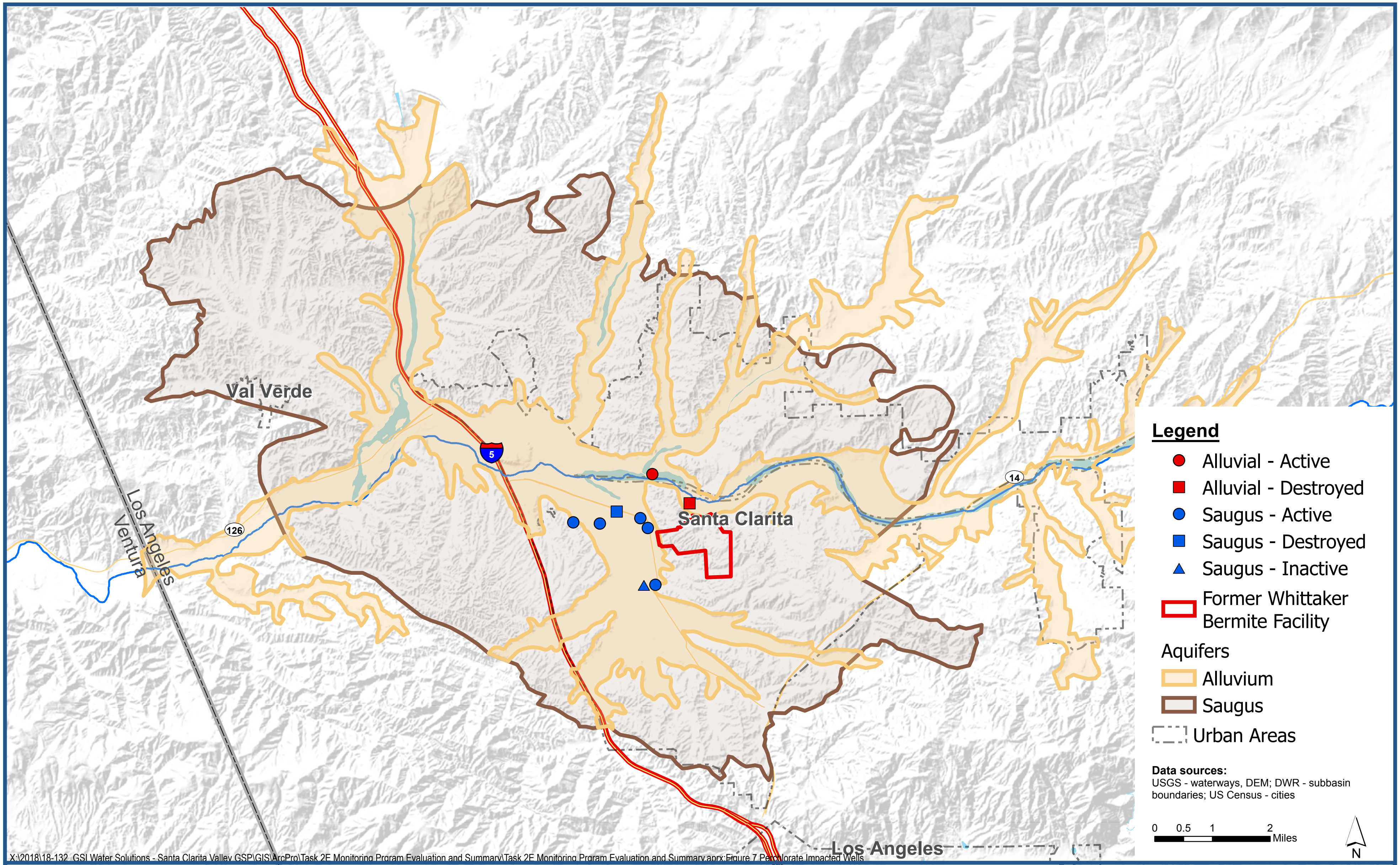
The manufacture and testing of explosives in the Basin by the Whittaker-Bermite Corporation from 1934 to 1987 resulted in perchlorate contamination of soils and water supply wells. In 1997, four water supply wells (NWD-11, VWD-157, SCWD-Saugus 1, and SCWD-Saugus 2) were impacted by perchlorate contamination. In 2007, the California Department of Public Health, now DDW, established a maximum contaminant level (MCL) for perchlorate of 6 micrograms per liter. The Department of Toxic Substances Control (DTSC) is the lead agency responsible for the regulatory oversight of the cleanup at the former Whittaker-Bermite facility. Currently, two ongoing cleanup projects related to the former facility are actively operating. Monitoring and reporting information related to these cleanup projects are stored on DTSC's EnviroStor database:

- Whittaker/Bermite Facility (19281087)
  https://www.envirostor.dtsc.ca.gov/public/profile_report?global_id=19281087
- Castaic Lake Water Agency – Whittaker Off-Site Groundwater Contamination (60000168)
  https://www.envirostor.dtsc.ca.gov/public/profile_report?global_id=60000168

The first case (19281087) is related to the removal and treatment of contaminated soils and waters at the physical 900-acre facility. The second case (60000168) involved SCV Water and was focused on the impacted production wells with perchlorate contamination. The DTSC and SCV Water (formerly the Castaic Lake Water Agency) entered into a voluntary cleanup agreement in 2003, titled Environmental Oversight Agreement, which was amended in 2012. The purpose of this was for DTSC to provide review and oversight of the response activities being undertaken related to the detection and treatment of impacted wells. The EnviroStor database contains documents of completed and future actions regarding the monitoring and cleanup of the groundwater contaminated with perchlorate. Quarterly monitoring reports contain data on sampled water quality analytes along with well construction information that meets requirements outlined in SGMA regulations §352.4. All wells with perchlorate detections are presented in Table 7-5 and displayed in Figure 7-7. All municipal supply wells are monitored for perchlorate and are reported on the CA Drinking Water Watch database.

Table 7-5. SCV Water Wells with Perchlorate Detections

Well Name	Year Detected	Well Status	Aquifer
NWD-11	1997	Inactive	Saugus
NWD-13	2006	Active	Alluvial
VWD-Q2	2005	Active	Saugus
VWD-157	1997	Destroyed – Replaced	Saugus
VWD-201	2010	Active – Well Head Treatment	Saugus
VWD-205	2012	Inactive	Saugus
SCWD-Saugus 1	1997	Active – Well Head Treatment	Saugus
SCWD-Saugus 2	1997	Active - Well Head Treatment	Saugus
SCWD-Stadium	2002	Destroyed – Replaced	Alluvial



Data sources:
USGS - waterways, DEM; DWR - subbasin boundaries; US Census - cities

X:\2018\18-132 GSI Water Solutions - Santa Clarita Valley GSP\GIS\ArcPro\Task 2E Monitoring Prgram Evaluation and Summary\Task 2E Monitoring Prgram Evaluation and Summary.aprx:Figure 7 Perchlorate Impacted Wells

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Perchlorate Impacted Production Wells - Former Whittaker Bermite Facility

Santa Clara River Valley East Subbasin
Groundwater Sustainability Plan

Figure 7-7

7.2.6.2 SCV Water Salt and Nutrient Management Plan (SNMP)

The purpose of the SNMP is to monitor the input of salt and nutrients into the surface water and groundwater systems. Water sources with elevated salinity and nutrient concentrations include urban and natural storm flows, discharge of treated wastewater, and naturally occurring salts found in sediments and groundwater within the Basin. An understanding of the amount of salt and nutrients being discharged into surface water and groundwater systems is important for the continued use of recycled water. Recycled water programs are an important aspect of long-term water supply assumptions for the Basin.

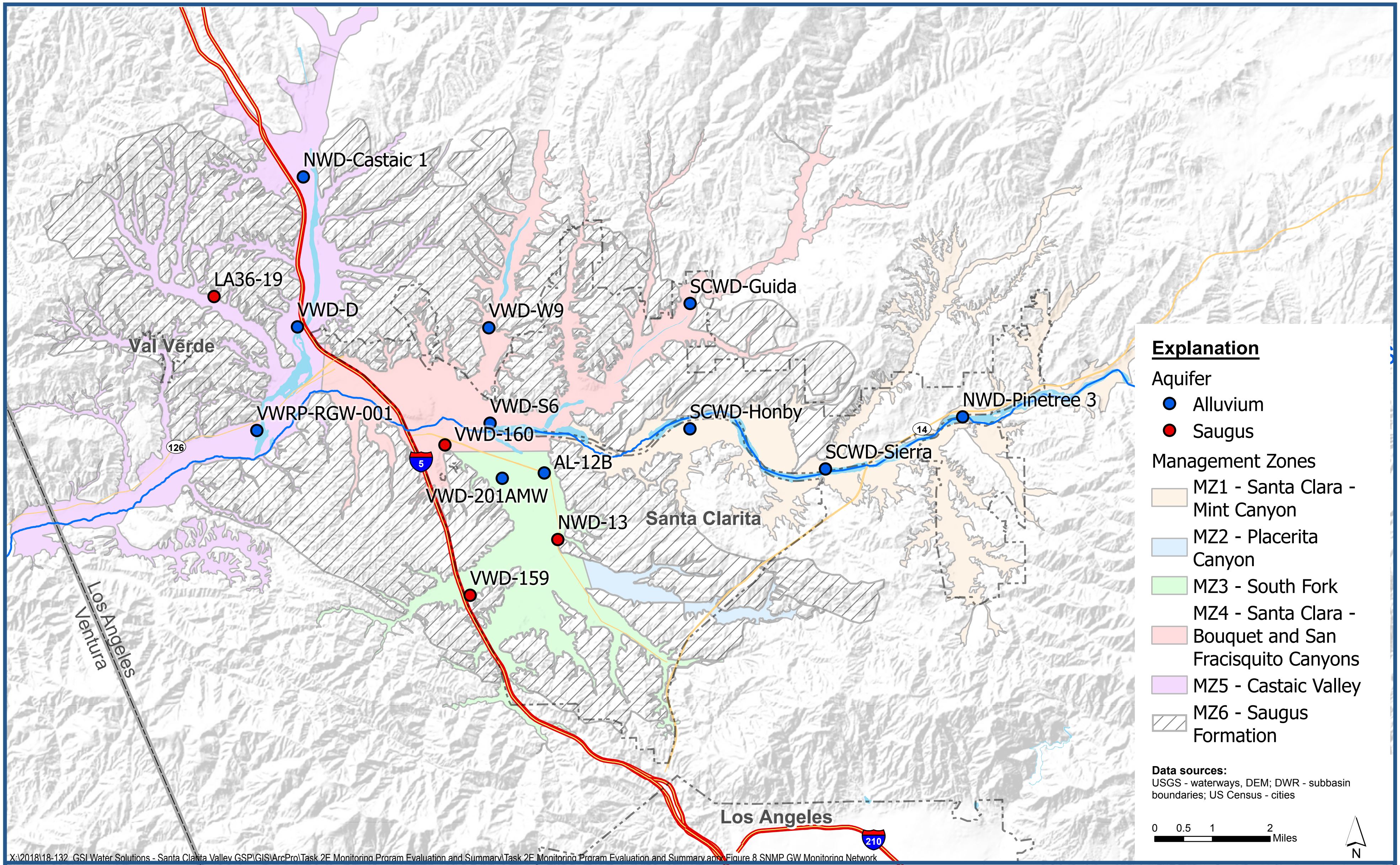
SCV Water's SNMP monitoring program includes the tracking and reporting of annual water sampling for TDS, chloride, nitrate, sulfate, and select chemicals of emerging concern (CECs) that primarily include per- and polyfluoroalkyl substances (PFAS). CECs are required to be sampled in accordance with U.S. Environmental Protection Agency's (EPA's) Unregulated Contaminant Monitoring Rule (UCMR) 3. Groundwater quality data used in the SNMP are obtained from existing monitoring programs where possible, including those overseen by SCV Water and other local entities (i.e., Los Angeles County Waterworks District 36, SCVSD, and FivePoint Holdings, LLC). Monitoring sites include wells and surface water locations; at least one new monitoring well site will be constructed in an area identified as a data gap. The SNMP Groundwater Management Zones and groundwater monitoring sites are depicted in Figure 7-8 and the surface water monitoring sites are depicted in Figure 7-9. The monitoring network presented here is based on Sections 12.3 and 12.4 (Table 4) of the SNMP. The drafting of the first SNMP Monitoring Report is currently underway.

The Lang Gage, which is included in the SNMP surface water monitoring network, was moved 150 feet upstream and was renamed the Capra Road Railroad Crossing (F93C-R) in June of 2013.

7.2.6.3 Santa Clarita Valley Sanitation District of Los Angeles County

The Los Angeles County Sanitation Districts operate two water reclamation facilities in the Basin: the Valencia WRP and the Saugus WRP. These two facilities treat millions of gallons of wastewater per day to be reused for beneficial purposes. These facilities discharge treated water into the Santa Clara River under Waste Discharge Requirements (WDR) with the Los Angeles Regional Water Quality Control Board (LARWQCB) and an NPDES permit for each individual facility. In addition, the Sanitation Districts are planning to build another WRP, the Newhall Ranch WRP. Currently, this proposed WRP has an NDPES permit and is also required to conduct monitoring prior to its operation. Monitoring programs were established for each WRP where effluent limitations are set for specific parameters. The Valencia WRP monitoring plan includes six monitoring locations, the Saugus WRP monitoring plan includes five monitoring locations, and the Newhall Ranch WRP monitoring plan includes two monitoring locations. The Saugus and Valencia monitoring sites include the influent, point of effluent discharge, sites up- and downstream of the effluent discharge along the Santa Clara River, and two groundwater wells (Saugus WRP – VWD-S6 and Valencia – VWRP-RGW-001). The Newhall Ranch WRP monitoring sites include two surface water locations up- and downstream of the proposed effluent discharge along the Santa Clara River. All monitoring sites for the Valencia and Saugus WRP WDR are included in the SNMP monitoring network (see Figures 7-8 and 7-9 and Table 7-6).

Receiving water quality requirements (monitored via Santa Clara River grab samples) are based on the water quality objectives from the Water Quality Control Plan: Los Angeles Region Basin Plan for the Coastal Watershed of Los Angeles and Ventura Counties. Effluent requirements include specific parameters such as boron, TDS, sulfate, chloride, nitrate, nitrite, ammonia nitrogen, copper, lead, mercury, nickel, zinc, cyanide, benzo anthracene, total trihalomethanes, and chronic toxicity.



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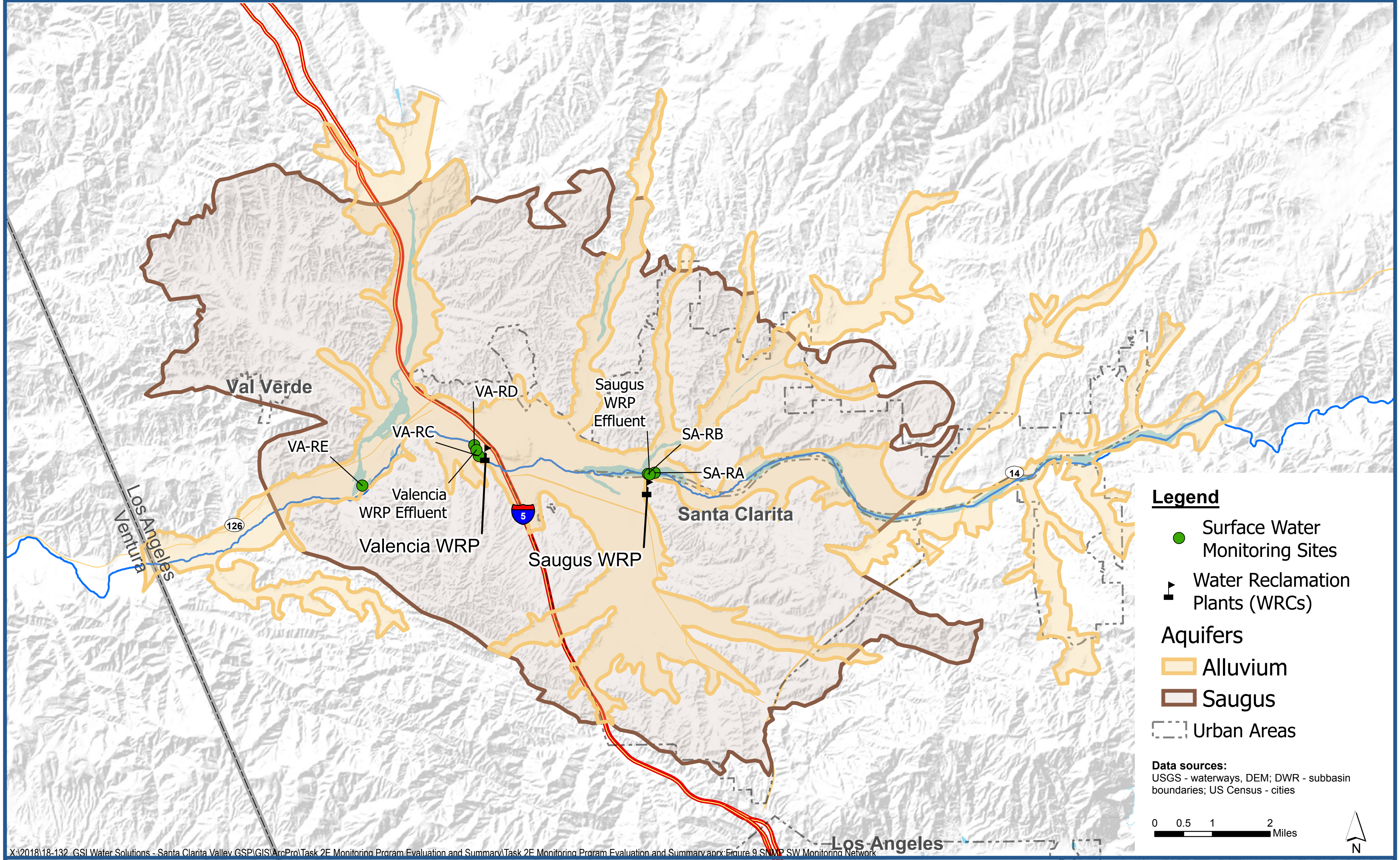
Salt and Nutrient Management Program
Groundwater Monitoring Network

Santa Clara River Valley East Subbasin
Groundwater Sustainability Plan

Figure 7-8



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Salt and Nutrient Management Program
Surface Water Monitoring Network

Santa Clara River Valley East Subbasin
Groundwater Sustainability Plan

Figure 7-9

Table 7-6. SNMP Monitoring Network

Well/ Sampling Name	Type of Well	Water Quality Constituent				Proposed Water Quality Sampling Frequency	Proposed Water Level Sampling Frequency	Management Area
		TDS	Chloride	Nitrate (as NO3)	Sulfate			
NWD-Pinetree 3	Alluvial	X	X	X	X	Annual	Annual	Mint Canyon
SCWD-Sierra	Alluvial	X	X	X	X	Annual	Annual	Mint Canyon
SCWD-Honby	Alluvial	X	X	X	X	Annual	Annual	Mint Canyon
AL-12B	Alluvial	X	X	X	X	Annual	Annual	South Fork
VWD-201AMW	Alluvial	X	X	X	X	Annual	Annual	South Fork
SCWD-Guida	Alluvial	X	X	X	X	Annual	Annual	Bouquet/ SanFran
VWD-S6	Alluvial	X	X	X	X	Annual	Annual	Bouquet/ SanFran
VWD-W9	Alluvial	X	X	X	X	Annual	Annual	Bouquet/ SanFran
NWD-Castaic 1	Alluvial	X	X	X	X	Annual	Annual	Castaic Valley
VWD-D	Alluvial	X	X	X	X	Annual	Annual	Castaic Valley
VWRP-RGW-001	Alluvial	X	X	X	X	Annual	Annual	Castaic Valley
NWD-13	Saugus	X	X	X	X	Annual	Annual	Saugus
VWD-159	Saugus	X	X	X	X	Annual	Annual	Saugus
VWD-160	Saugus	X	X	X	X	Annual	Annual	Saugus
LACWD 36-19	Saugus	X	X	X	X	Annual	Annual	Saugus
SA-RA	Surface	X	X	X	X	Annual	N/A	
SA-RB	Surface	X	X	X	X	Annual	N/A	
Saugus WRP Effluent [1]	Surface	X	X	X	X	Annual	N/A	
Valencia WRP Effluent [1]	Surface	X	X	X	X	Annual	N/A	
VA-RC	Surface	X	X	X	X	Annual	N/A	
VA-RD	Surface	X	X	X	X	Annual	N/A	
VA-RE	Surface	X	X	X	X	Annual	N/A	
Castaic Creek Below MWD Diversion	Surface	Surface water monitoring sites depicted in Figure 42 but not included in Table 5 of the SNMP						
USGS Blue Cut/County Line	Surface							
DPW Old Road Bridge	Surface							

Notes

[1] Many other water quality constituents are monitored at these locations.

The WDRs for the water reclamation plants includes additional monitoring that addresses water quality conditions and biological health across the entire watershed. SCVSD submitted the Santa Clara River Watershed-Wide Monitoring Program and Implementation Plan to the Regional Water Board on December 15, 2011. The plan includes monitoring for trends in surface water quality across the watershed while also monitoring the biological health of the watershed. The bioassessment program includes an analysis of the community structure of the instream macroinvertebrate, algal assemblages, algal biomass, and physical habitat assessments.

7.3 Summary of GSP Monitoring Program

Portions of the existing monitoring programs described above will be used in the development of monitoring networks for each of the applicable sustainability indicators that either exist or could occur in the future in the Basin. Monitoring locations and protocols from these programs can be used to monitor groundwater elevation, groundwater storage, water quality, subsidence, and interconnected surface water. Selection of a subset of monitoring sites that will constitute the representative monitoring network for the GSP monitoring program will prioritize sites that have a long period of record and are expected to provide effective monitoring of sustainability indicators related to groundwater extraction, beneficial uses of groundwater, and climatic conditions.

This section describes the proposed monitoring network, including GSA monitoring objectives, monitoring protocols, and data reporting requirements. This section was prepared in accordance with SGMA regulations in Article 5, Subarticle 4 § 354.32, which states "[t]he monitoring network shall promote the collection of data of sufficient quality, frequency and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions that occur through implementation of the Plan."

The monitoring network was designed to collect data to allow for the analysis of short- and long-term trends, seasonal variations, and estimate annual changes in groundwater storage, water quality, interconnected surface water, and subsidence. The monitoring sites have been distributed across the Basin to provide data that will support a comprehensive analysis of current and ongoing conditions within the Basin. This widespread distribution coupled with the monitoring frequency will allow the GSA to chart its progress towards the established sustainability goals and will also ensure real-time tracking of any impacts on beneficial users. Specifically, the monitoring program will allow the GSA to quantify changes in the sustainability indicators and assess the effects of GSP implementation and any projects and management actions that may be required to avoid significant and unreasonable undesirable results. Near-term, this data will facilitate changes to management programs to maintain continued progress towards the GSA's sustainability objectives and over the longer term will inform updates to the GSP and its sustainable management criteria (SMCs).

SGMA regulations require monitoring networks to be developed to promote the collection of data sets with enough quality, frequency, and spatial distribution to characterize groundwater and related surface water conditions in the groundwater basin and to evaluate changing conditions that occur through implementation of the GSP (§ 354.34(b)). The monitoring network should accomplish the following:

- Demonstrate progress towards achieving measurable objectives described in the GSP
- Monitor impacts to the beneficial uses and users of groundwater and interconnected surface water
- Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds
- Quantify annual changes in water budget components (§ 354.34(b)(1)-(4))

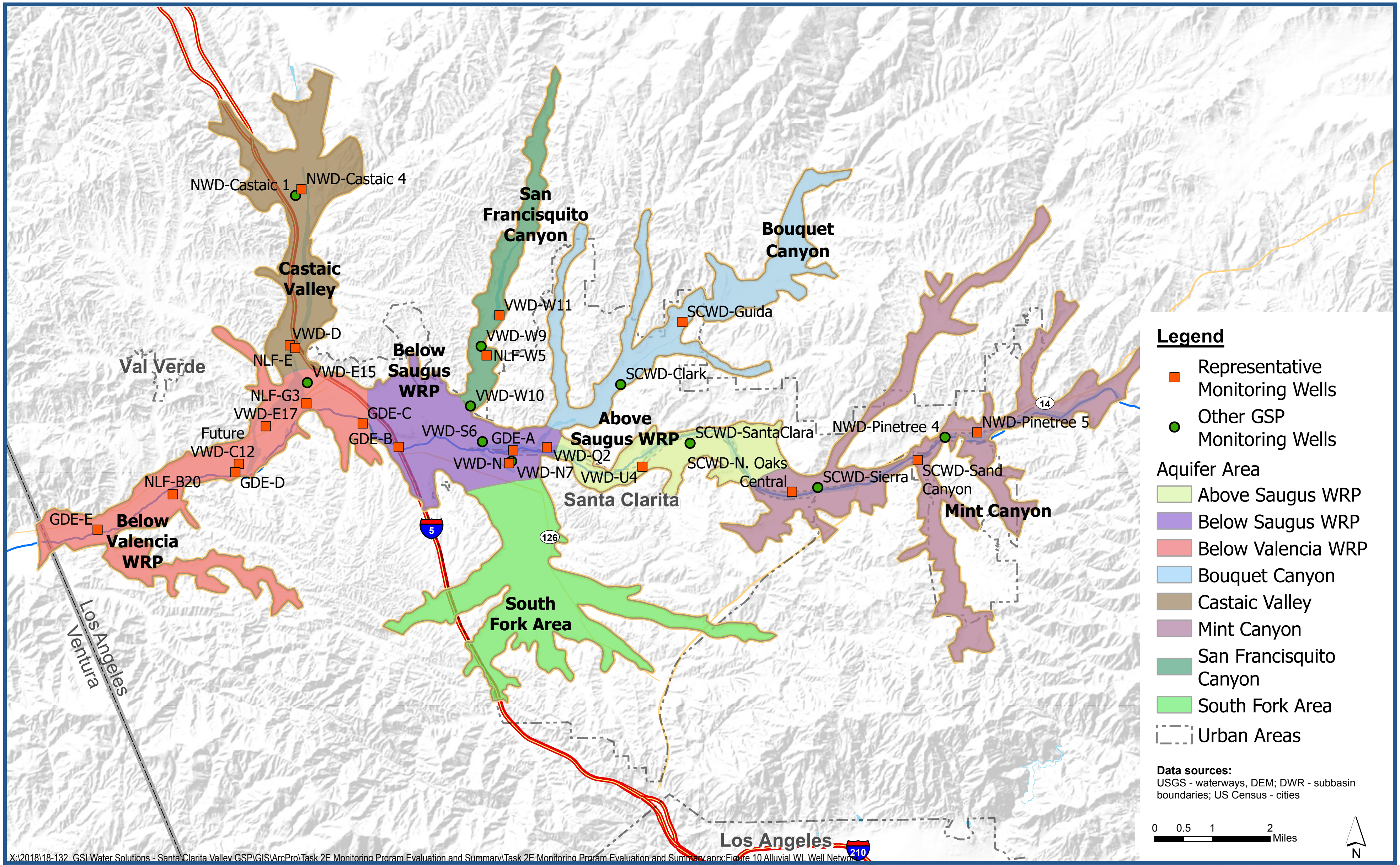
The minimum thresholds and measurable objectives for the network are described in Section 8 of the GSP. SGMA regulations require that if management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the basin setting and the SMCs that are specific to a given management area (§ 354.34(d)). Management areas are not being defined for the Basin. If management areas are developed in the future, the monitoring network will be reevaluated to ensure that there is sufficient monitoring to evaluate conditions.

7.3.1 Description of Monitoring Network (§ 354.34)

The GSP monitoring network is composed of aquifer specific wells that are screened in one of the principal aquifers in the Basin (the Alluvial Aquifer or the Saugus Formation). The representative monitoring well network will not include composite wells that span both aquifers. The network will enable the collection of data to assess sustainability indicators, evaluate the effectiveness of management actions and projects that are designed to achieve sustainability, and evaluate adherence to measurable objectives for each applicable sustainability indicator. The Basin is isolated from the Pacific Ocean; therefore, this GSP does not provide monitoring for seawater intrusion sustainability indicators.

The Basin currently has over 70 wells that are actively monitored for water level and/or groundwater quality data. However, for the purposes of the GSP monitoring program, a subset of these wells was identified that meet SGMA regulation monitoring network and program requirements described above. These selected representative monitoring sites (RMS), or representative monitoring wells, provide geographical coverage across the areas where groundwater is pumped from each of the two principal aquifers, and each well has a historical data record lasting from a few years to several decades (§ 354.36). This effort resulted in the selection of 21 representative monitoring wells in the Alluvial Aquifer and 4 representative monitoring wells in the Saugus Formation, as documented in Tables 7-7 and 7-8 (the selection process for the RMS is described further below). In addition to the representative monitoring wells, Tables 7-7 and 7-8 identify 10 additional wells in the Alluvial Aquifer and 8 additional wells in the Saugus Formation that are not representative monitoring wells, but currently are being monitored by SCV Water under the requirements of existing water supply permits with DDW and, therefore, will be monitored for water quality as part of the GSP monitoring program. The GSA has compiled well construction information for these wells, which allows the GSA to determine with certainty the aquifer being monitored. The selection of monitoring wells that are geographically distributed in the Basin account for the ability to use each monitoring well site for multiple sustainability indicators. The wells identified below in Tables 7-7 and 7-8 as representative monitoring wells will be used for monitoring of groundwater elevation, storage, and quality, which will enable the GSA to have a streamlined and efficient GSP monitoring program. As stated previously, these wells are already part of existing monitoring networks or will be installed as part of the GSP monitoring program.

Figures 7-10 and 7-11 illustrate the GSP monitoring wells in the Alluvial Aquifer and Saugus Formation. This coverage allows for the collection of data to evaluate groundwater gradients and flow directions over time and the annual change in storage. Furthermore, the monitoring frequency of the wells will allow for the monitoring of seasonal highs and lows. Because wells were chosen with the existing length of historical data record in mind, future groundwater data will be able to be compared to historical data. The monitoring program for each of the sustainability indicators is discussed in the following subsections.



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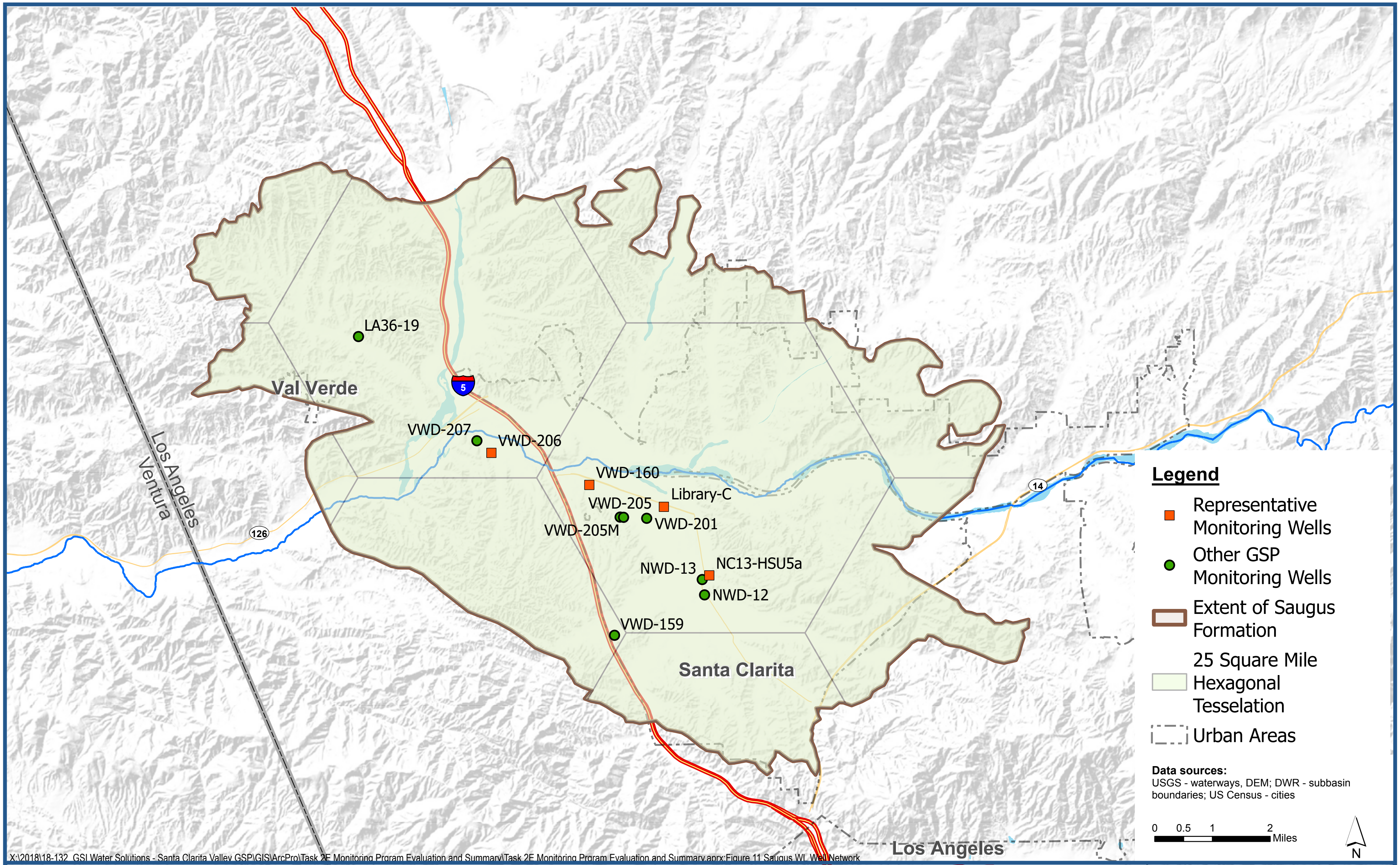
Representative Monitoring Well Network for the Alluvial Aquifer

Santa Clara River Valley East Subbasin
Groundwater Sustainability Plan

Figure 7-10



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Representative Monitoring Well Network for the Saugus Formation

Santa Clara River Valley East Subbasin
Groundwater Sustainability Plan

Figure 7-11

Table 7-7. Alluvial Aquifer GSP Monitoring Wells

Well Name	Latitude	Longitude	Reference Point Elevation (ft asl)	Well Depth (ft bgs)	Screened Interval (ft bgs)	Subarea	Sustainable Management Criteria
NWD-Castaic 1	34.489194	-118.614561	1129.0	310	110-297	Castaic Valley	GQ
NWD-Castaic 4[1]	34.490718	-118.612751	1129.0	203	59.5-UNK	Castaic Valley	GWL, S, GQ
NWD-Pinetree 4	34.425847	-118.418405	1552.5	185	110-185	Mint Canyon	GQ
NWD-Pinetree 5[1]	34.42695067	-118.4085914	1597.0	160	70-130	Mint Canyon	GWL, S, GQ
SCWD-Clark	34.440422	-118.51665	1253.0	160	20-120	Bouquet Canyon	GQ
SCWD-Guida[1]	34.455905	-118.497607	1342.0	116	56-150	Bouquet Canyon	GWL, S, GQ
SCWD-North Oaks Central[1]	34.412772	-118.465123	1391	244	50-244	Mint Canyon	GWL, S, GQ
SCWD-Sand Canyon[1]	34.420241	-118.426799	1525.0	250	60-140	Mint Canyon	GWL, S, GQ
SCWD-Santa Clara	34.42538	-118.49586	1289.0	160	90-135	Above Saugus WRP	GQ
SCWD-Sierra	34.413762	-118.457296	1417.0	175	60-175	Mint Canyon	GQ
Future VWD-C12[1, 2]	34.42193	-118.63297	953.0	TBD	TBD	Below Valencia WRP	GWL, S, GQ
VWD-D[1]	34.451518	-118.617003	1035.6	142	60-136	Castaic Valley	GWL, S, GQ
VWD-E15	34.44209	-118.611842	1023.0	160	90-135	Below Valencia WRP	GQ
VWD-E17[1]	34.4313	-118.62463	983.0	150	80-120	Below Valencia WRP	GWL, S, GQ
VWD-N[1]	34.4210879	-118.5509124	1131.56	280	76-237	Below Saugus WRP	GWL, S, GQ
VWD-N7	34.421573	-118.550156	1131.6	200	120-175	Below Saugus WRP	GQ
VWD-Q2[1]	34.424925	-118.539325	1166.6	170	76-126	Below Saugus WRP	GWL, S, GQ

Well Name	Latitude	Longitude	Reference Point Elevation (ft asl)	Well Depth (ft bgs)	Screened Interval (ft bgs)	Subarea	Sustainable Management Criteria
VWD-S6	34.426594	-118.558928	1127.2	220	130-195	Below Saugus WRP	GQ
VWD-U4[1]	34.419689	-118.510433	1242.8	135	60-130	Above Saugus WRP	GWL, S, GQ
VWD-W9	34.450584	-118.558871	1175.0	160	70-130	San Francisquito Canyon	GQ
VWD-W10	34.435612	-118.562372	1130.3	190	120-160	San Francisquito Canyon	GQ
VWD-W11[1]	34.458309	-118.553181	1208.3	180	110-155	San Francisquito Canyon	GWL, S, GQ
Future GDE-A[1]	TBD	TBD	TBD	TBD	TBD	TBD	ISW/GDE
Future GDE-B[1]	TBD	TBD	TBD	TBD	TBD	TBD	ISW/GDE
Future GDE-C[1]	TBD	TBD	TBD	TBD	TBD	TBD	ISW/GDE
Future GDE-D[1]	TBD	TBD	TBD	TBD	TBD	TBD	ISW/GDE
Future GDE-E[1]	TBD	TBD	TBD	TBD	TBD	TBD	ISW/GDE
NLF-B20[1]	34.41450	-118.65319	904.0	250	50-240	Below Valencia WRP	GWL, S, GQ
NLF-E[1]	34.450829	-118.615362	1024	180	12-93	Castaic Valley	ISW/GDE
NLF-G3[1]	34.43687414	-118.6121685	1002	190	90-160	Below Valencia WRP	ISW/GDE
NLF-W5[1]	34.448255	-118.557233	1155	265	20-116	San Francisquito Canyon	ISW/GDE

Notes

[1] This well is a representative monitoring well (i.e., a Representative Monitoring Site [RMS]).

[2] Information for this well is based on the existing well NLF-C12. A final name for this future well will be selected during final planning for its installation.

asl = above sea level
bgs = below ground surface
ft = feet
GDE = groundwater dependent ecosystem
GQ = Groundwater Quality
GWL =Groundwater Level
ISW = interconnected surface water
S = Groundwater Storage
TBD = to be determined
UNK = unknown

Table 7-8. Saugus Formation GSP Monitoring Wells

Well Name	Latitude	Longitude	Reference Point Elevation (ft. asl)	Well Depth (ft. bgs)	Screened Interval (ft. bgs)	Sustainable Management Criteria
LA36-19	34.45945	-118.64221	1248.0	2120	400-1250 1850-2100	GQ
Library-C[1]	34.4155	-118.55021	1151.66	857	832-852	GWL, S, GQ
NWD-12	34.393227	-118.538274	1204.0	1340	485-1280	GQ
NWD-13	34.397092	-118.538908	1194.0	1300	420-630	GQ
NC13-HSU5a[1]	34.3981	-118.53673	1198.84	530	505-525	GWL, S, GQ
VWD-159	34.383417	-118.565787	1291.2	1950	662-1900	GQ
VWD-160[1]	34.4213	-118.5727426	1102.1	2000	950-2000	GWL, S, GQ
VWD-201	34.4127	-118.555486	1151.7	1690	540-570	GQ
VWD-205	34.413103	-118.563544	1148.5	1950	820-1930	GQ
VWD-205M	34.413038	-118.562501	1142.0	1956	820-1504	GQ
VWD-206[1]	34.429732	-118.602348	1058.6	2060	490-630	GWL, S, GQ
VWD-207	34.432829	-118.606697	1035.7	1220	507-572	GQ

Notes

[1] This well is a representative monitoring well (i.e., a Representative Monitoring Site [RMS]).

asl = above sea level
GQ = Groundwater Quality
bgs = below ground surface
GWL = Groundwater Level
ft = feet
NA = not applicable
GDE = Groundwater Dependent Ecosystems
S = Groundwater Storage

The RMS network is designed to address each of the sustainability indicators:

- Chronic lowering of groundwater levels
- Reduction of groundwater storage
- Degraded Water quality
- Land subsidence
- Interconnected Surface Water (and impacts to GDEs)

Descriptions of the groundwater monitoring program's design and implementation with respect to each of these sustainability indicators are provided below.

7.3.2 Chronic Lowering of Groundwater Levels

As discussed previously, the groundwater elevation monitoring network should demonstrate the occurrence of groundwater (where it is present and influenced by groundwater pumping), flow direction, and hydraulic gradients between principal aquifers and surface water features:

- Sufficient density of monitoring wells to characterize groundwater table or potentiometric surface elevations in each principal aquifer.
- Static groundwater elevation values collected at least twice per year, to represent seasonal low and seasonal high groundwater conditions. Presently, groundwater levels are monitored monthly at RMS locations.

RMSs that are intended to monitor for chronic lowering of groundwater levels are presented in Figures 7-10 and 7-11 and construction details are provided in Tables 7-7 and 7-8.

7.3.2.1 Scientific Rationale for the Monitoring Site Selection Process

Considerations for the monitoring network density were based on the SCV Water groundwater operating plan for the Basin that describes the amount of planned pumping in each principal aquifer during normal, wet, and dry local climatic conditions, in consideration of the availability of SWP Table A allocations. The maximum amount that the Alluvial Aquifer will be pumped according to the operating plan is between 30,000 to 40,000 acre-feet per year (AFY). The maximum amount that the Saugus Formation will be pumped under the operating plan is approximately 35,000 AFY. The DWR BMPs document for monitoring network design recommends up to four wells per 100 square miles if groundwater pumping exceeds 10,000 AFY (DWR, 2016). For the Basin, that would result in a minimum of four wells in the Alluvial Aquifer and four wells in the Saugus Formation. A modified approach was used to develop a monitoring network that exceeded the minimum number recommended by DWR due to the differences between the Saugus Formation and Alluvial Aquifer, the geographic variability in groundwater conditions in the Basin, and the distribution of pumping in each aquifer.

After computing the minimum number of monitoring wells for the Basin based on the DWR BMPs (represented by the Hopkins method of four wells per 100 square miles [Hopkins and Anderson, 2016]), a hexagonal grid was generated over the Basin (see Figure 7-11). This was only conducted for the Saugus Formation, due to the limited extent and distribution of the Alluvial Aquifer. All available Saugus Formation wells with complete construction data and historical data were then mapped onto this grid. This overlay provided an indication that there is sufficient well coverage in the Saugus Formation with no data gaps for monitoring of the groundwater level, storage, and quality sustainability indicators. As the Basin is approximately 100 square miles in size, approximately one well per polygon is sufficient. However, additional wells were included to provide additional certainty in the monitoring of groundwater conditions in the Saugus Formation.

The monitoring network for the Alluvial Aquifer includes a subset of the existing wells monitored for CASGEM and other water management programs described previously. Wells with limited historical data, limited recent data, or wells that were in similar geographic locations to other wells with longer periods of record were omitted from the GSP monitoring network. The GSP monitoring network is sufficient for contouring of the entire aquifer. Due to the limited extent over which the Alluvial Aquifer covers in the Basin, two to three wells were selected per Alluvial subarea to allow for the determination of horizontal flow gradients.

7.3.2.2 Consistency with Data and Reporting Standards

The GSP monitoring of groundwater elevations will be conducted at least in the spring and late summer of each year to obtain seasonal high and low elevations as required by SGMA regulations. However, the wells in the network are already sampled on a monthly basis and should continue to be sampled at this interval to provide valuable additional data.

7.3.3 Reduction of Groundwater Storage

7.3.3.1 Scientific Rationale for the Monitoring Site Selection Process

Wells selected for the groundwater elevation sustainability indicator were also selected to be included in the groundwater storage monitoring network. The calculation of change in groundwater storage requires groundwater elevation data that are collected from the network of wells presented in Tables 7-7 and 7-8. The use of the groundwater elevation monitoring network will allow change in storage calculations to be calculated for each aquifer, either by computing the volume of groundwater represented by the difference in elevation between water years or by using the basin groundwater flow model. In either case, estimating annual changes in groundwater storage depends on groundwater elevation data collected from the groundwater elevation monitoring network.

7.3.3.2 Consistency with Data and Reporting Standards

The GSP monitoring of change in groundwater storage will be similar to the monitoring of groundwater elevations described above. Groundwater level data will be obtained at a minimum in the spring and late summer of each year to obtain seasonal high and low elevations as required by the SGMA regulations. This frequency will allow for the calculation of change in storage between consecutive seasonal high conditions, as described in §354.18(b)(4) of the SGMA regulations for water budget evaluations.

7.3.4 Seawater Intrusion

Seawater intrusion is not an issue in the Basin, as it is not a coastal basin. Therefore, no monitoring network or SMCs will be developed for this sustainability indicator.

7.3.5 Degraded Water Quality

7.3.5.1 Scientific Rationale for the Monitoring Site Selection Process

Wells were selected to be included in the water quality monitoring network based on their proximity to beneficial uses of groundwater. This includes the wells identified in Tables 7-7 and 7-8. Similar to monitoring of chronic declines in groundwater elevations and changes in groundwater storage, the same wells used for those sustainability indicators will be used to monitor for the degraded water quality sustainability indicator. This element of the GSP monitoring network will rely on existing monitoring programs currently being conducted by SCV Water that are required under existing water supply permits with DDW.

Private wells (e.g., domestic and agricultural) wells are presently not included in the SCV water quality monitoring network, nor does a program otherwise exist to monitor domestic well water quality. This is a data gap. Because domestic drinking water is a beneficial use of groundwater in the Basin, it will be necessary to develop a baseline of water quality for domestic well water quality in certain parts of the Basin that may be affected by basin-wide pumping or GSA activities in the future. It is hoped that owners of selected domestic wells will volunteer to have their wells sampled and tested. The process for selecting domestic wells to be included in the program are presented in Section 9. Domestic wells included in the program will be sampled and tested for salts and nutrients (TDS, sulfate, nitrate, boron, chloride), VOCs, perchlorate, and, potentially, other constituents such as PFAS.

7.3.5.2 Consistency with Data and Reporting Standards

The GSP monitoring of degraded water quality will be similar to the monitoring of groundwater elevations and storage described above with regard to the utilization of the same monitoring network. Except for the domestic well monitoring, the monitoring of groundwater quality will be consistent with existing permit requirements that SCV Water meets as part of providing groundwater supplies for beneficial uses. Groundwater quality sampling will be conducted at least annually each year to assess the occurrence of degraded water quality.

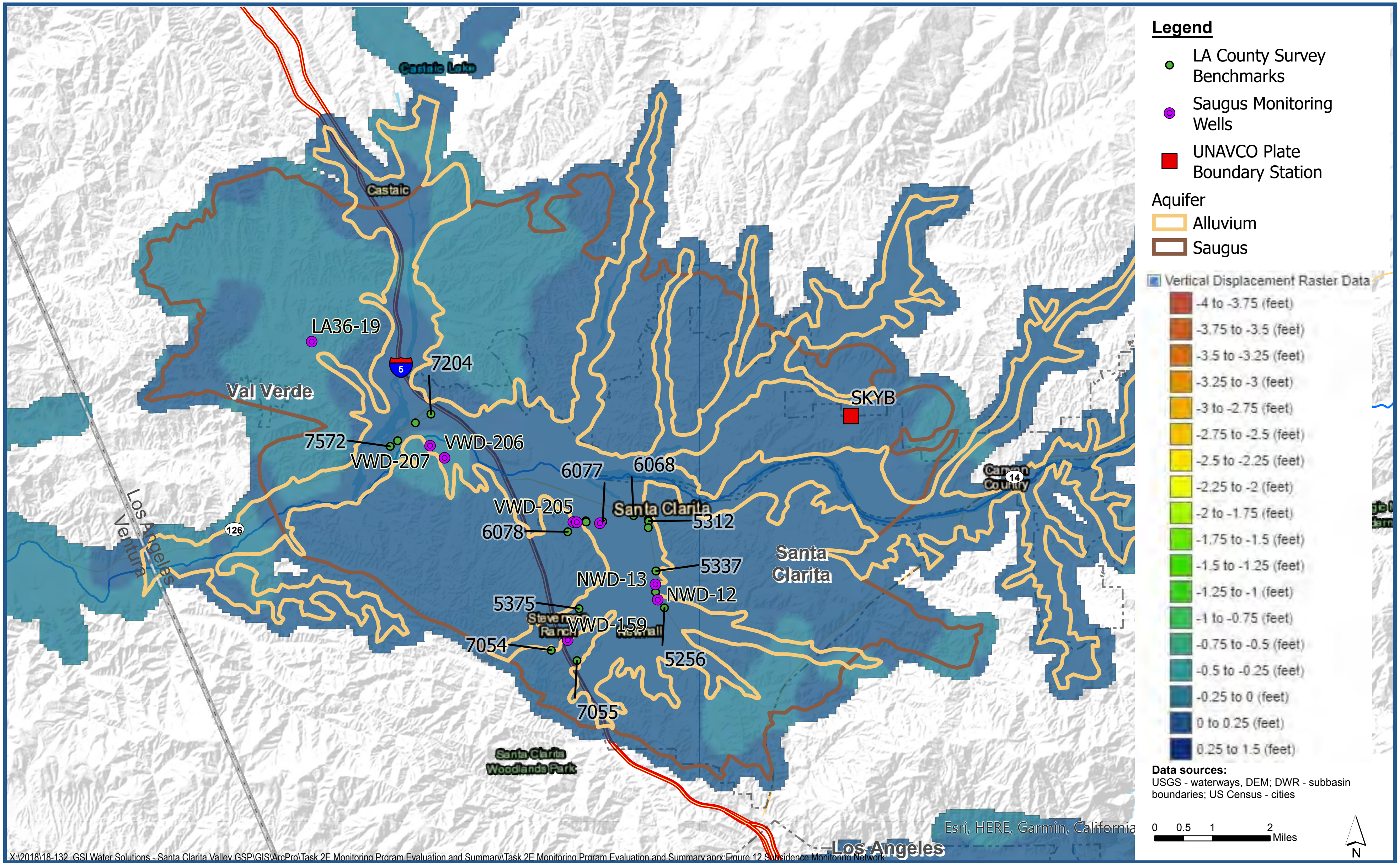
7.3.6 Land Subsidence

Saugus Formation groundwater pumping in the western and central areas of the Basin is expected to be greater and more frequent in selected areas in the future as compared to historical amounts due to additional groundwater wells in the west, and perchlorate containment activities in the central part of the Basin. This is predicted by the basin groundwater model to result in groundwater elevations that are temporarily (during dry periods) on the order of approximately 150 feet lower than long-term average historical elevations during extended dry periods west of the former Whittaker-Bermite site in the vicinity of well V201 (Appendix J). These lower groundwater elevations are also representative of full build-out land use conditions with pumping in accordance with the Basin operating plan and perchlorate containment objectives. These changes in groundwater elevations include continuous operation of these wells (V201, V205, Saugus 1, and Saugus 2) for perchlorate containment purposes, which is a departure from historical conditions (for wells V201 and V205) whereby wells V201 and V205 were operated at reduced levels when the groundwater was needed to meet water demands. Although analysis of subsidence data from existing programs described above were conducted and showed no conclusive evidence of subsidence, the potential for subsidence of some limited amount may occur due to projected changes in groundwater pumping patterns in an area. The combination of subsidence data obtained from DWR for InSAR coverage of the entire Basin, along with LACDPW benchmark surveys and groundwater elevation monitoring is considered sufficient to monitor for potential subsidence impacts in the future.

7.3.6.1 Scientific Rationale for the Monitoring Site Selection Process

Monitoring of subsidence in the Basin will utilize InSAR data and existing benchmarks established by LACDPW for subsidence monitoring in the Basin. On the order of 10 of these stations will be surveyed each January and August for elevation by SCV Water. The locations of selected LACDPW stations are shown on Figure 7-12. These locations were selected because they are in an area of the Basin considered to most susceptible to subsidence and where infrastructure, such as well V201, conveyance pipelines, and roadways are located. Final selection of benchmark locations will be made following discussions with LACDPW. The elevation of each benchmark station will be calibrated to benchmarks established by LACDPW so that consistency between historical elevations can be maintained.

The GSP monitoring of land subsidence will comply with the accuracy required by DWR and utilize data provided by that agency to assess the occurrence and magnitude of subsidence on a spatial basis at critical infrastructure locations where the greatest reductions in groundwater levels are likely to occur. The monitoring network for subsidence will utilize the InSAR data, supplemented by bi-annual elevation survey data obtained at LACDPW benchmark sites. Survey measurements will be compared to LACDPW data (which is collected only every 5 or 6 years) and adjusted as necessary to maintain consistency between the data sets. The combination of the two monitoring programs will provide SCV Water with the ability to evaluate subsidence on frequencies ranging from several times per year to every 6 years.



Data sources:
USGS - waterways, DEM; DWR - subbasin boundaries; US Census - cities

X:\2018\18-132_GSI Water Solutions - Santa Clarita Valley GSP\GIS\ArcPro\Task 2E Monitoring Program Evaluation and Summary\Task 2E Monitoring Program Evaluation and Summary.aprx;Figure 12 Subsidence Monitoring Network

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Ground Surface Vertical Displacement Estimated Using InSAR Data

Santa Clara River Valley East Subbasin
Groundwater Sustainability Plan

Figure 7-12

7.3.7 Interconnected Surface Water (GDE) Monitoring Network

The GSP Monitoring Plan also includes elements to ensure the avoidance of impacts to GDEs. It includes groundwater level monitoring at 10 locations within the identified GDE area; see Figure 8-7 for the locations of these wells, which consist of four existing wells and six new wells. The GDE monitoring program includes the following elements:

1. Install 6 shallow monitoring wells (also referred to as piezometers) at locations along the river corridor representing river segments and two locations in selected tributaries where GDEs are present.
2. Measure the elevation of the monitoring well measuring points and thalweg nearest to the monitoring well.
3. Assess the relationship between water levels measured at the GDE monitoring wells, river flow, WRP discharges, rainfall, and nearby pumping to assess the validity of the data observed in these monitoring locations.
4. Calibrate the measured water levels with levels predicted by the groundwater flow model.
5. Conduct groundwater level monitoring to track water levels relative to triggers.
6. In monitoring wells that provide meaningful data, identify a trigger for each well based on historical low groundwater levels (data or estimate). Identify a trigger above historical low in areas where sensitive aquatic species reside (e.g., I-5 Bridge).
7. Monitor flow at the Old Road Bridge streamflow gage (the only nearby gage) downstream from where sensitive species (e.g., unarmored three-spine stickleback) are thought to exist in pools at the I-5 Bridge. Periodically visually observe and document surface water flow conditions at this location (I-5 Bridge pool area and streamflow gage) if surface water gauging is not possible during low-flow conditions.
8. Conduct limited periodic biological monitoring at GDE monitoring locations to assess conditions at those locations.
9. Use enhanced vegetation index data (EVI, time series, and map view) for the GDE area as a screening tool to assess changes in GDE area vegetation annually during the summer.

7.3.7.1 Use of Predictive Modeling

Because there is a lack of dedicated monitoring wells with a history of water levels in the GDE area, it was necessary to use SCV Water's groundwater flow model of the Basin to estimate groundwater levels at different points along the river. The model has been calibrated to historical data over the past four decades (1980 through 2019) and was used to identify groundwater levels based on historical hydrology, pumping, and land use conditions. These historical groundwater levels were used to identify trigger levels that, if approached or exceeded, would cause an evaluation of GDE conditions and if needed, an evaluation of methods to avoid impacts to GDEs (refer to Section 8 for a discussion of these trigger levels).

Modeling of future pumping patterns suggests that, if triggers were to be reached or approached in the future along the Santa Clara River, this would likely first occur approximately 1 mile downstream of the Valencia WRP discharge point during unprecedented drought conditions. This area may act as an early indication of lowering groundwater levels for the entire river valley. This area will likely experience the most severe declines in groundwater levels (and potential reductions below trigger levels) during the dry season of a drought period with potential recovery in the fall and winter seasons depending on local rainfall conditions. Used as an indicator of a more widespread effect, the initial signal of low groundwater levels near the western boundary of the Basin may indicate the need to anticipate evaluation and potential management actions in the east to protect priority GDEs (such as those near the I-5 Bridge) before adverse effects are manifested. This predictive ability will help to sustain the most vulnerable priority GDEs.

It is anticipated that the triggers that have been estimated using the groundwater model will be updated once GDE monitoring wells are installed and more is learned about correlation of groundwater elevations, streamflows, WRP discharges, and potential undesirable results to GDEs. Further, a correlation between modeled historical levels and actual levels measured at each monitoring well will be developed.

7.3.7.2 Future Multiple Dry Year Conditions

In evaluating the potential effects of climate change on the Santa Clara River watershed, it is estimated that, in the future, the area may experience drought conditions that are more severe and persist for longer durations than have been experienced to date. As a result, groundwater elevations below previously observed historical lows may occur. If groundwater pumping increases in the future, the combination of increased pumping and prolonged, or especially intense, drought conditions may lower groundwater levels beyond historical lows and potentially affect GDEs. In much of the river channel, the riparian vegetation may be resilient to these longer drought periods. Although vegetation may be stressed and may retreat in areas temporarily, habitat for sensitive species (including the presence of surface water for fish and amphibians and willow and cottonwood forests for birds) would remain in the river corridor and the ecology would recover when wetter conditions occurred. However, in areas where sensitive species rely on river flow and aquatic habitat, temporary elimination of surface flow could result in permanent loss of these sensitive aquatic species. In these priority areas where sensitive aquatic species (e.g., UTS) exist, more frequent groundwater monitoring and frequent observation of surface flow conditions will be conducted. If the trigger is reached, the evaluation process described below will be implemented, and, if necessary, management actions would be implemented early to avoid groundwater pumping-caused undesirable results to GDEs.

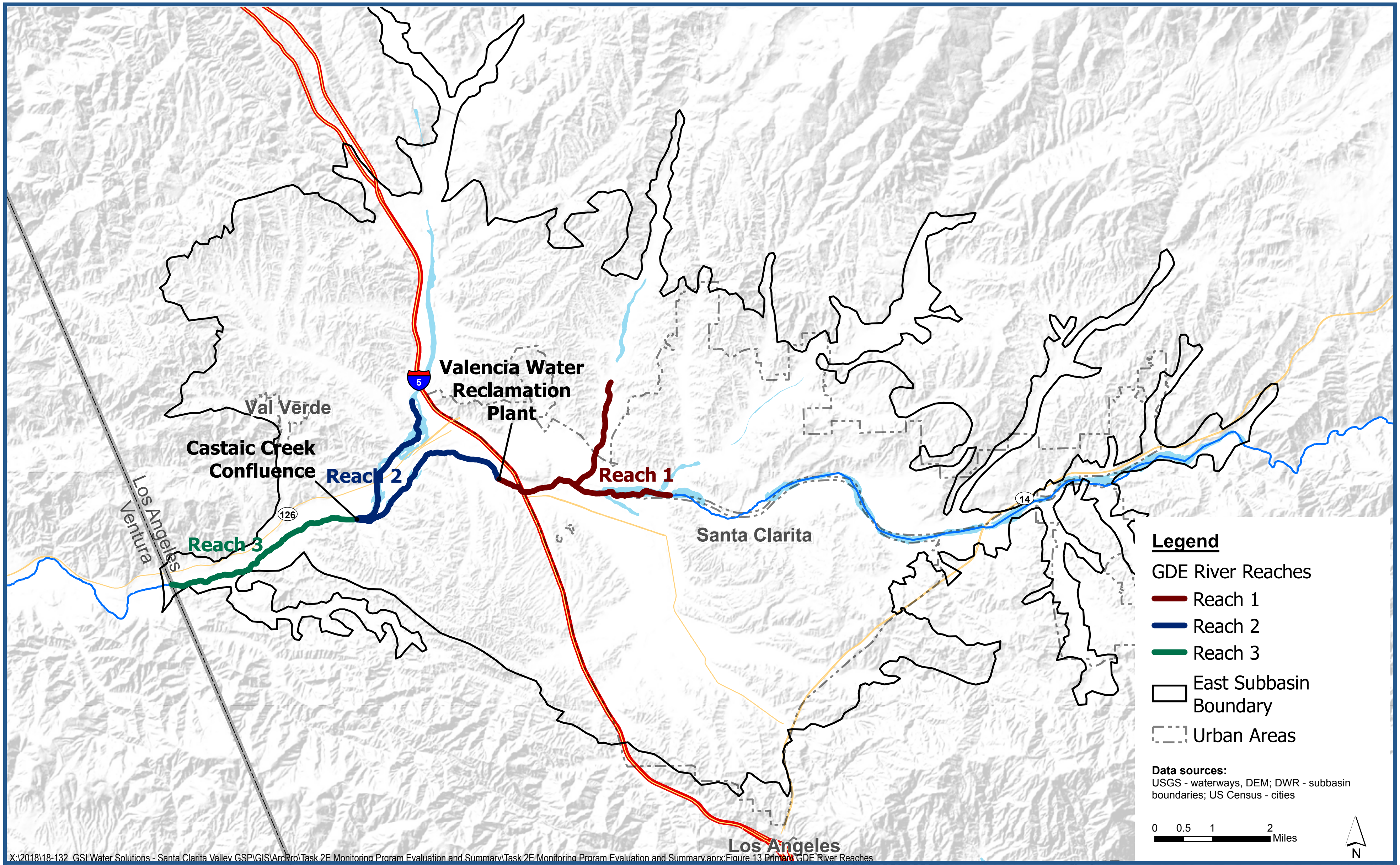
7.3.7.3 GDE Monitoring

GDE Monitoring Well Locations

Section 8 of the GSP identifies potential locations for monitoring wells along the river corridor where GDEs occur. The location of monitoring wells can be further refined into three distinct reaches supporting GDEs: Reach 1 from Bouquet Canyon to the Valencia WRP; Reach 2 from Valencia WRP to just below the Castaic Creek confluence; and Reach 3 from below Castaic Creek to the LA/Ventura County Line. These reaches, shown in Figure 7-13, correspond to predominantly gaining and losing river segments. Monitoring wells will be established to track average groundwater levels in these segments. Two monitoring wells will be established in each reach. In addition, two existing alluvial wells will be used to monitor groundwater levels up San Francisquito Creek and Castaic Creek (two tributaries to the Santa Clara River) because GDEs have also been identified in these areas. Exact locations of the monitoring wells are not known at this time; access agreements with landowners need to be obtained and locations that do not impact habitat must be identified.

GDE Triggers

For each monitoring well, the historical low groundwater level will be established to serve as the trigger (refer to Table 8-6). Triggers will be established 2 feet above the historical lows in River Reach 1, near the I-5 Bridge, to ensure that management actions, if needed, can be implemented in a timely manner. This reach contains priority GDEs, based on the presence of sensitive aquatic species. In addition to groundwater level monitoring in this priority reach, the presence of surface water flow will be monitored at the Old Road Bridge gage, checked (visually or with cameras), and documented on at least a weekly basis during low-flow periods in the area near the I-5 Bridge, where unarmored three-spine stickleback have been observed.



Luhdorff & Scalmanini
Consulting Engineers

Primary GDE River Reaches

Santa Clara River Valley East Subbasin
Groundwater Sustainability Plan

Figure 7-13

Elevation of Monitoring Wells and River Channel

The elevation of the monitoring wells and river channel will be surveyed. The river channel (low-flow channel thalweg), will be topographically surveyed within close proximity to each monitoring well. These elevations will assist in evaluating the significance of impacts associated when triggers are reached. The survey should be refreshed after major storm events as needed.

GDE Monitoring Plan Implementation

It is anticipated that it will be necessary to take time to evaluate the groundwater level data obtained from the newly installed GDE monitoring wells to better understand the validity of the data and how the data relate to a number of processes going on in the vicinity including streamflow, WRP flows, tributary flows, and pumping. Once it is determined that the data being generated are meaningful, groundwater levels will be obtained and recorded at approximately a monthly basis at GDE monitoring sites during low flow summer months and quarterly during wet periods. Periodic limited biological monitoring will also be performed at GDE monitoring locations and EVI analysis will be performed in the summer on an annual basis. During multiple drought years, the frequency may increase to implement management actions in a timely manner if necessary. The GDE monitoring well(s) will be fitted with transducers and data loggers so that high resolution daily data can be obtained. The GSA, in partnership with landowners, will record water level data, conduct quality assurance/quality control (QA/QC) of the data, and incorporate the data in the data management system (DMS).

When a trigger is reached or approached, a qualitative evaluation process will be implemented as described in the following section.

Evaluation Process when Triggers are Reached or Approached

Section 8 of the GSP states that when a trigger is reached or approached, an evaluation process will be initiated to determine whether the lowered groundwater levels are a result of pumping and could result in a significant and unreasonable effect to GDEs. This Monitoring Plan includes a process to report the trigger event to the GSA Board as needed with an accompanying Trigger Evaluation Report that evaluates the need for management actions to be implemented. Management Actions would be implemented if the lowering groundwater levels caused by groundwater extraction could result in permanent loss of GDEs anywhere in the GDE area or loss of aquatic habitat in areas that currently provide essential habitat to UTS (sensitive aquatic species in the vicinity of I-5 Bridge) where cessation of surface flow occurs during low-flow conditions in the river channel. The evaluation would be conducted in a timely manner if it appears that groundwater levels are approaching or likely to exceed GDE trigger levels discussed in Section 8 of the GSP.

Several questions have been identified below that may shed light on the significance of lowered groundwater levels.

Questions that will be addressed are presented below.

1. **Is the affected river segment supported by surface flow from WRP discharges? (Surface water may support habitats during temporary periods of low groundwater.)**

   Surface water is generally persistent from the VWRP to the western boundary of the Basin. The Trigger Evaluation Report (or Evaluation Report) may document that streamflows are persistent even with lowered groundwater levels. If streamflows are not present below the VWRP discharge, the Evaluation Report would conclude that surface flows are not sustaining vegetation during the historically low groundwater period, and further evaluation of the following questions may lead to management actions.

2. **Is the historical low groundwater level already below the tree/shrub root depths? (If so, further declines in the same year may not affect GDEs.)**

   The Evaluation Report may rely on topographic data and depth to groundwater data from recent monitoring well readings to determine whether groundwater levels are below tree/shrub root depths. The existing vegetation may not be relying on groundwater in areas where temporary drawdowns of 15 feet or more feet below ground surface (bgs) occur regularly. A topographic survey of the thalweg may be helpful to estimate root zone areas in the affected reach. In areas where groundwater is lowered more than 2 or 3 feet below the historical lows, GDEs may be disconnected from their groundwater water source to an unprecedented degree. If surface water is also not present in these areas, temporarily sustaining GDEs, management actions may be warranted.

3. **Will the GDEs survive the temporary loss of access to groundwater? (Depending on the season, groundwater levels may be expected to rise above historical lows within a month or two, avoiding permanent loss of habitat. When groundwater levels are restored sufficiently quickly in the winter months, effects to GDEs may not be significant.)**

   The Evaluation Report should evaluate the season to provide a qualitative assessment of the duration for which lower groundwater levels may occur, assuming that water levels will recover initially with cooler temperatures in the fall and then more substantively with rain events. If triggers are reached early in the year, the GDEs may experience more stress than if the triggers are reached late in the hot weather season. The Evaluation Report may recommend initiating vegetation monitoring to assess whether drought stress is visible in the river segment. If vegetation is showing signs of stress attributable to historically low or lower groundwater levels caused by pumping, then the Evaluation Report will be updated, and management actions may be warranted.

   For the aquatic habitat in Segment 1, any temporary loss of surface flow is to be avoided with management actions before it occurs.

4. **Has the trigger been reached often in recent years? Droughts that lower groundwater levels are a natural occurrence, but do not occur every year. To sustain GDEs over the long term, groundwater levels affected by drought conditions must recover sufficiently quickly and remain higher most years in order to support healthy, sustainable habitats over the long term.)**

   The Evaluation Report should report the frequency with which the triggers have been reached. If triggers have been reached in 2 or 3 years within a 10-year period, the Trigger Evaluation Report may recommend initiating vegetation monitoring to assess for recurring stress and gradual degradation of habitat. If a gradual decline in habitat quality is seen as a result of groundwater pumping that may lead to undesirable results, the Evaluation Report will be updated, and management actions may be warranted.

5. **Are the declines in groundwater levels resulting from pumping?**

   The Evaluation Report may compile pumping data from wells that are known to be pumping in the Basin and compare them to current pumping recorded for the recent past (months). If historical pumping levels are equal to or greater than current pumping rates, the Evaluation Report may identify that something other than groundwater pumping, such as unprecedented drought conditions or other changes in the water balance of the Basin are contributing to the condition. The Evaluation Report should then outline actions that could be taken to ensure undesirable results caused by groundwater pumping are avoided. If it is determined that the cause of groundwater levels below the trigger are likely caused by pumping, then management actions may be warranted.

6. Has new information been obtained that can be used to refine the GDE trigger levels presented in Section 8?

The Evaluation Report should provide the context for recommendations of future evaluation, monitoring, and action items. It should seek to refine the trigger over time to better correlate with the potential for undesirable results. If there is new information that has been developed regarding the resilience or sensitivity of the GDEs and the special status species that rely on the habitat values, then the Evaluation Report should identify this updated information and recommend management actions as needed to avoid undesirable results.

Evaluation Report

The above Evaluation Process questions will be discussed in an Evaluation Report. The report will include a summary of available data and recommendations for implementation of management actions and/or revision of triggers and will include justification for the conclusions based on the priority of the affected river segment and the other Evaluation Process questions. As shown in Figure 7-13, these variables may present different conclusions in each of the river and tributary segments. In Segment 1, the trigger is set to trigger an evaluation in order to minimize the potential for reaching historical lows, before an evaluation report can be completed, providing protection for priority GDEs. In Segment 2 and the tributaries, groundwater levels below historical lows may not be significant, as groundwater levels are already 15 feet below the river channel. In Segment 3, a drawdown of 2 feet below historical lows may not result in adverse effects, due to the persistent surface water resulting from groundwater upwelling as a result of Saugus Formation discharging in this area. However, a further reduction may reduce flows in the river, which could be more significant. The Evaluation Report to the GSA Board will explain the significance of the evaluation and will recommend whether Management Actions are required. Possible management actions intended to respond to potential impacts to GDEs are presented in the Management Actions and Projects section of the GSP (Section 9).

Presentation to the GSA Board

The Evaluation Report will be presented to the GSA Board at its next regularly scheduled meeting, or sooner if necessary for the Board to consider implementing projects or management actions.

Upland GDEs (not likely to be affected by downstream groundwater extraction)

Upland areas that are understood to contain GDEs have been identified in Placerita Canyon and Sand Canyon, but the areas may not be connected to groundwater or may not be affected by pumping downstream (refer to Figure 3 in Appendix E). For these reasons, the areas are not included in the GDE monitoring and evaluation program described above; however, these areas are of interest to stakeholders and some limited assessment and monitoring is proposed.

Upland GDE Monitoring Program

A habitat survey will be conducted in upland areas in Placerita Canyon and Sand Canyon to better understand local GDE conditions. This evaluation will determine the extent to which these areas are supported by groundwater levels that may be influenced by groundwater pumping and will provide recommendations regarding the need to continue to monitor these areas.

7.3.8 Description of Monitoring Protocols (§ 354.34)

7.3.8.1 Protocols for Monitoring Sites

Monitoring protocols that will be used by the GSA as part of implementing this GSP are largely based on the DWR BMP *Sustainable Management of Groundwater: Monitoring Protocols, Standards, and Sites* (DWR, 2016). The recommended monitoring protocols were adjusted and added to fit the specific monitoring needs of the Basin to achieve sustainability. Monitoring protocols for seawater intrusion were not necessary, as the Basin is a groundwater basin approximately 40 miles inland from the coast. Monitoring protocols for measuring groundwater extraction amounts also are included. Monitoring protocols regarding groundwater extraction are not described in the BMP; accounting for groundwater pumping will be an integral part of achieving sustainability in the Basin. The monitoring protocols that are described in this document will provide the necessary data to track the minimum thresholds and measurable objectives for each of the sustainability indicators. The monitoring protocols established herein will be reviewed every 5 years as a part of periodic GSP updates. The following protocols will be applied to all monitoring sites:

- A unique identifier will be assigned that includes a written description of the site location, well or location identification (ID), date established, access instructions, type(s) of data to be collected, latitude, longitude, and elevation.
- A log will be kept in order to track all monitoring site details and track all modifications to the monitoring site.

7.3.8.2 Groundwater Level Elevation

Protocols for Measuring Groundwater Levels

Protocols for measuring groundwater levels include the following:

- Measure depth to water in the well using procedures appropriate for the measuring device. Equipment must be operated and maintained in accordance with manufacturer’s instructions. Groundwater levels should be measured to the nearest 0.01 foot relative to the Reference Point (RP).
- Shut off pumping for at least 8 hours, if the well is normally operational, to obtain a static water level measurement. If the well has been pumped, multiple measurements should be collected to ensure the well reached equilibrium such that no significant changes in water level are observed. Every effort should be made to ensure that a representative stable depth to groundwater is recorded. If a well does not stabilize, the quality of the value should be appropriately qualified as a questionable measurement.
- The groundwater elevation should be calculated using the following equation.

$$\mathrm{GWE} = \mathrm{RPE} - \mathrm{DTW}$$

Where:
GWE = Groundwater Elevation in NAVD88 datum
RPE = Reference Point (RP) Elevation in NAVD88 datum
DTW = Depth to Water

- The measurements of depth to water should be consistent in units of feet, to an accuracy of hundredths of a foot.
- The well caps or plugs should be secured following depth to water measurement.
- Groundwater level measurements are to be made on a semi-annual basis at a minimum, during periods that will capture seasonal highs and lows.

Recording Groundwater Level Measurements

- The sampler should record the well identifier, date, time (24-hour format), RPE, height of RP above or below ground surface, DTW, GWE, and comments regarding any factors that may influence the depth to water readings such as weather, nearby irrigation, flooding, potential for tidal influence, or well condition. If there is a questionable measurement or the measurement cannot be obtained, it should be noted. Standardized field RMSs should be used for all data collection.
- All data should be entered into the DMS as soon as possible. Care should be taken to avoid data entry mistakes and the entries should be checked by a second person.

Installing Pressure Transducers and Downloading Data

Many wells in the existing SCV Water monitoring program already have transducers installed. The following procedures will be followed during installation of new pressure transducers and periodic data downloads:

- The sampler must use an electronic sounder and follow the protocols listed above to measure the depth to groundwater (groundwater level) and calculate the groundwater elevation in the monitoring well to properly program and reference the installation. It is recommended that transducers record measured groundwater level to conserve data capacity; groundwater elevations can be calculated at a later time after downloading.
- The sampler must note the well identifier, the associated transducer serial number, transducer range, transducer accuracy, and cable serial number.
- Transducers must be able to record groundwater levels with an accuracy of at least 0.01 foot. Professional judgment will be exercised to ensure that the data being collected is meeting the data quality objectives (DQO) and that the instrument is capable. Consideration of the battery life, data storage capacity, range of groundwater level fluctuations, and natural pressure drift of the transducers should be included in the evaluation.
- The sampler must note whether the pressure transducer uses a vented or non-vented cable for barometric compensation. Vented cables are preferred, but non-vented units provide accurate data if properly corrected for natural barometric pressure changes. This requires the consistent logging of barometric pressures to coincide with measurement intervals.
- Follow manufacturer specifications for installation, calibration, data logging intervals, battery life, correction procedure (if non-vented cables used), and anticipated life expectancy, to ensure that DQOs are being met for the GSP.
- If the well is not already equipped with a pressure transducer, secure the cable to the well head with a well dock or another reliable method. Mark the cable at the elevation of the reference point with tape or an indelible marker. This will allow estimates of future cable slippage.
- The transducer data should periodically be checked against hand-measured groundwater levels to monitor electronic drift or cable movement. This should happen during routine site visits, at least annually, to maintain data integrity.
- The data should be downloaded as necessary on a regular basis to ensure no data are lost. It should be promptly entered into the DMS following the QA/QC program established for the GSP. Data collected with non-vented data logger cables should be corrected for atmospheric barometric pressure changes, as appropriate. After the sampler is confident that the transducer data have been safely downloaded and stored, the data should be deleted from the data logger to ensure that adequate data logger memory remains.

7.3.8.3 Groundwater Storage Measurements

The monitoring protocols for evaluating change in groundwater storage are the same as the protocols described above for groundwater levels.

7.3.8.4 Groundwater Quality Measurements

Annual monitoring of groundwater quality will include sampling and laboratory analysis of selected constituents that are required from existing programs permitted through DDW and as required by the SNMP (as shown in Tables 7-4 and 7-6). Additional constituents will be considered in the future as additional information becomes available. During sampling events, measurement of selected water quality parameters will take place in the field. These field parameters should be measured at an annual frequency and include electrical conductivity at 25 °C in µS/cm, pH, temperature (in °Celsius [C]), and dissolved oxygen in mg/L.

The GSP monitoring program will use the following protocols for collecting groundwater quality samples:

- Prior to sampling, the analytical laboratory will be contacted to schedule laboratory time, obtain appropriate sample containers, and clarify any sample holding times or sample preservation requirements.
- Each well used for groundwater quality monitoring will have a unique identifier. This identifier will appear on the well housing or the well casing to verify well identification.
- In the case of wells with dedicated pumps, samples should be collected at or near the wellhead following purging.
- Prior to sampling, the sampling port and sampling equipment will be cleaned of any contaminants. The equipment will be decontaminated between each sampling location or well to avoid cross-contamination.
- The static groundwater level in the well should be measured following appropriate protocols described above in the groundwater level measuring protocols.
- For any well not equipped with low-flow or passive sampling equipment, an adequate volume of water should be purged from the well to ensure that the groundwater sample is representative of ambient groundwater and not stagnant water in the well casing. Purging three well casing volumes is generally considered adequate. Professional judgment should be used to determine the proper configuration of the sampling equipment with respect to well construction, such that a representative ambient groundwater sample is collected. If pumping causes a well to be evacuated (go dry), document the condition and allow well to recover to within 90 percent of original level prior to sampling.
- Field parameters of pH, electrical conductivity and temperature should be collected during purging and prior to the collection of each sample. Field parameters should be evaluated during the purging of the well and should stabilize prior to sampling. Measurements of pH should only be measured in the field; lab pH analysis are typically unachievable due to short hold times. Other parameters—such as oxidation-reduction potential, dissolved oxygen (in situ measurements preferable), or turbidity—may also be useful for assessing purge conditions. All field instruments will be calibrated daily and evaluated for drift throughout the day.
- Sample containers should be labeled prior to sample collection. The sample label must include sample ID (often well ID), sample date and time, sample personnel, sample location, preservative used, and analytes and analytical method.
- Samples should be collected under laminar flow conditions. This may require reducing pumping rates prior to sample collection.

- All samples requiring preservation must be preserved as soon as practically possible, ideally at the time of sample collection. Ensure that samples are appropriately filtered as recommended for the specific analyte. Entrained solids can be dissolved by preservative leading to inconsistent results of dissolve analytes. Specifically, samples to be analyzed for metals should be field filtered prior to preservation; do not collect an unfiltered sample in a preserved container.
- Samples should be chilled and maintained at 4 °C to prevent degradation of the sample. The laboratory's Quality Assurance Management Plan should detail appropriate chilling and shipping requirements.
- Samples must be shipped under chain of custody documentation to the appropriate laboratory promptly to avoid violating holding time restrictions.
- Groundwater quality samples shall be collected annually.
- All data will be entered into the DMS as soon as possible. Data entries should be checked by a second person to avoid incorrect data.

7.3.8.5 Groundwater Extraction Measurements

Measurements of groundwater extractions are conducted in the Basin in the vast majority of wells that are not categorized as de minimis use (e.g., domestic wells using less than 2 AFY). Measurement devices utilized by the municipal pumper members of the GSA consist of totalizer meters that record extractions. The GSA may seek pumping information from other non-municipal wells that are not de minimis users. The meters will be periodically checked for accuracy using the manufacturer's recommendations. If necessary, meters will be periodically calibrated according to the manufacturer's specifications. The meters will be read on at least a quarterly basis and the data collected will be recorded in gallons and converted to acre feet.

7.3.8.6 Subsidence Measurements

Subsidence monitoring will be conducted by utilizing the existing InSAR monitoring program and by monitoring elevations at selected benchmarks described previously. It should be noted that the monitoring program will detect both increases and decreases in land surface elevations over time. The following procedures will be followed:

- Download and review subsidence data collected by DWR and LACDPW in the Basin on an annual basis.
- Downloaded data will be stored in the DMS following QA/QC.
- Subsidence data will be downloaded when available from the various agencies and uploaded to the DMS.
- The elevation of selected benchmarks will be measured using a high-resolution GPS unit that will report elevations to the nearest centimeter or less. The data will be recorded in a logbook and entered into the DMS and checked against previous readings. If there are potentially anomalous readings, the unit will be recalibrated, and the elevation reading will be repeated.

7.3.8.7 Interconnected Surface Water Measurements

Groundwater levels measured at GDE monitoring locations, river flow (measured in cfs at the Old Road gage), and stream channel bottom (thalweg) elevation data will be collected using the procedures described previously. GDE monitoring wells will be equipped with transducers and data loggers and set for hourly data collection. Flow measurements at the Old Road gage will be downloaded from the USGS website on at least a weekly basis. During extended drought conditions when groundwater levels are approaching the trigger level at the I-5 Bridge, flow in the river will be visually observed at that location on at least a weekly basis to assess whether there is a potential for river flow to stop and impact sensitive aquatic species.

Data collected will be compiled and analyzed for QA/QC and entered into the DMS.

7.3.8.8 Representative Monitoring (§ 354.36)

RMS are defined in the SGMA regulations as a subset of monitoring sites that are representative of conditions in the Basin. All the monitoring sites in this section are considered RMSs, using methods of selection consistent with the BMPs described above under the groundwater level protocols. Groundwater level monitoring will be used to determine changes in groundwater storage. Change in storage cannot be directly measured; therefore, this sustainability indicator relies on groundwater elevation measurements as a proxy to calculate change in storage. As a result, groundwater level data will be used in conjunction with aquifer parameters and the groundwater model to compute changes in groundwater storage across the Basin. In the case of subsidence, the use of InSAR data that encompasses the entire Basin will be used.

7.3.8.9 Assessment and Improvement of Monitoring Network (§ 354.38)

The GSA does not anticipate that the data gaps will impact the Basin’s ability to achieve sustainability and is committed to fill in data gaps as identified herein. As described in §354.38 of the SGMA regulations, the GSA is required to analyze the monitoring network for improvements as follows:

- Each GSA shall review the monitoring network and include an evaluation in the Plan and each 5-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.
- Each GSA shall identify data gaps wherever the basin does not contain enough monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the GSA.
- If the monitoring network contains data gaps, the Plan shall include a description of the following:
  - The location and reason for data gaps in the monitoring network
  - Local issues and circumstances that limit or prevent monitoring
- Each GSA shall describe steps that will be taken to fill data gaps before the next 5-year assessment, including the location and purpose of newly added or installed monitoring sites.
- Each GSA shall adjust the monitoring frequency and distribution of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:
  - Minimum threshold exceedances
  - Highly variable spatial or temporal conditions
  - Adverse impacts to beneficial uses and users of groundwater
  - The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin

Review and Evaluation of the Monitoring Network

The monitoring networks described above for each of the applicable sustainability indicators will be evaluated on a yearly basis. This evaluation will involve a review of the described minimum thresholds and measurable objectives and their comparison to observed trends in the monitoring network. Furthermore, a more comprehensive review of the monitoring network will be conducted every 5 years as part of the GSP update. During this review, management actions and projects will be evaluated, and the monitoring network will be assessed for their efficacy in tracking progress based on the actions and projects. These evaluations and assessments also will highlight any additional data gaps and recommended changes to the monitoring networks.

Identification and Description of Data Gaps

Identification and description of data gaps for the monitoring network described above for each of the applicable sustainability indicators are described below.

Groundwater Elevation

Groundwater elevation data has been extensively collected within the Basin over the past several decades. However, despite this data collection effort, spatial data gaps still exist in some areas where groundwater development of the Saugus Formation has not occurred. Currently, those areas are not considered data gaps, however, the monitoring network will be expanded by including new Saugus wells that may be installed in the future.

Monitoring wells will need to be installed for the GDE area as shown on Figure 7-14. After these wells are installed, the actual measured water level will be correlated with the model predicted water level, which may require an adjustment of the trigger levels and measurable objective at each location.

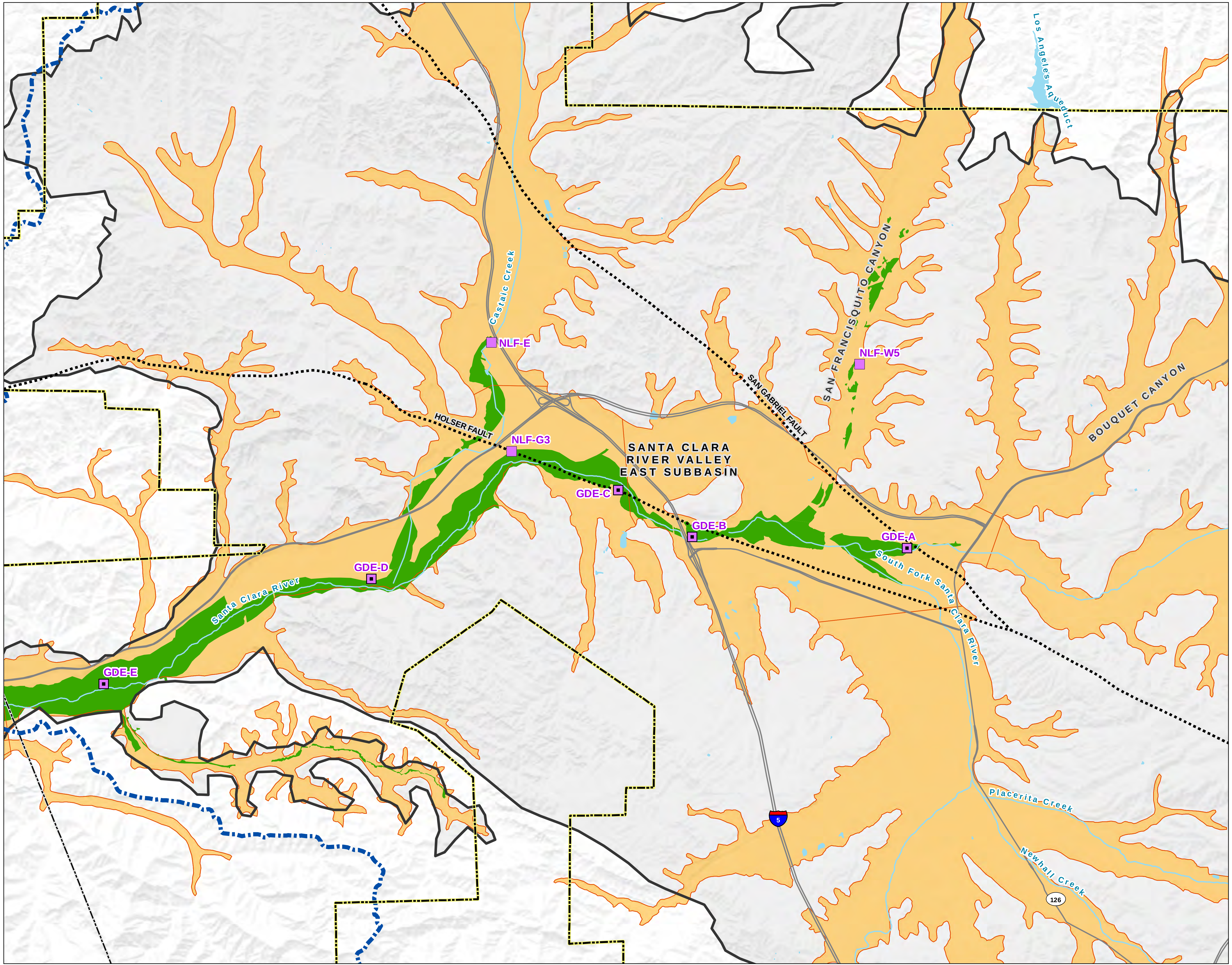


FIGURE 7-14

Groundwater Monitoring Network for GDEs

Santa Clara River Valley
East Groundwater Basin
Groundwater Sustainability Plan

LEGEND

GDE Monitoring Well in the Alluvial Aquifer

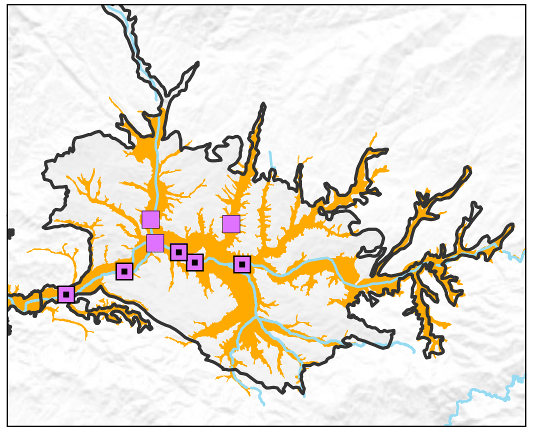
- 🟪 Existing Observation Well
- ⊡ New Observation Well (to be constructed)

Phreatophyte Locations

- 🟩 Riparian Mixed Hardwood

All Other Features

- Santa Clara River Valley Groundwater Basin
- Alluvial Aquifer
- Watershed Boundary
- Service Area Boundary for SCV Water
- Major Road
- Watercourse
- Waterbody



NOTE

SCV Water: Santa Clarita Valley Water Agency

Date: December 17, 2021
Data Sources: USGS, DWR Bulletin 118, ESA

Document Path: Y:\0420_CLWA\Source_Figures\019_EastSubbasinGSP\GSP\Section7\Figure7-14_GW_Monitoring_Network_GDEs.mxd, abarry

Groundwater Quality

Groundwater quality data is collected extensively throughout the Basin as a result of several existing monitoring programs. These programs provide a spatial distribution of data such that no data gaps currently occur in the Basin, other than for domestic wells. The GSA is proposing a process for identifying suitable domestic wells to be included in the water quality monitoring network in the projects and management actions section of the GSP. Similar to groundwater elevations above, should expanded use of the groundwater supplies from the Saugus Formation occur that is not currently envisioned, data gaps could arise.

Groundwater Storage

Groundwater storage data gaps are described in the groundwater elevation section, as water levels are being used as a proxy for groundwater storage.

Subsidence

The Basin has not experienced significant levels of subsidence, however, projections of groundwater level declines in the Saugus Formation in the central and western portions of the Basin have the potential to result in an increase in subsidence. The use of existing subsidence monitoring programs and annual monitoring of ground surface elevations by the GSA at selected LACDPW monitoring stations will help address any data gaps that SCV Water may have in monitoring of this sustainability indicator in the future during GSP implementation.

Interconnected Surface Water and GDEs

Data gaps currently exist in the monitoring of interconnected surface water and GDEs within the identified GDE area. These data gaps are due to the lack of monitoring wells adjacent to the Santa Clara River. The installation of shallow groundwater monitoring wells has been planned by the GSA as a proxy for surface water measurements. Access to locations upstream from the I-5 Bridge for installation of monitoring wells has been obtained from the City of Santa Clarita and the GSA has been coordinating with the landowner downstream of the I-5 Bridge.

Description of Steps to Remedy Data Gaps

Data gaps have been described above and the GSA will take the following steps, prior to the first 5-year GSP update in 2027 to address these data gaps:

- The GSA will install up to six new groundwater monitoring wells adjacent to the Santa Clara River and selected tributaries in the identified GDE area. These new wells will address the data gaps described for interconnected surface water and GDEs. Furthermore, these new wells will be added to the groundwater elevation monitoring networks in the Alluvial Aquifer to assess the temporal variability of stream-aquifer interactions.
- The GSA will review the well inventory in the DMS and to the extent reasonably practicable, conduct a survey to confirm the presence and type of active wells.
- As described in the Projects and Management Actions section of the GSP, the GSA will identify suitable domestic wells to be included in the water quality monitoring program. Sampling events will be coordinated with well owners to prevent pumping and access issues.

In addition to these steps, the monitoring network will be evaluated on a yearly and 5-year basis. If additional data gaps arise, the GSA will consider the implications of these gaps, associated costs, and importance to the continued implementation of the GSP, and take appropriate actions to address the gaps.

Description of Monitoring Frequency and Density of Sites

Monitoring frequency and density of sites for all sustainability indicators are described in previous sections of this plan.

7.4 Data Management System

This section presents the development of the DMS for the GSP. Specifically, this section presents the following:

- An inventory and evaluation of available data sources
- Identification of existing monitoring programs
- Recommendation of an appropriate DMS platform for GSP purposes
- Development of the DMS structure
- Populating the DMS
- Development of DMS documentation
- Identification and prioritization of existing data gaps
- An action plan to fill data gaps

The DMS developed as part of this GSP is intended to provide the GSA with a data management tool that, at a minimum, will store and produce data for use in GSP and related annual report submittals to DWR. In addition, this DMS will also have the capability to be linked to visualization tools for stakeholder outreach and can also be transitioned up to a larger-scale or enterprise-level database. The DMS stores data sets that have been used in the development of various aspects of this GSP and will be used for annual reports, including the following:

- Basin setting description
- Well location density maps
- Groundwater pumping distribution
- Sustainability indicator data (groundwater levels, groundwater quality, subsidence, groundwater dependent ecosystems)
- Water budget data used to support GSP numerical modeling development

The DMS stores data related to GSP development and also includes automated queries and report objects that format and output data into groundwater-level hydrographs (and other time-series plots as needed), and well location maps that will be useful in the presentation and interpretation of groundwater conditions in the Basin. For reporting purposes, exportable data summary tables are readily generated from the DMS for inclusion in plans and annual reports. Additional queries, as needed beyond the basic queries already established, can be developed to produce maps, figures, and hydrographs for the GSP. The DMS allows for direct input of future data collection efforts conducted as part of the GSP monitoring program and to produce maps of monitoring locations that will allow for the identification of areas of limited data (data gaps). These maps will help in the development of an implementation schedule for SCV Water to address data gaps for the sustainability indicators that have limited historical data sets, such as groundwater dependent ecosystems, streamflow (to assist in evaluating interconnected surface water), and others.

7.4.1 Inventory and Evaluation of Available Data Sources

The inventory and evaluation of the available data sources that were accessed is presented in Table 7-9. This table includes a list of the data sources, the types of data obtained from each source, and the relative quality of the data obtained from each source. Generally, the quality of the data from each source is of moderate to high quality; however, there was one data source for which the data could be improved with a field survey (i.e., the well location accuracy is of moderate to low quality for the data from the County of Los Angeles [LA County]). Most of the data incorporated into the DMS is groundwater and surface water data measured in the Santa Clarita Valley.

Table 7-9. DMS Data Sources

Data Source	Data Type	Data Quality Rank[1]
Santa Clarita Valley Water Agency (including Los Angeles County Waterworks District No. 36)	Groundwater Wells Groundwater Levels Groundwater Quality Groundwater Production Imported Water Precipitation	High to Moderate (L/E) Moderate (M/D) High High High High
California Department of Water Resources	Well Completion Reports Water Levels (CASGEM) Precipitation Castaic Reservoir Releases	Moderate (L) Varies by Original Source High High
Los Angeles County Department of Public Works including Pitchess Detention Center and LA County Flood Control District	Wells Groundwater Levels Groundwater Production Streamflow Discharge	Moderate to Low (L/E/A) Moderate/Unknown (M) Moderate/Unknown Moderate/Unknown (M)
FivePoint Holdings, LLC (formerly Newhall Land and Farming)	Wells Water Levels Production	Moderate (L/E/A) Moderate (M) Moderate (M)
Whittaker-Bermite	Wells Groundwater Levels Groundwater Quality	High High High
Regional Water Quality Control Board	Stream Water Quality	High
National Centers for Environmental Information	Precipitation	High
SWRCB Division of Drinking Water	Groundwater Wells Groundwater Quality	Moderate (L/E/A) High

Data Source	Data Type	Data Quality Rank[1]
SWRCB Geotracker	Wells Groundwater Levels Groundwater Quality	High to Moderate (A) High to Moderate (R) High
Los Angeles County Sanitation District	Wastewater Discharge	High
U.S. Geological Survey	Streamflow Discharge	High
Geosyntec	Groundwater Wells Groundwater Levels Groundwater Quality	Unknown (L/E/A) Unknown (M/R) Unknown (M/R)
UNAVCO - University NAVSTAR Consortium	Continuous GPS (Land Surface Elevation Monitoring)	High
Los Angeles County Department of Public Works	Land Surface Elevation Survey	High to Moderate

Note

[1] Moderate and Unknown Rankings are qualified with basis for imprecision and/or inaccuracy: Measurement Method (M), Date (D), Location Coordinates (L), Elevation (E), and Attribute Completeness(A), or Record Completeness (R).

SWRCB = State Water Resources Control Board

7.4.2 Identification of Existing Monitoring Programs

The following is a list of ongoing monitoring programs that are being conducted on an ongoing basis in the Basin:

- Division of Drinking Water for municipal water supply well groundwater quality monitoring
- SCV Water rainfall, groundwater level, and groundwater quality monitoring
- Whittaker-Bermite Monitoring for soil and groundwater quality
- CASGEM for annual monitoring of groundwater levels in the Basin
- NPDES for potable water discharge quality
- SCV Water Salt and Nutrient Management Plan monitoring
- Municipal Separate Stormwater System (MS4) monitoring
- LA County (Department of Public Works for streamflow monitoring, Flood Control District for groundwater levels, and Sanitation District for wastewater discharge monitoring)
- Regional Water Quality Control Board regulated sites (landfills and other sites with ongoing groundwater monitoring)
- UNAVCO continuous GPS monitoring of land surface elevation changes (subsidence)

7.4.3 Recommended Data Management System Platform for GSP Development

To ensure user flexibility, the database was designed using Microsoft® Access 2007–2016 and the *.accdb* database format. Access has the capacity to store related tables of data, up to a total of 2 gigabytes (GB) of data and can be transitioned to larger-scale database software as necessary.

The currently archived data occupy about 85 megabytes (MB), (or less than half) of the available storage capacity. Access is capable of importing data from, and exporting data to, other commercially available software programs for data visualization or to an enterprise-level database for multi-user needs. For geospatial data, a file geodatabase (SCVGSAgdb) has been constructed in ArcGIS using thematically grouped feature data sets. The geodatabase contains spatial data and is related to the DMS Access database to support the production of tables, figures, and maps for GSA planning and reporting purposes.

7.4.4 Development of DMS Structure

The database structure was designed to maximize the utility of the data by using a structure that is similar to the structure developed by DWR, USGS, and California Department of Public Health. Each data record entered into the database identifies the data source and has a unique identification number. Each site is uniquely identified by a Local Well Name, usually with a corresponding State Well Number, SiteID, or Source Name, and other related IDs from other monitoring programs. The main data tables and LOV (List of Values) tables included in the DMS are listed below. Further detailed descriptions of these tables, a visual depiction of these tables and their related fields, and examples of the data they contain are presented in Appendix J.

As a general overview, there are six main data tables related to the central T_WELL data table in the DMS and currently seven additional supporting LOV tables. The main data tables include the following:

1. T_WELL - groundwater well and monitoring point records; linked to the SCVwells data set in SCVGSAgdb by [WELL_NAME] field
2. T_WL –groundwater level records
3. T_WQ – ground and surface water quality data
4. T_PROD – groundwater production data
5. T_SWP –State Water Project and Imported Water data by Purveyor/Division
6. T_STREAM – streamflow discharge data
7. T_PRECIP – precipitation data

Supporting LOV tables include the following:

- T_LOV_WQ_AN – Water Quality Analyte
- T_LOV_SRC – Data/Record Source
- T_LOV_WL_QLFR – Water Level Measurement Qualifier
- T_LOV_WELLTYP – Well Type
- T_LOV_WL_MTHD – Water Level Measurement Method
- T_LOV_UOM – Unit of Measure

The DMS T_WELL table currently contains 1,206 entries that are a subset of the 2,082 records in the SCVwells data set as listed in the SCVGSAgdb. The wells in T_WELL have associated temporal water level, quality, or production data records in the other data tables of the DMS. The fields in the T_WELL table are carried over from the SCVwells data set in the SCVGSAgdb. The description of the SCVwells data set and the definition of these fields can be found in Appendix K.

7.4.5 Populating the DMS

The DMS currently contains 14 data/LOV tables that store all the data for a total number of more than 176,000 records. As mentioned above, the number of data records currently stored in the DMS is only 85 MB out of the 2-GB capacity. Future importing of data and information into the DMS should first include a review and formatting of the data into a format that is compatible with the existing data table formats in the DMS.

7.4.6 Development of DMS Documentation

Documentation of the DMS is ongoing as the DMS is further developed through the GSP process. Appendix K includes screen shots of the tables and existing queries that will be updated through the GSP development process.

7.4.7 Identify and Prioritize Existing Data Gaps

The identification and prioritization of data gaps has been developed primarily during the development of the Basin Setting, Water Budgets, and Monitoring Networks sections of this GSP. Described herein, is a preliminary identification and prioritization of data gaps that will be refined during the GSP development process. The identification of data gaps is a requirement of a GSP, with a focus on the six sustainability indicators listed below. The historical and spatial distribution of data that exist for the six sustainability indicators were evaluated and the data gaps for each indicator are listed below, along with an initial prioritization of high/medium/low.

Sustainability Indicators

Minimal Data Gaps:

- Reduction in Storage in Alluvial Aquifer (metric=extraction volume)
- Chronic Lowering of Groundwater Levels in the Alluvial Aquifer (metric=groundwater elevations)

Moderate Data Gaps:

- Water quality in domestic wells
- Extraction information from non de minimus wells other than municipal wells
- Subsidence: Land surface elevation benchmarks
- Elevation control for wells and monitoring locations

Pronounced Data Gap:

- Depletion of Interconnected Surface Water (including GDEs) as a result of a lack of monitoring locations for shallow groundwater occurrence in the GDE area.

Not Applicable:

- Seawater Intrusion

7.4.8 An Action Plan to Fill Data Gaps

The action plan to address data gaps has been developed and is described in Section 9. An implementation plan that includes the implementation schedule and estimated costs for addressing data gaps is presented in Section 10. The GSA plans to install shallow monitoring wells to collect shallow groundwater level data in areas likely to support GDEs and to evaluate the presence of interconnected surface water. It is expected that during the first 5 years following GSP adoption in 2022, the GSA will address the data gaps that are present in the Santa Clarita Valley.

7.5 References

DWR. 2016. *Water Budget BMP: Best Management Practices for the Sustainable Management of Groundwater*. Prepared by the California Department of Water Resources (DWR) Sustainable Groundwater Management Program. December 2016.

GSSI. 2016. *Final Salt and Nutrient Management Plan, Santa Clara River Valley East Subbasin.* Volumes 1 and 2. Prepared for Castaic Lake Water Agency and Santa Clara River Valley East Subbasin Salt and Nutrient Management Plan Task Force by Geoscience Support Services, Inc. (GSSI). December 8, 2016.

Hopkins, J. and B. Anderson. 2016. *User Manual 52 – A Field Manual for Groundwater-level Monitoring at the Texas Water Development Board.* September 2016.

LCSE. 2003. *Groundwater Management Plan, Santa Clara River Valley Groundwater Basin, East Subbasin, Los Angeles County, California*. Prepared by Luhdorff & Scalmanini, Consulting Engineers.

LCSE. 2020. *2019 Santa Clarita Water Report.* Prepared by Luhdorff and Scalmanini, Consulting Engineers (LSCE). Prepared for Santa Clarita Valley Water Agency and Los Angeles County Waterworks District 36. July 2020.

LCSE. 2021. *Technical Memorandum: Subsidence Vulnerability, Santa Clarita Valley Water Agency, Santa Clara River Valley Basin, East Subbasin.* Prepared by Luhdorff & Scalmanini Consulting Engineers. Prepared for GSI Water Solutions, Inc.

Towill, Inc. 2020. InSar Data Accuracy for California Groundwater Basins, CGPS Data Comparative Analysis, January 2015 to September 2019. Prepared for the California Department of Water Resources. March 23.

8. Sustainable Management Criteria

This section defines the criteria by which sustainability will be evaluated, defines conditions that constitute sustainable groundwater management, and discusses the process by which the Santa Clarita Valley Groundwater Sustainability Agency (SCV-GSA) will characterize undesirable results and how it established minimum thresholds and measurable objectives for each sustainability indicator in the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin).

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

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

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

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

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

- How the definition of what might constitute significant and unreasonable conditions was developed
- How minimum thresholds were developed, including the following:
  - The information and methodology used to develop minimum thresholds (§ 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 (§ 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 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))

- How undesirable results were developed, including the following:
  - The criteria defining when and where the potential effects on beneficial uses and users of groundwater (as described by the sustainability indicators) cause undesirable results (i.e., significant and unreasonable effects), 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 the beneficial users and uses (§ 354.26 (b)(3))

8.1 Definitions

The SGMA legislation and regulations include a number of new terms relevant to the SMCs. These terms are defined below using the definitions included 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 possible, plain language, with only a limited use of highly technical terms and acronyms, was used to assist as broad an audience as possible in understanding the development process and implications of the SMCs.

- **Groundwater-dependent ecosystem (GDE)** refers to habitat, plant communities, and aquatic and terrestrial species that rely on surface or near surface water that is supported by groundwater.
- **Interconnected surface water** refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer. Interconnected surface waters are parts of streams, lakes, or wetlands where the groundwater table is close enough to the ground surface to influence water in the lakes, streams, or wetlands or vice versa.
- **Interim milestone** refers to a target value representing measurable groundwater conditions, in increments of 5 years, set by a Groundwater Sustainability Agency (Agency) as part of a Groundwater Sustainability Plan (Plan or GSP). Interim milestones are targets such as groundwater levels that will be achieved every 5 years to demonstrate progress towards sustainability.
- **Management area (MA)** refers to an area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors.
- **Measurable objectives (MO)** 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 (MT)** refer to numeric values for each sustainability indicator that are used to define undesirable results. Minimum thresholds are established at representative monitoring sites. Minimum thresholds are indicators of where an unreasonable condition might occur. For example, a particular groundwater level might be a minimum threshold if lower groundwater levels would result in a significant and unreasonable reduction in groundwater storage.
- **Representative monitoring site (RMS)** refers to a monitoring site within a broader network of sites that typifies one or more conditions within the basin or an area of the basin. This term is synonymous with representative well site.
- **Sustainability indicator** refers to the set of six conditions defined by the California Department of Water Resources (DWR) that may be present in a basin that may result in effects, when significant and unreasonable, that cause undesirable results (defined below), and impact sustainability of the basin as described in California Water Code Section 10721(x).

- **Uncertainty** refers to a lack of understanding of the basin setting that significantly affects the Agency's[46] ability to develop SMCs and appropriate projects and management actions in the Plan,[47] 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** Section 10721 of SGMA 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.

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

8.2 Sustainability Goal and Objectives

8.2.1 Sustainability Goal

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

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

The SCV-GSA's sustainability goal is to manage the groundwater resources of the Basin for current and future beneficial uses of groundwater, including the river environment, through an adaptive management approach that builds on robust science and monitoring and considers economic, social, and other objectives of a wide variety of stakeholders.

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[46] The Santa Clarita Valley Groundwater Sustainability Agency (SCV-GSA) is the Agency referred to in this definition.

[47] The Santa Clara River Valley East Groundwater Basin Groundwater Sustainability Plan (SCV GSP) is the Plan referred to in this definition.

This plan has two main objectives, reflecting the values of the local community: (1) to maintain water supply for municipal, agricultural, and domestic uses in times of climate change and variability of imported supply, and (2) to protect GDEs from permanent harm caused by groundwater pumping.

The context for the sustainability goal is the recognition that no undesirable effects have occurred in the Basin to date. Groundwater levels have declined during dry periods, and the Basin has refilled in wet periods. But the *Groundwater Management Plan, Santa Clara River Valley Groundwater Basin, East Subbasin, Los Angeles County, California* (Basin Operating Plan) described in Section 6 contemplates groundwater levels lower than historical levels during dry years, to accommodate future buildout, conjunctive use operating strategies, and climate change (LSCE, 2003). The principal question examined in the Plan is whether these lower groundwater levels will cause undesirable results.

The groundwater model predicts that basin groundwater levels will continue to recover during wet years, even as groundwater levels are drawn down further in dry years. SGMA expressly allows for this result (Water Code §10721(x)(1)). Thus, undesirable results are unlikely to occur due to chronic lowering of groundwater levels or significant and unreasonable reduction of groundwater storage.

The other sustainability indicators will be closely monitored to ensure that lower groundwater levels do not cause unreasonable results (see Section 7). The GSA will take action to close data gaps. In the case of depletions of interconnected surface water, trigger levels are set to recognize potential undesirable results in time to address them. Because the precise nature of these potential undesirable results is unknown, the plan includes a variety of possible management actions, to preserve flexibility in adaptive management (see Section 9).

8.2.1.1 Information from Basin Setting used to Establish the Sustainability Goal

The sustainability goal is informed by the analyses of basin conditions presented in the GSP, Stakeholder input, Board of Directors' input and direction, and many specialized studies as presented in the appendices[48] for the GSP.

The Basin contains two aquifers providing municipal, domestic, agricultural, and other groundwater supply for the valley. Municipal providers utilize imported State Water Project (SWP) water, and banked water as necessary to conjunctively operate the Basin. Municipal water conservation efforts are effective and meet state goals. Local concerns with groundwater quality, such as with perchlorate contamination, and more recently per- and polyfluoroalkyl substances (PFAS), have not prevented municipal providers' ability to provide clean, safe water. The Santa Clarita Valley and surrounding areas are still developing in line with plans set by the City of Santa Clarita and County of Los Angeles (LA County). Accordingly, build out of the valley is expected by 2050 in line with these plans and between 2021 and 2050 a population increase of approximately 142,600 people is expected, with water demand increases from 66,630 acre-feet per year (AFY) to 101,000 AFY.

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[48] Refer to the following: Appendix B, Hydrogeologic Conceptual Model: Geologic Framework and Principal Aquifers; Appendix C, Hydrogeologic Conceptual Model: Groundwater Conditions in the Santa Clara River Valley Groundwater Basin, East Subbasin; Appendix E, Considerations for Evaluating Effects to Groundwater Dependent Ecosystems in the Upper Santa Clara River Basin; and Appendix G, Development of a Numerical Groundwater Flow Model for the Santa Clara River Valley East Groundwater Subbasin.

Tributaries to the Santa Clara River in the steeper upland portions of the Basin in the east contain relatively thin alluvial aquifer materials. Lower tributary areas and the Santa Clara River contain thicker deposits of alluvium and provide important groundwater supply for the community. The deeper Saugus Aquifer provides an important source of groundwater to the community each year and is a particularly important groundwater source during drought. Groundwater in the Saugus Aquifer is generally unconfined in the upland areas, and to the west confining conditions are more prevalent.

Recent studies of local aquatic plant and animal species, groundwater-surface water interactions, and historical groundwater elevations have allowed the GSA to identify that groundwater dependent habitat has been resilient over time, including recovery after historic low water levels in drought. Data gaps exist with GDEs, future water levels may be lower than the historic water levels, and, as such, a GDE monitoring area and GDE evaluation process has been developed, triggered by historic low water levels (or 2 feet higher in some areas).

The Basin has not experienced chronic declines in groundwater levels and storage in the past. Groundwater is exchanged between the Alluvial Aquifer and Saugus Aquifer depending on local hydrology and groundwater conditions. Prior to urbanization, there were periods where dry weather (non-stormflow) surface water did not flow out of the Basin, but today sound groundwater management along with importation of SWP water and purchased and stored groundwater supplies (since the early 1980s) have produced perennial dry weather flows out of the Basin. Even accounting for climate change and some increased water use with development, dry weather flows out of the Basin are expected to continue into the future.

8.2.1.2 Discussion of Thresholds and Triggers

Minimum thresholds for chronic decline in water levels, chronic depletion in storage, depletion of interconnected surface water, degraded water quality, and subsidence, reflect the planned utilization of the Basin and groundwater consistent with the 2020 Santa Clarita Valley Urban Water Management Plan (UWMP) (KJ, 2021).

Minimum thresholds for chronic decline in water levels, chronic depletion in storage, and depletion of interconnected surface water that reflect chronic declines in water levels and depletions in storage are not anticipated during and after GSP implementation and the Basin will continue to be operated sustainably.

Minimum thresholds for degraded water quality reflect the current understanding of degraded water quality in some locations and the municipal agencies' ability to install wellhead treatment as needed, as well as the overarching authority of State regulatory agencies to direct investigations and cleanup of contamination. Further, the minimum thresholds for degraded water quality also include inorganic water quality criteria intended to maintain existing water quality in accordance with Salt and Nutrient Management planning efforts, so as not to jeopardize future use of recycled water.

Minimum thresholds for subsidence reflect the understanding of the Saugus Formation geology, historical land surface elevations, and simulated future low water levels. In some cases, future low water levels, which are temporary, will be 100 to 150 feet lower than in the past. Review of land surface elevation benchmark data from LA County do not clearly show that localized subsidence has occurred from past groundwater extraction and do suggest that tectonic forces play a large role in land surface elevations regionally. Minimum thresholds for subsidence reflect planned utilization of the Basin that will temporarily lower water levels more than in the past, and expanded monitoring is needed to fill data gaps.

GDEs are considered in the GSP by recognizing that even at historical low water levels, GDEs have been resilient and recovered following drought stress. Triggers for GDE evaluation are set at historical low levels, or 2 feet higher than historical low levels in one area upstream from the Interstate 5 (I-5) bridge where particularly sensitive species exist. If these triggers are met a GDE evaluation process will take place, and if it appears the GDEs may be impacted as a result of groundwater extraction, management actions will be implemented. With time, data gaps associated with GDE monitoring will be filled and criteria and management actions revised.

8.2.1.3 Discussion of Measures

The GSA has identified data gaps and a plan to fill them over time. Future work includes expanding water quality monitoring via a voluntary program to include domestic and private non-de-minimis wells where key data gaps exist. Piezometer installation and elevation surveys are planned for the GDE monitoring area. Subsidence monitoring will take place twice per year, and more frequently if water levels reach historic lows. The GSA will utilize LA County's existing benchmark locations for elevation monitoring. The GSA will also use InSAR satellite data to track ground surface elevation trends. Outreach for promoting water conservation is also planned for areas not currently covered by existing municipal water conservation programs in the Basin.

The GSA anticipates that if minimum thresholds are exceeded, the GSA will evaluate the cause. If that evaluation indicates the minimum thresholds were exceeded due to groundwater extraction and/or the trend of the data indicate undesirable results are imminent, then management actions would be called upon to mitigate the undesirable results within the 20-year implementation period. The GSA will consult with landowners before determining which management actions should be deployed, and how such management actions will be deployed to avoid undesirable results. The effect of the management actions will be reviewed annually, and additional management actions will be implemented as necessary. The absence of undesirable results, defined as significant and unreasonable effects of groundwater conditions throughout the planning horizon, will indicate that the sustainability goal has been achieved. The GSA will adaptively manage the Basin to ensure the GSP is effective and undesirable results are avoided.

If undesirable results are anticipated for chronic decline in water levels, chronic depletion in storage, depletion of interconnected surface water, or land subsidence, measures taken may include, but not be limited to the following:

- Redistribute pumping away from the affected area.
- Reduce pumping in nearby wells.
- Conduct additional releases from Castaic Lake.
- Bring in additional SWP water or other imported banked water to make up for reduced groundwater supply.
- Implement tiered water conservation measures for the Basin.
- Reduce pumping in the most affected aquifer.

If undesirable results are anticipated for degraded water quality, measures taken may include, but not be limited to:

- Review alternatives for improving groundwater quality in the affected area,
- Work with affected groundwater users to deploy well head treatment systems,
- Arrange for alternate water supply,
- Shift pumping to other locations, and/or
- Reduce or stop pumping near the affected area.

If the GDE trigger levels are reached, an evaluation program will take place that includes reviewing whether the low water levels and water level trends are caused by groundwater extraction and whether undesirable results to GDEs arising from groundwater extraction are anticipated to occur. If significant and unreasonable effects are anticipated from groundwater extraction, then any necessary management actions would be implemented in a timely manner as described below:

1. The GSA consultation with groundwater pumpers may assess the potential to do the following:
    - Shift pumping to another location to reduce impact on GDEs, and/or
    - Stop pumping in wells near the GDEs, and/or
    - Increase the quantity of imported water into the Basin.

    Should any of the above be a consideration, the groundwater flow model may also be used to determine optimum pumping locations/aquifer most likely to avoid undesirable results.

2. The GSA may coordinate with Santa Clarita Valley Water Agency (SCV Water) to consider implementing a mandatory water conservation program so that overall pumping in the Basin can be reduced.

3. If the evaluation shows that non municipal production wells are contributing to the problem, then the GSA will conduct outreach up to and including meetings with private well owners and stakeholders to discuss how to best respond to the concern.

4. If monitoring data and weather predictions indicate that undesirable results are likely to persist into the following year and the above actions are not likely to mitigate the impacts, then it may be necessary to develop additional projects designed to increase the amount of water in the river system as described in Section 9.6.3.

8.2.2 Human Right to Water

The DWR's Disadvantaged Community (DAC) Mapping tool (https://gis.water.ca.gov/app/dacs/) identifies three different types of DACs (Places, Tracts, and Block Groups) in the Upper Santa Clara River Basin.

As part of the Integrated Regional Water Management (IRWM) Disadvantaged Community Involvement Program Grant in the Greater Los Angeles IRWM Funding Area, outreach efforts have been underway to understand the needs of DACs. Outreach within the Upper Santa Clara River Basin includes the Water Talks Program. This program is a partnership between the City of Santa Clarita, College of the Canyons, California State University San Bernardino, and PLACEWORKS. The Program allows for community members to learn more about water issues in their community and provide input. Public input will continue to be gathered with this program well into 2022. At the completion of this public input stage, DAC needs within the Basin will be better understood. The next phase of this IRWM Grant includes provision of funding opportunities for selected projects in the DACs.

To date, the Water Talks outreach effort has not identified community areas within the Basin that do not have access to safe potable water. Much of the Basin is provided water service from SCV Water and LA County Waterworks District No. 36. Some areas of the Basin, generally in the tributary canyons, rely on private domestic wells for water supply. One area, Bouquet Canyon, has had a shortage of groundwater supply for several years due to administrative concerns with releasing water from the Bouquet Canyon Reservoir. In one case, a home for developmentally disabled adults needed to truck water in for its supply. The SCV Water has pursued grant funding to assist with installation of a potable water pipeline to bring water to two locations within Bouquet Canyon, including a home for developmentally disabled adults and a mobile home park.

The SCV-GSA's Project Manager for GSP Development is also the Chair of the Upper Santa Clara River IRWM group. Regular reports are provided to the SCV-GSA about IRWM activities, and the GSA anticipates this communication to continue through GSP development and implementation.

8.2.3 Qualitative Objectives for Meeting Sustainability Goals

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

- **Avoid Chronic Lowering of Groundwater Levels**
  - Maintain groundwater levels that continue to support current and future groundwater uses and a healthy river environment in the Basin
- **Avoid Chronic Reduction of Groundwater Storage**
  - Maintain sufficient groundwater volumes in storage to sustain current and planned groundwater use in prolonged drought conditions while avoiding permanent degradation of environmental values
- **Avoid Land Subsidence**
  - Reduce or prevent land subsidence that causes significant and unreasonable effects to groundwater supply, land uses, infrastructure, and property interests
- **Avoid Degraded Groundwater Quality**
  - Maintain access to drinking water supplies
  - Maintain access to agricultural water supplies
  - Maintain quality consistent with current ecosystem uses
- **Avoid Depletion of Interconnected Surface Water**
  - Avoid significant and unreasonable effects (i.e., undesirable results) on beneficial uses in the Basin, including GDEs, caused by groundwater extraction
  - Maintain sufficient groundwater levels and surface water flow in the river and pools to sustain aquatic habitat where unarmored three-spine stickleback (UTS) and other native fishes are present (e.g., at the I-5 Bridge[49]), to the extent such decreases are caused by groundwater extraction
- **Seawater Intrusion**
  - Not applicable due to the inland location of the Basin.

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[49] Specifically, the Santa Clara River Bridge, herein referred to as the I-5 Bridge.

8.3 General Process for Establishing Sustainable Management Criteria

This section presents the process that was used to develop the SMCs for the Basin, how public input from local stakeholders was considered, the criteria used to define undesirable results, and how minimum thresholds and measurable objectives were established.

8.3.1 Public Input

The public input process was built on the GSA member agencies' long history of engaging local stakeholders and interested parties on water issues. This included the formation of the Stakeholder Advisory Committee (SAC), which has representatives from large, medium, and small pumpers; local residents; businesses; and environmental groups. The SMCs and beneficial uses presented in this section were developed using a combination of information from public input, public meetings, comment forms, hydrogeologic analysis, and meetings with SCV Water staff and SAC members.

The general process for establishing SMCs included the following:

- Holding a series of SAC meetings and workshops that outlined the GSP development process and introduced stakeholders to SMCs.
- Conducting public meetings to present initial conceptual minimum thresholds and measurable objectives and receive additional public input. Three meetings on SMCs were held within the boundaries of the Basin.[50]

8.3.2 Criteria for Defining Undesirable Results

In Section 8.2.3, the qualitative objectives for meeting sustainability goals were presented as ways of avoiding undesirable results for each of the sustainability indicators. The following are the general criteria used to define undesirable results in the Basin:

- Groundwater use must be causing significant and unreasonable effects in the Basin
- A minimum threshold is exceeded in a specified number of representative wells over a prescribed period
- Impacts to beneficial uses occur, including to GDEs and/or threatened or endangered species

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

8.3.3 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

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

8.3.3.1 Avoid Chronic Lowering of Groundwater Levels

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

- Information gathered from the SMC public meetings about the public's perspective of significant and unreasonable conditions and preferred current and future groundwater levels
- Historical groundwater level data from wells monitored by SCV Water and other agencies

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[50] See https://scvgsa.org/public-input for details on the meetings and workshops.

- Depths and locations of existing wells
- Maps of current and historical groundwater level data
- Mapping of the location and types of GDEs
- Groundwater modeling of future conditions (for groundwater pumping and natural hydrologic conditions) to estimate future groundwater levels at representative monitoring sites

The monitoring network and protocols that will be used to measure groundwater levels at the representative monitoring sites are presented in Section 7, Monitoring Networks. The data will be used to monitor groundwater levels as well as assess changes in groundwater storage as discussed below.

8.3.3.2 Avoid Chronic Reduction of Groundwater Storage

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

8.3.3.3 Avoid Land Subsidence

Minimum thresholds for subsidence were established to protect groundwater supply, land uses, infrastructure, and property interests from substantial subsidence that may lead to undesirable results. Changes in ground surface elevation are measured using InSAR data available from the California Department of Water Resources (DWR) and using land surface elevations at benchmarks established in the region by Los Angeles County.

8.3.3.4 Avoid Degraded Groundwater Quality

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

- Historical groundwater quality data from production wells in the Basin
- Federal and state drinking water quality standards and water quality objectives (WQOs) presented in the *Water Quality Control Plan: Los Angeles Region Basin Plan for the Coastal Watershed of Los Angeles and Ventura Counties* (Basin Plan) (LARWQCB, 1994) and the *Final Salt and Nutrient Management Plan, Santa Clara River Valley East Subbasin* (SNMP) (GSSI, 2016)
- Feedback about significant and unreasonable conditions from SCV Water staff members and the public

The historical groundwater quality data used to establish thresholds are presented in Section 7.4.

Thresholds for contaminants (e.g., perchlorate, volatile organic compounds [VOCs]. and PFAS) are not proposed because assessment, source identification, and cleanup of these constituents of concern are regulated under the authority of state agencies, including the Regional Water Quality Control Board, LA Regional Water Quality Control Board (LARWQCB). The GSA does not have the responsibility nor the authority to manage these contaminants, which were present in groundwater prior to the enactment of SGMA in January 2015. However, it is important to avoid, to the extent practicable, increases in concentrations caused by pumping or by actions taken by the GSA. SCV Water, a member agency of the GSA and a municipal pumper, coordinates with regulatory agencies regarding monitoring for contaminants. As part of GSP implementation, the GSA will conduct outreach to private well operators and seek participants for a water quality monitoring program in addition to the existing municipal water quality monitoring. Water quality data will regularly be reviewed and analyzed consistent with the SMCs. If it is determined that increases in contaminant concentrations are being caused by pumping and leading to undesirable results, management actions would be initiated after consultation with municipal pumpers and applicable landowners. Elevated concentrations of salts and nutrients (e.g., total dissolved solids [TDS], sulfate, chloride, and nitrate) can impact beneficial uses, including drinking water and agricultural uses. Thus, minimum thresholds and measurable objectives are proposed for these constituents in accordance with the Basin Plan and SNMP.

8.3.3.5 Avoid Depletions of Interconnected Surface Water

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

- Available surface water gaging data before and after importation of California SWP water and construction of the water reclamation facilities
- Water budget computations using the groundwater model that show estimated exchanges between surface water and groundwater at a number of river segments during historical and projected future time frames
- Groundwater modeling of historical and projected future conditions to estimate groundwater levels at locations that currently do not have wells but are proposed as new representative monitoring sites (RMSs) for the monitoring program
- Studies that identify the extent and distribution of GDEs

Historically, streamflows in the Basin have benefitted from increasing urbanization since the mid-1960s, when the two water reclamation plants (WRPs) in the Basin began operating and discharging treated water into the Santa Clara River. As shown in Figure 8-1, this historical augmentation of Santa Clara River streamflows is apparent from stream gaging data collected at the former County Line stream gage (U.S. Geological Survey [USGS] gage 11108500, located 0.75 miles downstream of the Basin) through water year 1996 and since then at the Piru stream gage (USGS gage 11109000, located 3.5 miles downstream of the Basin). Figure 8-1 also shows that the monthly streamflow volumes during the summer season (July through September) were nearly zero from 1959 through 1966, then increased from the late-1960s through the mid-1990s as discharge volumes from the two WRPs in the Basin increased steadily from year to year. Streamflows during the past decade (2010 through 2019) have been lower than before 2010 despite decreases in the amount of annual groundwater pumping occurring from the Basin during this period (see Figure 8-2). The reductions in summer-season streamflows at the Piru stream gage since 2010 likely have arisen from (1) WRP discharge reductions that have arisen from increased water conservation efforts in the Basin and (2) below-normal rainfall in the Basin, which has caused natural lowering of groundwater levels and therefore reduced the amount of groundwater discharge into the perennial reach of the river in the western portion of the Basin.

Future modeled flows largely match those occurring under current land use and water use conditions. As shown in Figure 8-3, the future land and water uses in the Basin are not expected (based on groundwater modeling analyses) to cause a return to the low-flow or zero-flow summer-season conditions that were observed in the river prior to urbanization. Figure 8-4 shows groundwater-model estimates of annual non-storm streamflows that would occur at the western basin boundary if current land and water uses were to persist into the future (purple line) and how those streamflows compare under the future projected full build-out condition for the Basin's land and water uses (green line). The current-condition and future-condition model simulations each project land and water use conditions onto a repeat of the historical rainfall conditions (natural hydrology) that occurred from water years 1940 through 2019 (without climate change).

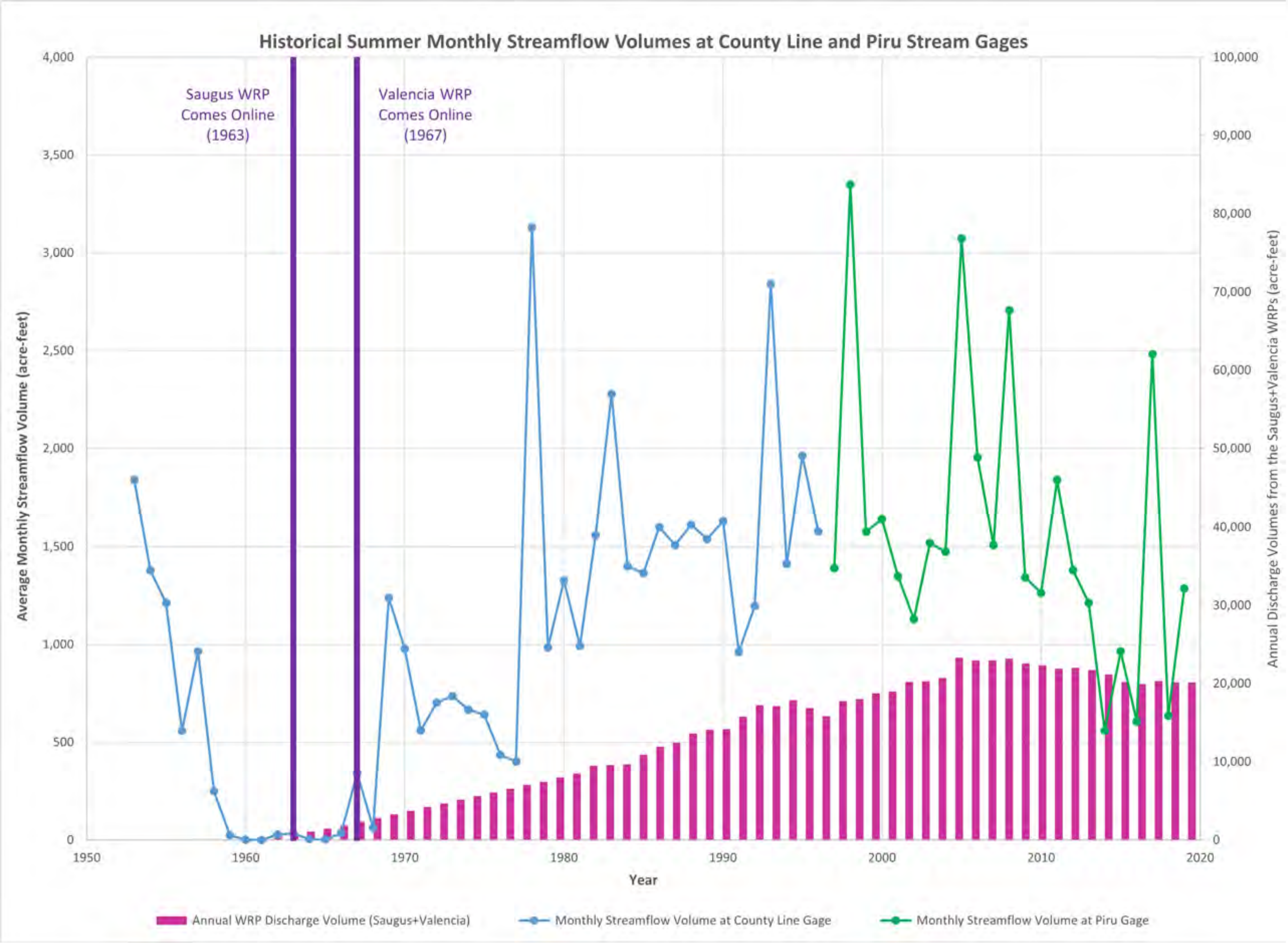

Figure 8-1. Historical Summer Monthly Streamflow Volumes at County Line and Piru Stream Gages with WRP Discharge Volumes

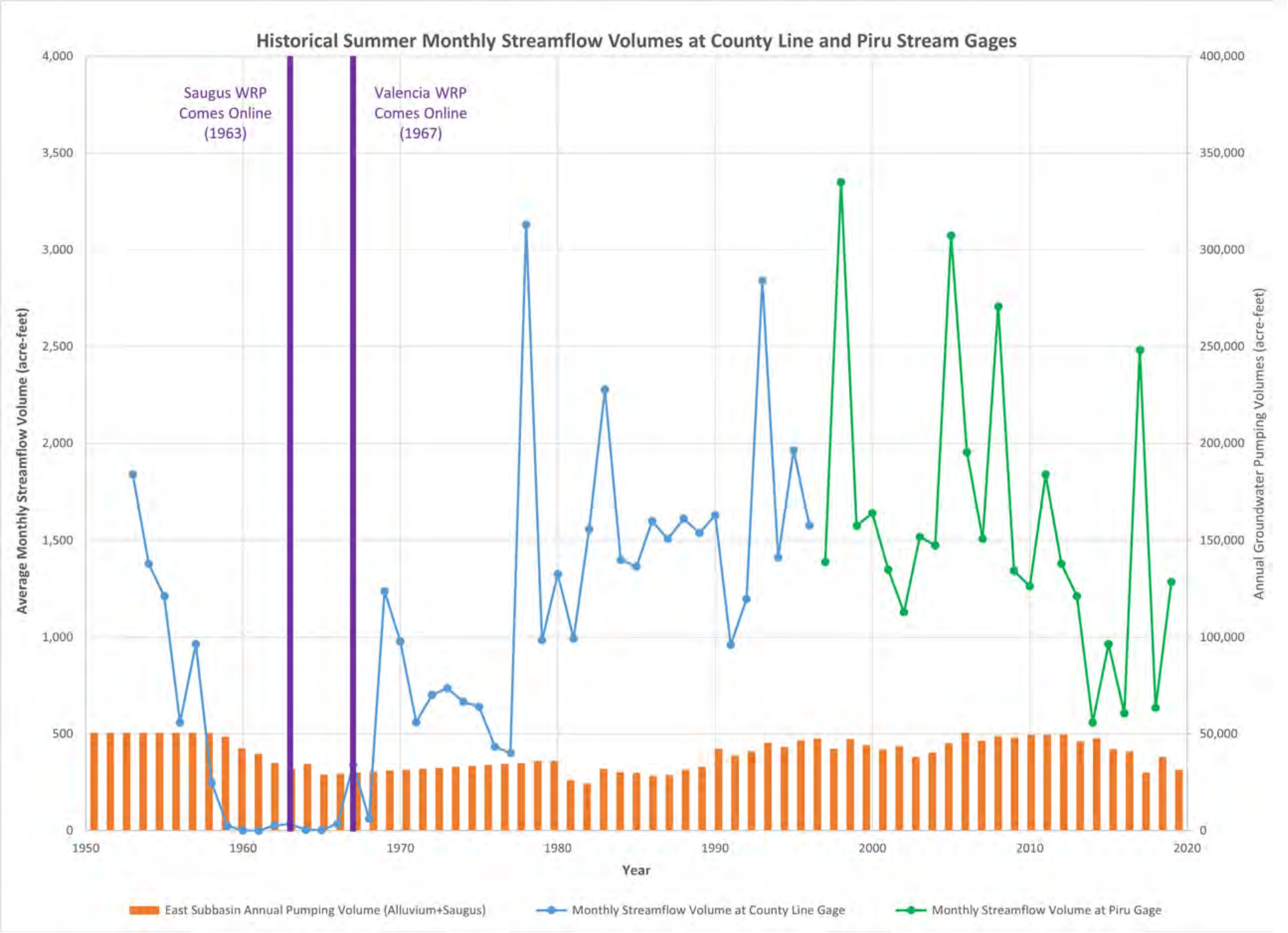

Figure 8-2. Historical Summer Monthly Streamflow Volumes at County Line and Piru Stream Gages with Saugus and Alluvium Pumping

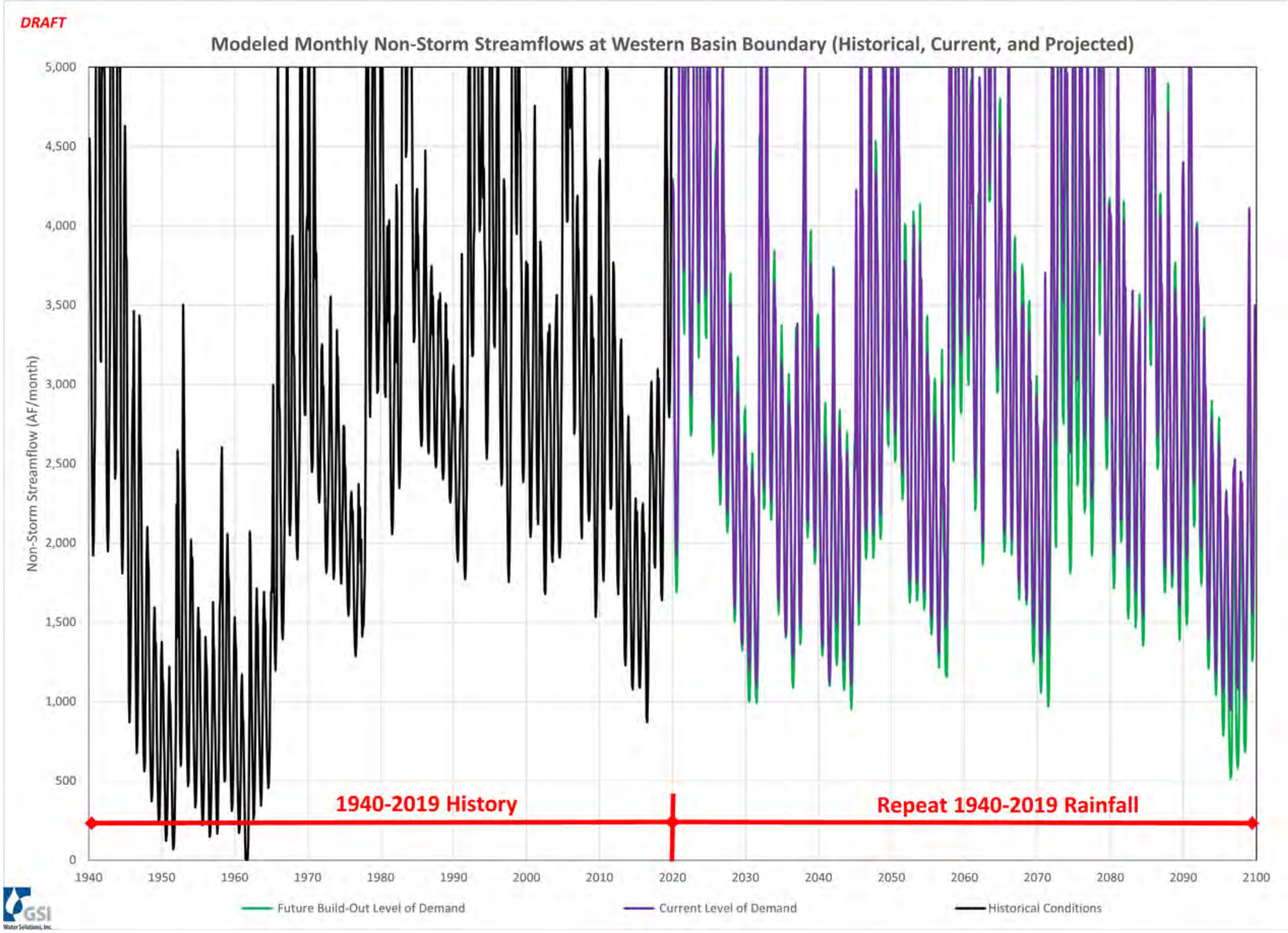

Figure 8-3. Modeled Monthly Non-Storm Streamflows at Western Basin Boundary for Historical, Current, and Projected Levels of Groundwater Use

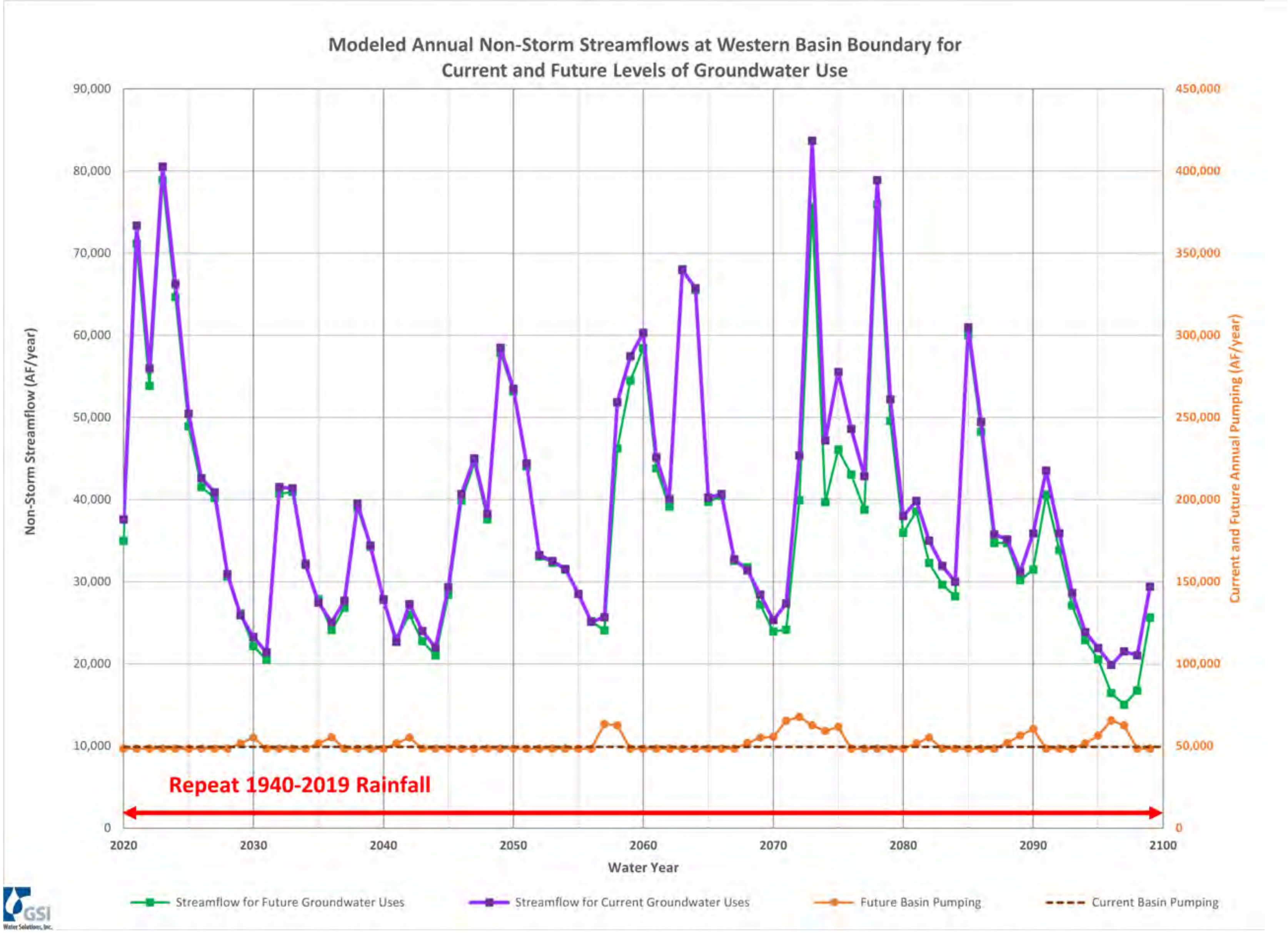

Figure 8-4. Modeled Annual Non-Storm Streamflows at Western Basin Boundary for Current and Projected Levels of Groundwater Use

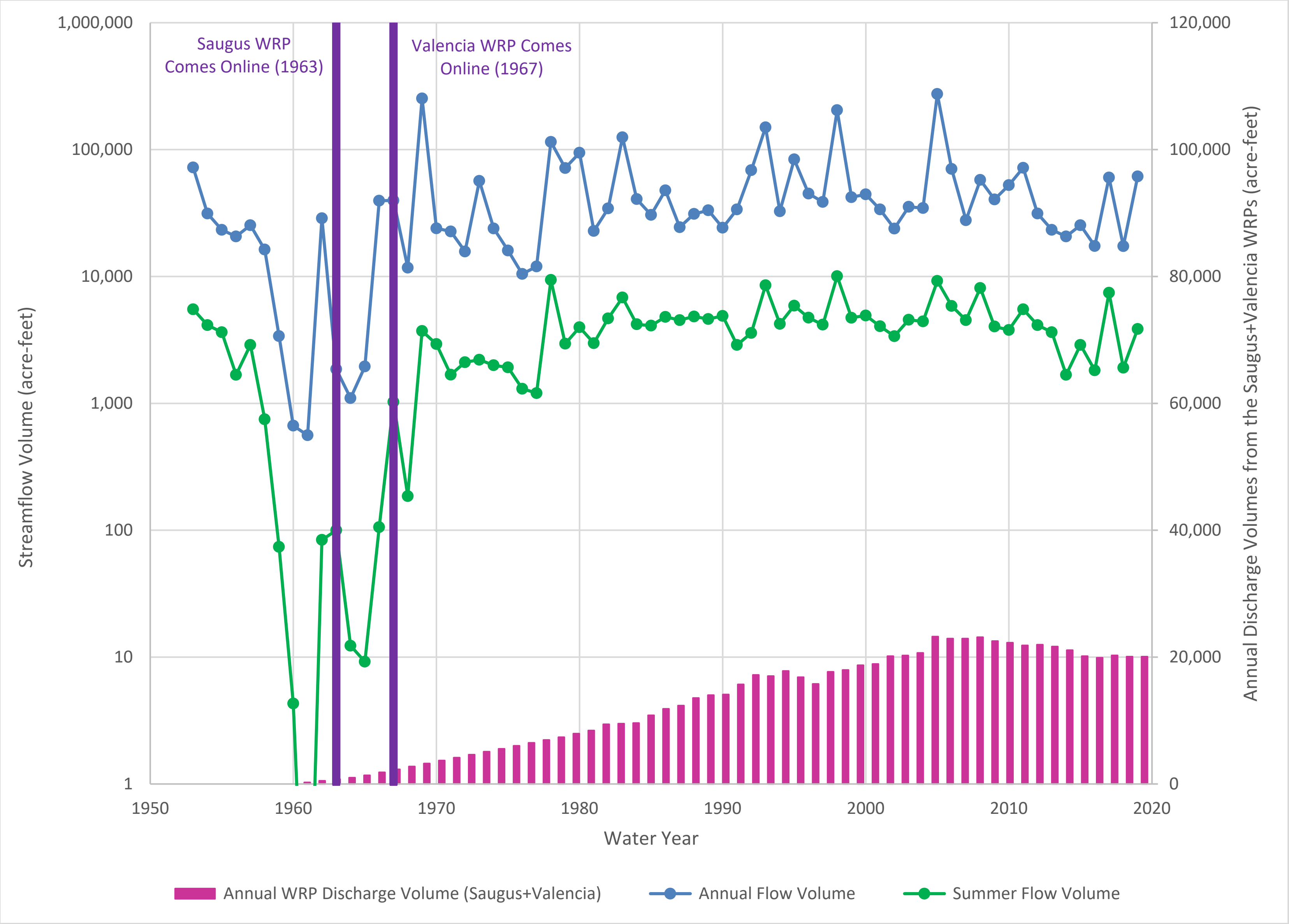

Figure 8-5. Historical Summer and Annual Flow Volumes measured in the Santa Clara River at County Line and Piru Stream Gauges

Together, Figures 8-3 and 8-4 illustrate that changes in non-storm flows leaving the Basin occur only at certain times, rather than at all times, which means that future pumping is expected to create only periodic, rather than chronic, depletion of streamflow. Furthermore, Figures 8-3 and 8-4 illustrate the effects of groundwater pumping on dry weather alone; not shown on these figures is the fact that historically measured stormwater flows during years of normal and above-normal rainfall are significantly higher than the historically measured dry-weather flows. Figure 8-5 demonstrates that, on an annual basis, total flows in the river (i.e., the sum of dry-weather flows and storm flows) historically have been one to two orders of magnitude greater than the dry-weather flows. Because only periodic depletions of dry-weather flows are expected to occur in the future (per Figures 8-3 and 8-4), the total flows in the river are expected to continue to be one to two orders of magnitude greater than the dry-weather flows. In summary, on an annual basis, any future changes in the total flow volume leaving the Basin are expected to be de minimis in magnitude, with the summer non-storm flows continuing to remain higher than historically occurred during the decades that preceded the onset of urbanization in the Basin (as shown in Figure 8-3).

8.3.4 Relationship between Individual Minimum Thresholds and Other Sustainability Indicators

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

8.4 Representative Monitoring Sites

To this point, the sustainability goals and the qualitative objectives for meeting these goals and the general process for establishing SMCs have been discussed and described. The following sections present descriptions of undesirable results and the development of minimum thresholds and measurable objectives for each of the sustainability indicators. These thresholds are established at monitoring sites (wells) that are deemed to be representative of local and basin-wide groundwater conditions. Representative wells were selected from a subset of the wells that have been monitored over time in the Basin and have the following characteristics:

- They have known well completion information and are screened exclusively within either the Alluvial Aquifer or the Saugus Formation.
- They have wide spatial distribution, so as to provide information across the majority of the Basin.
- They have a reasonably long record of data so that trends can be determined.
- They have signatures (groundwater levels or water quality trends) that are representative of wells in the surrounding area or management area if applicable.

The rationale for selecting RMS is discussed in Section 7 and is summarized here. The RMS network is shown in Figure 7-1 and consists of 17 wells (13 in the Alluvial Aquifer and 4 in the Saugus Formation) that will monitor for chronic reductions in groundwater levels and storage. Each of these 17 wells is already present in the Basin. A network of 8 additional shallow monitoring wells in the Alluvial Aquifer will be used to monitor for potential impacts to GDEs., Two of these wells are already present in the Basin and six additional GDE monitoring wells will be installed. The RMS network is considered an interim network because it relies on six yet-to-be constructed GDE monitoring wells and also relies at this time on a number of production wells, which are the wells with the longest history of water level data in the Basin. Over the course of the 20-year SGMA implementation horizon, SCV-GSA expects to transition from a monitoring network dominated by production wells to a monitoring network that has more non-pumping observation wells.

Representative monitoring sites—consisting of existing wells and planned future well sites where wells do not presently exist—were used in the modeling of groundwater level changes under historical and predicted future groundwater demand with and without climate change influences. Minimum thresholds and measurable objectives have been established using a combination of measured groundwater level data and the results of groundwater modeling. The results of this modeling indicate no significant and unreasonable impacts to beneficial uses of groundwater (by agriculture, recreation, businesses, and municipal and domestic users) are occurring presently or are anticipated in the future, under assumed climate conditions and complying with the Basin Operating Plan for the Basin as presented in the 2020 Santa Clarita Valley UWMP (see Section 6.5).

8.5 Summary of Sustainable Management Criteria

Table 8-1 summarizes the SMCs for the six groundwater sustainability indicators. Table 8-1 first describes the type(s) of potential undesirable results associated with each sustainability indicator, then describes the minimum thresholds and measurable objectives for each indicator. Detailed discussions of the SMCs for each groundwater sustainability indicator are provided in Sections 8.6 through 8.11.

Table 8-1. Summary of Sustainable Management Criteria

Potential Undesirable Results	Minimum Threshold	Measurable Objective	Other Notes
Chronic Lowering of Groundwater Levels			
Groundwater levels fall below minimum thresholds in 25 percent of representative wells in the Alluvial Aquifer or 50 percent of representative wells in the Saugus Formation throughout a 3-year period.	Lowest groundwater elevation from the 95-year future-conditions model or Lowest historically observed groundwater elevation in modern era (i.e., since 1980), whichever is lower (as shown in Table 8-2).	Average of the future modeled or historically observed groundwater elevations (using the same data set as for the minimum threshold as shown in Table 8-2).	An undesirable result occurs if the same group of representative monitoring sites experiences this condition throughout the 3-year period. Use static groundwater level measurements collected twice per year (in the spring and late summer).
Chronic Reduction of Groundwater in Storage			
Same as for chronic lowering of groundwater levels. An additional undesirable result is an inability to meet groundwater demands during a multi-year drought.	Same as for chronic lowering of groundwater levels.	Same as for chronic lowering of groundwater levels.	Same as for chronic lowering of groundwater levels.
Seawater Intrusion			
Not applicable (this is an inland basin)			
Degraded Groundwater Quality			
Degradation of groundwater quality beyond WQOs and assimilative capacities established in the SNMP in 20 percent of representative wells.	WQOs for TDS, chloride, nitrate, and sulfate or ambient water quality if it exceeds the WQO.	Prevent water quality degradation for salts and nutrients and for contaminants.	Minimum thresholds are not established for contaminants because state regulatory agencies have the responsibility and authority to regulate and direct actions that address contamination.
Land Subsidence			
Substantial interference with land uses, impacts on the use of critical infrastructure and roads, or subsidence greater than minimum thresholds at 10 percent of monitoring locations.	The subsidence measured between June of one year and June of the subsequent year shall be no more than an average of 0.1 foot in any single year and a cumulative 0.5 foot in any 5-year period observed at 10 percent or more monitoring locations.	Maintenance of current ground surface elevations trends.	Based on InSAR-measured subsidence during June of each year and LA County benchmark elevation monitoring twice per year.
Depletion of Interconnected Surface Water			
Permanent loss or significant degradation of existing native riparian or aquatic habitat due to lowered groundwater levels caused by groundwater pumping throughout the GDE area. In areas that currently provide essential habitat to UTS and native fishes (sensitive aquatic species in the vicinity of I-5 Bridge), cessation of surface flow and pools during low-flow conditions in the river channel caused by groundwater extraction is an undesirable result.	Surface water depletion caused by groundwater extraction as measured by groundwater levels falling below the lowest predicted future groundwater elevation measured at GDE-area monitoring wells.	Average of future modeled groundwater elevations (using the same data set as for the minimum threshold).	GDE trigger levels (see Table 8-6) that are at or above historical low elevations (as estimated from the model) will be used to initiate an assessment of GDE conditions caused by groundwater extraction and management actions that might be needed to protect GDEs.

Notes

GDE = groundwater-dependent ecosystem
I-5 = Interstate 5
SNMP = Salt and Nutrient Management Plan
TDS = total dissolved solids
UTS = unarmored three-spine stickleback
WQO = water quality objective

8.6 Chronic Lowering of Groundwater Levels Sustainable Management Criterion

8.6.1 Undesirable Results

As noted above, the groundwater model of the Basin indicates that undesirable results from chronic lowering of groundwater levels and reduction of groundwater in storage are not expected to occur in the future. Undesirable results could occur if groundwater pumping exceeds recharge for a prolonged period either basin-wide or in a particular area of the Basin where lowering of water levels would cause an impact. Under certain circumstances, and in conjunction with other conditions or activities in the Basin, the following conditions may contribute to the occurrence of undesirable results:

- **Extended drought:** Drought periods that are longer in duration or more intense than anticipated in the plan.
- **A new normal for climate change:** Reductions in long-term recharge to the Basin beyond what is anticipated in the plan (i.e., less recharge during non-drought periods)
- **Emergency interruption of imported supplies:** Not being able to access imported or banked water supplies and thereby needing to pump for multiple years at annual volumes beyond those described in the Basin Operating Plan

Undesirable results are significant and unreasonable lowering of groundwater levels in the Basin that are characterized as follows:

- In the Alluvial Aquifer, groundwater levels (non-pumping water level elevations) drop below minimum thresholds (see Table 8-1) in the same 25 percent of representative wells throughout a 3-year period. Using this characterization minimizes the chance of misleading indications of an unsustainable condition in the Alluvial Aquifer while providing an indication of a potential undesirable result before it occurs. Three consecutive years was chosen because this time frame indicates that the condition is likely to be chronic and not a result of a single-year temporary effect. Three years indicates that there is a trend that is significant and unreasonable.
- In the Saugus Formation, groundwater levels (non-pumping water level elevations) drop below minimum thresholds (see Table 8-1) in the same 50 percent of representative wells throughout a 3-year period. The use of 50 percent of the representative wells in the Saugus Formation for this assessment (1) accounts for the confined nature of the Saugus Formation, which recognizes that changes in pumping can propagate over a larger area than occurs in the Alluvial Aquifer, and (2) minimizes the chance that localized changes in pumping operations could result in misleading indications of an unsustainable condition at an individual well while a larger group of representative Saugus Formation wells together shows no such unsustainable condition on an aquifer-wide basis. Three consecutive years was chosen because this time frame indicates that the condition is likely to be chronic and not a result of a single-year temporary effect. Three years indicates that there is a trend that is significant and unreasonable.
- In areas that currently provide essential habitat to UTS and native fishes (sensitive aquatic species), cessation of surface flow and pools during low-flow conditions in the river channel caused by groundwater extraction would also be considered a significant and unreasonable effect (see Section 8.11).

The water level monitoring that has been conducted to date and the groundwater modeling analyses that have been performed for the GSP together indicate that no chronic declines in groundwater levels or reductions of groundwater in storage have occurred in the past when following the current Basin Operating Plan (LSCE, 2003), which is described in Section 6. The model also indicates that undesirable results are not expected to occur in the future. Accordingly, the minimum thresholds are set based on predicted future water levels from the groundwater flow model simulation for the year 2042 water budget projection, which accounts for future full build-out of land uses and water uses, and which repeats the 95-year historical hydrologic (rainfall) record but with adjustments to rainfall and evapotranspiration to account for a year 2030 level of climate change. These minimum thresholds are described in the next section and are established for representative monitoring sites in different parts of the Basin, reflecting conditions in those areas. The minimum thresholds and measurable objectives are considered conservative and protective of the resource because undesirable results are not predicted to occur in the Basin under the Basin Operating Plan (LSCE, 2003). The actions that will be taken if minimum thresholds are reached are described in Section 9.5.4.1 for this sustainability indicator.

8.6.2 Minimum Thresholds

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.” Table 8-2 includes the water level elevations for the minimum thresholds established for the Alluvial Aquifer and Saugus Formation. Appendix L of the GSP presents a well location map and hydrographs showing the minimum thresholds for each representative well that will be used to monitor for chronic lowering of groundwater levels.

Table 8-2. Chronic Lowering of Groundwater Level Minimum Thresholds and Measurable Objectives for the Alluvial Aquifer and the Saugus Formation

RMS Site ID[1] (Alt. ID)	Well Type	Minimum Threshold (MT) (feet NAVD 88)	Measurable Objective (MO) (feet NAVD 88)	Basis for MT and MO
Alluvial Aquifer				
NLF-B20	Existing Production Well	884	890	Future Model
Future VWD-C12[2]	Future Production Well	912	918	Future Model
VWD-E17	Existing Production Well	941	959	Future Model
VWD-D	Existing Production Well	978	1,005	Future Model
VWD-N	Existing Production Well	1,062	1,076	Future Model
VWD-Q2	Existing Production Well	1,105	1,126	Historical Data
VWD-U4	Existing Production Well	1,154	1,189	Historical Data
SCWD-North Oaks Central	Existing Production Well	1,286	1,335	Historical Data
SCWD-Sand Canyon	Existing Production Well	1,418	1,449	Historical Data
NWD-Pinetree 5	Existing Production Well	1,476	1,499	Historical Data
NWD-Castaic 4	Existing Observation Well	1,058	1,088	Future Model
VWD-W11	Existing Production Well	1,103	1,161	Future Model
SCWD-Guida	Existing Production Well	1,263	1,295	Historical Data
Saugus Formation				
VWD-160	Existing Production Well	833	934	Future Model
VWD-206	Existing Production Well	746	942	Future Model
Library-C	Existing Observation Well	902	968	Future Model
NC13-HSU5a	Existing Observation Well	885	1,002	Future Model

Notes

[1] Refer to Figure 7-1 in Section 7 and Appendix L for representative well locations.

[2] VWD-C12 is the tentative name for this well, which reflects that it will replace NLF-C12. A final name for this well will be selected during final planning for its installation.

NAVD 88 = North American Vertical Datum of 1988

RMS = representative monitoring site

8.6.2.1 Minimum Thresholds for the Alluvial Aquifer

As identified in Tables 8-1 and 8-2 for each representative monitoring site, the minimum threshold for the Alluvial Aquifer is based on either the lowest predicted future groundwater elevation or the lowest historically measured groundwater elevation, whichever is lower. Setting the minimum threshold at the lower of these two data sets provides a conservative basis for identifying a minimum threshold that describes the potential for a significant and unreasonable effect (i.e., an undesirable result) to occur; specifically, the minimum threshold values are conservative because the historical groundwater monitoring data, along with modeling of historical and future conditions, together indicate that chronic water level declines have not occurred historically and are not expected to occur in the future.

Future groundwater elevations are estimated from groundwater flow model simulations under future projected full build-out of land use and water use conditions in the Basin. The future groundwater levels that serve as minimum thresholds at certain wells were selected using the groundwater flow model simulation for the year 2042 water budget projection, which simulates the predicted future land use and water demands under 95 years of historical climate conditions that are adjusted for a 2030 level of climate change. Wells in the western and central portions of the Basin use the future modeled lowest groundwater elevation, while wells in the eastern portion of the Basin use the historically observed lowest groundwater elevation.

8.6.2.2 Initial Minimum Thresholds for the Saugus Formation

The minimum thresholds for the Saugus Formation are equal to the lowest future predicted groundwater level estimated to occur at each representative monitoring site in the Saugus Formation (see Table 8-2). These levels were selected using groundwater flow model simulations of the predicted future land use, water demand, and climatic conditions (with climate change) as simulated in the year 2042 water budget projection. Because historical groundwater monitoring data and water budget analyses show that chronic water level declines have not occurred historically and are not expected to occur in the future under assumed climate and groundwater pumping and groundwater use conditions, the opportunity may exist to sustain higher rates of pumping in the Saugus Formation to meet supply needs during prolonged droughts without causing undesirable results. Further evaluation will be conducted on this. Therefore, the current minimum thresholds established for the Saugus Formation RMSs are considered interim and subject to change.

8.6.2.3 Relationship between Individual Minimum Thresholds and Relationships to Other Sustainability Indicators

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

- **Avoid Chronic Reduction of Groundwater Storage.** Changes in groundwater levels reflect changes in the amount of groundwater in storage. The minimum thresholds for avoiding chronic reductions in groundwater levels by definition will maintain an adequate amount of groundwater in storage over extended periods of time when pumping does not exceed the basin yield on a long-term basis. Therefore, the minimum thresholds for avoiding chronic declines in groundwater levels will not result in long-term significant or unreasonable changes in groundwater storage. This relationship between chronic reductions in storage and groundwater levels also means that the groundwater levels which serve as minimum thresholds and measurable objectives for chronic reductions in groundwater levels can serve as proxies for chronic reductions of groundwater storage.

- **Avoid Land Subsidence.** A significant and unreasonable condition for subsidence is permanent pumping-induced subsidence that substantially interferes with surface land use. Subsidence can be caused by more than one factor, including tectonics and/or groundwater extraction. Subsidence can be caused by dewatering and compaction of clay-rich sediments in response to lowering groundwater levels caused by pumping. Very small amounts of ground surface elevation fluctuations have been reported across the Basin and are within the measurement margin of error, as described in Appendix C. The groundwater level minimum thresholds shown in Table 8-2 are set below existing and historical groundwater levels, which could induce additional subsidence. However, the local soils and geological conditions are less susceptible to compaction and subsidence because there are no known thick clay layers that extend across the full area where the Saugus Formation is present (although some clay layers are distinctly present in localized areas). Groundwater levels would likely have to be substantially lower than are predicted to occur in the future to produce significant subsidence. Should significant and unreasonable subsidence be observed from lowering groundwater levels, the groundwater level minimum thresholds will be raised to avoid this subsidence.
- **Avoid Degraded Groundwater Quality.** Protecting groundwater quality is critically important to all who depend upon the groundwater resource, particularly for drinking water and agricultural uses. Maintaining groundwater levels above minimum thresholds helps minimize the potential for experiencing degraded groundwater quality and helps avoid making water quality worse (since enactment of SGMA in 2015), or exceeding WQOs for constituents of concern in drinking water and agricultural wells. Groundwater quality could be affected through two processes:
    1. Low groundwater levels in an area could cause deeper, poor-quality groundwater to flow into existing supply wells. Groundwater level minimum thresholds are set below current groundwater levels, meaning a flow of deep, poor-quality groundwater could hypothetically occur in the future at or below minimum threshold levels. However, this is unlikely to occur because the Saugus Formation is a deep aquifer system with a substantial thickness (greater than 2,000 feet) of high-quality groundwater. Should groundwater quality data indicate that degradation is occurring due to lower groundwater levels related to pumping, the groundwater level minimum thresholds will be reviewed, and consideration will be given to changing pumping patterns if this result is found to be caused by pumping.
    2. Changes in groundwater levels arising from management actions implemented by the GSA to achieve sustainability could change groundwater gradients, which could cause poor-quality groundwater to flow towards supply wells that would not have otherwise been impacted. Examples of these actions may include installation of groundwater recharge facilities (e.g., gravity stormwater recharge or aquifer recharge with recharge wells). Because these kinds of projects are subject to review under the California Environmental Quality Act, concerns about the potential to move contaminant plumes would be evaluated before such a project could be implemented. Groundwater quality in the Basin has been impacted by perchlorate (and other constituents of concern) released from the Whittaker-Bermite Corporation (Whittaker-Bermite) facility over many decades. SCV Water and its predecessor agencies have responded to this contamination by proactively installing wellhead treatment and by operating downgradient wells in a manner to capture and treat contamination. These activities, and the normal seasonal and annual operational changes in pumping schedules that SCV Water conducts to meet groundwater demands, will continue in the future and may change groundwater gradients and flow directions in the aquifers. These operational activities are not considered “actions” that result in degradation of groundwater quality under SGMA. The GSA will continue to collaborate with state agencies and SCV Water to help address contamination and avoid further impacts to beneficial uses.

- **Avoid Depletion of Interconnected Surface Water.** As discussed in Section 8.11, a significant and unreasonable condition for depletion of surface water is groundwater pumping-induced reduction in river flow and depth to groundwater that impacts GDEs in the Basin. Section 8.11 also examines how groundwater levels below historical levels may have an impact on GDEs, including on sensitive aquatic species, such as UTS and other native fishes. Because the minimum thresholds for groundwater levels are lower than historically observed, trigger levels have been established that result in further evaluations that may lead to management actions. These trigger levels are intended to be protective of GDEs if the depth to groundwater falls below historical levels.
- **Avoid Seawater Intrusion.** This sustainability indicator is not applicable to the Basin.

The minimum thresholds set for chronic groundwater level decline are protective of all beneficial uses and do not result in significant and unreasonable effects (i.e., undesirable results) for the other sustainability indicators.

8.6.2.4 Effects of Minimum Thresholds on Neighboring Basins

The GSA for the neighboring Fillmore and Piru Subbasins is required to develop a GSP by 2022. These two subbasins are hydrologically downgradient of the Basin (groundwater flows from the Basin into the Piru Subbasin though a relatively thin layer of alluvium less than 10 feet thick).

The minimum thresholds in this GSP are consistent with the groundwater conditions identified in prior modeling studies of the Basin Operating Plan (CH2M HILL and LSCE, 2005; LSCE and GSI, 2009). The Basin Operating Plan was developed and refined through those studies and was developed with input from the United Water Conservation District (UWCD), a significant water provider in Ventura County, under an ongoing memorandum of understanding between SCV Water and UWCD that was executed in 2003. The Basin Operating Plan envisions groundwater extractions that are less than those that occurred prior to the conversion of agricultural lands to municipal uses and the importation of water (LCSE, 2003). Historical stream gaging data demonstrate how urbanization has increased the amount of streamflow in the Santa Clara River in the western portion of the Basin (particularly below the outfall for the Valencia WRP), which in turn has increased the amount of streamflow to the downstream adjacent basin (the Piru Subbasin). A significant and unreasonable effect (i.e., an undesirable result) is not expected to occur under the future pumping program for the Basin because the amount of dry-weather (non-storm) streamflow exiting the Basin will be more than was observed in the years preceding the onset of urbanization. Changes in dry-weather flows will be de minimis compared with total long-term flows leaving the Basin because stormwater flows are much higher than dry-weather flows and are expected to be unchanged by future groundwater pumping, [51] Lastly, it is anticipated that any physical solution involving the importation of water and/or the control of pumping to manage flows between the upper and lower basins would be reached between UWCD and SCV Water because of the common reliance of these agencies on the SWP and their responsibilities. The SCV-GSA has a cooperative working relationship with the downstream GSA, and the two GSA’s will share technical data, develop cooperative monitoring programs, and identify sensitive issues.

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[51] The estimated total flow into the Piru Subbasin fluctuates over a fairly limited range of volumes on a long-term basis (ranging between approximately 7,000 and 8,000 acre-feet per year [AFY]). This 1,000 AFY range is small compared with annual variations in pumping and the amount of annual climate-driven variation that occurs in several of the water budget terms in the Basin.

8.6.2.5 Effects of Minimum Thresholds on Beneficial Uses and Land Uses

The groundwater level minimum thresholds have been selected to protect beneficial uses in the Basin while providing a reliable and sustainable groundwater supply. Groundwater modeling results indicate that future pumping in the Basin during extended droughts could reduce groundwater elevations below historically measured levels without causing a chronic lowering of groundwater levels or a chronic reduction of groundwater in storage. There is a potential for lower groundwater levels to impact GDEs at some locations along the Santa Clara River corridor and tributaries. Appendix E presents a GDE monitoring and management program that includes triggers, evaluation, and management actions intended to prevent cessation of flow and loss of pools in areas where native fishes reside and permanent loss of GDEs. That report describes impacts to GDEs that include temporary acute loss of habitat in areas where sensitive species reside (e.g., the I-5 Bridge). Since that report was prepared, the GSA adopted more clear terminology in the GSP that refers to cessation of flow and loss of pools in areas where native fishes reside (e.g., near the I-5 Bridge).

8.6.2.6 Relevant Federal, State, or Local Standards

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

8.6.2.7 Methods for Quantitative Measurement of Minimum Thresholds

Groundwater level minimum thresholds will be directly measured from existing or new monitoring wells. The groundwater level monitoring program will be conducted in accordance with the monitoring plan outlined in Section 7 and will consist of collecting groundwater level measurements that reflect non-pumping conditions. The groundwater level monitoring program will be designed and conducted to meet the requirements of the technical and reporting standards included in the SGMA regulations. As discussed in Section 8.6.1, an exceedance of minimum thresholds will be deemed to have occurred if groundwater levels fall below minimum thresholds in 25 percent of representative wells in the Alluvial Aquifer or 50 percent of representative wells in the Saugus Formation throughout a 3-year period (see Table 8-1).

8.6.3 Measurable Objectives

The measurable objectives for chronic lowering of groundwater levels provide access to groundwater consistent with the Basin Operating Plan for historical dry hydrologic periods, such as the dry period from 2006 through 2016. Measurable objectives for chronic lowering of groundwater levels provide operational flexibility above minimum threshold levels to ensure that the Basin can be managed sustainably over a reasonable range of climate and hydrologic variability. Measurable objectives may change after GSP adoption, as new information and hydrologic data become available.

8.6.3.1 Methodology for Setting Measurable Objectives

Measurable objectives were established to meet the sustainability goal and were based on historical groundwater level data, future predicted water levels using the groundwater flow model, and input from the SAC. Table 8-2 includes the estimated elevations for the measurable objectives established for the Alluvial Aquifer and Saugus Formation. Appendix L presents hydrographs showing the measurable objectives.

8.6.3.2 Measurable Objectives for the Alluvial Aquifer

As identified in Tables 8-1 and 8-2, at each representative monitoring site the measurable objective for the Alluvial Aquifer is based on either the 95-year average predicted future groundwater elevation or the average of the historical groundwater elevations measured since 1980, whichever is lower. Future groundwater elevations are estimated from groundwater flow model simulations under future projected full build-out of land use and water use conditions in the Basin. The future groundwater levels that serve as measurable objectives at certain wells were selected using the groundwater flow model simulation for the year 2042 water budget projection, which simulates the predicted future land use and water demands under 95 years of historical climate conditions that are adjusted for a 2030 level of climate change. Wells in the western and central portions of the Basin use the future modeled average groundwater elevation, while wells in the eastern portion of the Basin use the average of the historical groundwater elevation measurements since 1980.

Groundwater modeling indicates that, under future land use, groundwater pumping, and climatic conditions (including climate change), it is possible that short-term reductions in groundwater levels below historical levels may occur. These reductions would be temporary, not chronic. During these short-term periods, there is a potential for lower groundwater levels to have an effect on GDEs at some locations along the Santa Clara River corridor and tributaries. Appendix E presents a GDE monitoring and management program, which includes triggers intended to prevent cessation of flow and loss of pools in areas where native fishes reside and permanent loss of GDEs (also see Sections 7.3.7 and 9.5.5).

8.6.3.3 Initial Measurable Objectives for the Saugus Formation

The measurable objectives for the Saugus Formation are equal to the long-term average future predicted groundwater levels that are estimated to occur at each representative monitoring site completed in the Saugus Formation (see Table 8-2). These levels were selected using groundwater flow model simulations of the predicted future land use, water demand, and climatic conditions (with climate change) as simulated in the year 2042 water budget projection. As shown in time-series plots in Appendix L, groundwater elevations under future conditions are expected to be lower than historical groundwater elevations at each of the representative monitoring sites completed in the Saugus Formation.

8.6.4 Interim Milestones

Interim milestones show how the GSA would move from current conditions to meeting the measurable objectives if undesirable results have been identified. For the Basin, there are no identified undesirable results at this time, and implementation of the GSP is expected to maintain a sustainable condition in the Basin throughout the planning and implementation horizon; therefore, no interim milestones are proposed. If new data identify undesirable results in the future, interim milestones may be proposed as part of a GSP update that is planned for every 5 years.

8.7 Reduction of Groundwater in Storage Sustainable Management Criterion

8.7.1 Undesirable Results

As noted above, the groundwater model of the Basin indicates that undesirable results from chronic lowering of groundwater levels and reduction of groundwater in storage are not expected to occur in the future. Conceptually, undesirable results could occur if groundwater pumping exceeds recharge for a prolonged period either across the Basin or in a particular area of the Basin where lowering of water levels would cause an impact. Under certain circumstances, and in conjunction with other conditions or activities in the Basin, the following conditions may contribute to the occurrence of undesirable results:

- **Extended drought:** Drought periods that are longer in duration or more intense than anticipated in the Basin Operating Plan.
- **A new normal for climate change:** Reductions in long-term recharge to the Basin beyond what is anticipated in the plan (i.e., less recharge during non-drought periods)
- **Emergency interruption of imported supplies:** Not being able to access imported or banked water supplies and thereby needing to pump for multiple years at annual volumes beyond those described in the Basin Operating Plan

Undesirable results are significant and unreasonable reductions in the quantity of groundwater in storage that are characterized as follows:

- In the Alluvial Aquifer, non-pumping groundwater levels (as a proxy for storage change) drop below the basin-wide minimum threshold value for decline in water levels in the same 25 percent of representative wells throughout a 3-year period, leading to long-term reduction in groundwater storage. Using this characterization minimizes the chance of misleading indications of an unsustainable condition in the Alluvial Aquifer while providing an indication of a potential undesirable result before it occurs. Three consecutive years was chosen because this time frame indicates that the condition is likely to be chronic and not a result of a single-year temporary effect. Three years indicates that there is a trend that is significant and unreasonable.
- In the Saugus Formation, groundwater levels (non-pumping water level elevations) drop below minimum thresholds (see Section 8.6.2) in the same 50 percent of representative wells throughout a 3-year period. The use of 50 percent of the representative wells in the Saugus Formation for this assessment (1) accounts for the confined nature of the Saugus Formation, which recognizes that changes in pumping can propagate over a larger area than occurs in an unconfined aquifer such as the Alluvial Aquifer, and (2) minimizes the chance that localized changes in pumping operations could result in false indications of an unsustainable condition at an individual well while a larger group of representative Saugus Formation wells together shows no such unsustainable condition on an aquifer-wide basis. Three consecutive years was chosen because this time frame indicates that the condition is likely to be chronic and not a result of a single-year temporary effect. Three years indicates that there is a trend that is significant and unreasonable.
- Reduction of groundwater in storage results in an inability to meet demand during a multi-year drought.

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

8.7.2 Minimum Thresholds

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

The minimum threshold for reduction of groundwater in storage is established for the Basin as a whole, not for individual aquifers. Therefore, any reduction in storage that would cause an undesirable result in only a limited portion of the Basin, as determined through implementation of the groundwater monitoring plan, shall be addressed in that area or in areas where declining groundwater levels indicate management actions or projects will be effective.

In accordance with the SGMA regulation cited above, the minimum threshold metric is a volume of pumping per year, or an annual pumping rate. Conceptually, the sustainable yield is the total volume of groundwater that can be pumped annually from the Basin on a long-term (multi-year/multi-decadal) basis without leading to undesirable results. As discussed in Section 6, absent the addition of supplemental water, the future estimated long-term sustainable yield of the Basin under reasonable climate change assumptions is at least 52,200 AFY and is likely higher, given that water budget analyses of future conditions estimated to occur under year 2042 conditions (which consist of full build-out of land uses and water uses, plus future climate change) show an absence of chronic declines in groundwater levels and chronic reductions in groundwater in storage. Therefore, the minimum threshold is set at 52,200 AFY.

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

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

8.7.2.1 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

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

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

- **Avoid Chronic Lowering of Groundwater Levels.** Because groundwater levels will be used as a proxy for estimating groundwater pumping and changes in groundwater storage, the reduction in groundwater storage would not cause undesirable results for this sustainability indicator.
- **Avoid Land Subsidence.** Future groundwater levels would likely have to be substantially lower than are predicted to occur in the future to produce significant subsidence. Should significant and unreasonable inelastic subsidence caused by groundwater extraction be observed from future groundwater levels, the groundwater level minimum thresholds for this sustainability indicator will be raised to avoid future subsidence.
- **Avoid Degraded Groundwater Quality.** The minimum threshold proxy of long-term stability in groundwater levels helps minimize the potential for experiencing degraded groundwater quality.
- **Avoid Depletion of Interconnected Surface Water.** As discussed for chronic reduction of groundwater levels, a significant and unreasonable condition for depletion of surface water is a pumping-induced reduction in river flows and groundwater levels that impacts GDEs in the Basin. As discussed in Section 8.11, groundwater levels that are below historical levels may have an impact on GDEs, including on sensitive aquatic species such as the UTS. Because the minimum thresholds for groundwater levels and storage are lower than historically observed, trigger levels have been established in the GDE monitoring area that, if exceeded, would result in further evaluations and, in turn, may lead to management actions. These trigger levels are intended to be protective of GDEs if groundwater levels fall below historical levels.
- **Avoid Seawater Intrusion.** This sustainability indicator is not applicable to the Basin.

8.7.2.2 Effects of Minimum Thresholds on Neighboring Basins

The water budget analyses presented in Section 6 of the GSP show that the Basin Operating Plan developed by SCV Water results in a water budget that is in balance, with no chronic long-term declines in groundwater levels and only short-term reductions in storage that do not result in significant and unreasonable effects. The minimum thresholds of this GSP, including thresholds which prevent long-term reductions in storage, further constrain future operation of the Basin. Modeling of water levels in the Basin with projected pumping in accord with these thresholds and the Basin Operating Plan demonstrates that flows out of the Basin will be similar to what has been observed in the recent past and not fall below the volumes that were occurring in the decades leading up to the onset of urbanization-driven water importation into the Basin. As a result, implementation of the minimum thresholds in the GSP will not significantly affect the Fillmore and Piru Subbasins.[52]

8.7.2.3 Effects on Beneficial Uses and Land Uses

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

8.7.2.4 Relevant Federal, State, or Local Standards

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

8.7.2.5 Methods for Quantitative Measurement of Minimum Thresholds

The measurement program for evaluating the minimum thresholds for reductions in groundwater in storage will rely on the groundwater level data collection program described previously for chronic lowering of groundwater levels (see Section 8.6). Groundwater levels (as a proxy for storage change) that drop below the basin-wide minimum threshold value for decline in water levels throughout a 3-year period in 25 percent of the same representative wells in the Alluvial Aquifer or 50 percent of the same representative wells in the Saugus Formation may lead to long-term reduction of groundwater in storage (see Table 8-1). The actions that will be taken if minimum thresholds are reached are described in Table 8-2 and Section 9.5.4.1 for the chronic lowering of groundwater levels sustainability indicator, which is directly linked to the sustainability indicator for reduction of groundwater in storage.

8.7.3 Measurable Objectives

The sustainability indicators for avoiding chronic reductions of groundwater in storage use groundwater levels as a proxy. The minimum thresholds and measurable objectives that protect against significant and unreasonable reduction in groundwater storage are based on those used to protect against chronic lowering of groundwater levels. The measurable objective for chronic reduction in groundwater in storage, using the groundwater level proxy, is equivalent to the measurable objective for chronic lowering of groundwater levels, using average groundwater elevations at representative monitoring wells that are predicted for future full build-out of land use and water use conditions (which also accounts for climate change). Measurable objectives may change after GSP adoption, as new information and hydrologic data become available.

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[52] In addition, short-term reductions in groundwater in storage are not expected to result in significant and unreasonable changes in groundwater flow from the Basin to the Piru Subbasin because the thickness of the alluvium at the boundary between these two subbasins is small (less than 10 feet) and the estimated total flow into the Piru Subbasin fluctuates over a fairly limited range on a long-term basis (between approximately 7,000 and 8,000 AFY). This 1,000-AFY range is small compared with annual variations in pumping and the amount of annual climate-driven variation that occurs in several of the water budget terms in the Basin.

8.7.4 Interim Milestones

Interim milestones show how the GSA would move from current conditions to meeting the measurable objectives if undesirable results have been identified. For the Basin, there are no identified undesirable results at this time, and implementation of the GSP is expected to maintain a sustainable condition in the Basin throughout the planning and implementation horizon; therefore, no interim milestones are being proposed for reduction in groundwater storage. If new data identify undesirable results in the future, interim milestones may be proposed as part of a GSP update that is planned for every 5 years.

8.8 Seawater Intrusion Sustainable Management Criterion (Not an Issue)

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

8.9 Degraded Groundwater Quality Sustainable Management Criterion

This sustainability indicator takes into consideration protection of municipal drinking water supplies, domestic uses, and agricultural uses of groundwater in the Basin. For municipal wells and drinking water supplied by domestic wells, basin standards established by LARWQCB were used to establish thresholds. For agricultural uses, thresholds were established using WQOs for the Basin and available assimilative capacities for salts and nutrients that are protective of beneficial uses, including agriculture. WQOs and assimilative capacity thresholds contained in the SNMP prepared for the Basin were used in this analysis (GSSI, 2016).

Groundwater quality in the Basin has been impacted by perchlorate (and other constituents of concern) released from the Whittaker-Bermite facility for many decades. SCV Water (and its predecessors) have worked with the LARWQCB, California Department of Toxic Substances Control (DTSC) and the Whittaker-Bermite Corporation to understand the nature and extent of historical releases of contaminants that have reached groundwater. SCV Water has made a concerted effort to actively monitor its supply wells for indications of contaminant migration and has installed wellhead treatment within areas of concern to make sure high-quality water is delivered to its customers. These activities, along with normal seasonal and annual operational changes in pumping schedules that SCV Water needs to make to meet demand, will continue in the future and may change groundwater gradients and flow directions in the aquifers.

Furthermore, the existence of contamination (perchlorate, VOCs) in the Basin pre-dates SGMA enactment (January 2015) and is not a result of pumping. While PFAS were detected after 2015 in a number of wells, it is likely that PFAS were present prior to 2015 but not detected until laboratory detection limits became lower. This preexisting contamination, as well as contamination that may be discovered in the future, is not the responsibility of the GSA to manage. It is the responsibility and authority of state regulatory agencies (e.g., LARWQCB and DTSC) to take actions that respond to the contamination. The GSA will continue to collaborate with state agencies and SCV Water to help address contamination and avoid further impacts to beneficial uses.

8.9.1 Undesirable Results

Conditions that are significant and unreasonable that may be an undesirable result include the following:

- **Water management actions** that interfere with existing groundwater remediation efforts or cause plume migration, creating permanent loss of groundwater supply.
- **Concentrations of regulated contaminants** in untreated groundwater water from private domestic or agricultural or municipal wells exceed regulatory thresholds.
- **Loss of municipal groundwater supply** due to migration of a contaminant plume and inability to pump and treat groundwater or reasonably secure an alternative water supply.
- **Groundwater pumping** that causes concentrations of TDS, chloride, nitrate, and sulfate to exceed WQOs or basin-wide assimilative capacity, described in the 2016 SNMP, or puts new state permits for distribution of recycled water at risk.
- **Interference with remediation activities.** Water management actions implemented under the GSP that interfere with existing remediation efforts creating permanent loss of groundwater supply.

8.9.2 Minimum Thresholds

Section 354.28(c)(2) of the SGMA regulations states that "The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin." The purpose of the minimum thresholds for constituents of concern in the Basin is to avoid increased degradation of groundwater quality from baseline concentrations measured since enactment of SGMA in January 2015. Minimum thresholds established for contaminants and for salts and nutrients are presented in the following subsections. The actions that will be taken if minimum thresholds are reached are described in Section 9.5.4.2 for this sustainability indicator.

8.9.2.1 Contaminants

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

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

As noted in Section 5.1.8, concentrations of several regulated constituents exceed Basin Plan limits in a number of municipal supply wells. The extent of the contamination is still being evaluated. SCV Water has taken wells out of service and built wellhead treatment facilities to meet groundwater quality standards for water served to its customers.

As has been the case thus far, if additional wells become impacted by contamination, SCV Water and the GSA will collaborate with LARWQCB and other regulatory agencies that have responsibility to investigate and regulate groundwater contaminants that could pose a risk to groundwater quality.

Groundwater quality data are not available for private domestic wells at this time. This is a data gap that is addressed as part of the Management Actions and Projects in Section 9 of this GSP. It is hoped that private domestic well owners will volunteer to be included in a monitoring program to establish an initial baseline water quality database for private domestic wells. The GSA will consult with landowners who wish to participate to facilitate cooperative data sharing procedures. Once a baseline is established, exceedance of water quality standards in the Basin Plan in 20 percent of the monitored private wells will be the basis for minimum thresholds for degraded groundwater quality at private domestic wells. It may be necessary to adjust the threshold for the percentage of wells exceeding the limit if there are many wells in a particular area that experience degraded groundwater quality, as observed from baseline testing. Table 8-3 presents regulatory standards for selected constituents of concern for drinking water listed in the Basin Plan and the 2020 SCV Water annual water quality report.

Table 8-3. Water Quality Standards for Selected Constituents of Concern for Private Drinking Water Wells

Constituent of Concern	Basin Plan Standard
Total Dissolved Solids[1]	700 – 1000 mg/L
Chloride[1]	100 – 150 mg/L
Sulfate[1]	150 – 350 mg/L
Nitrate (as Nitrogen) [1]	10 mg/L.
Perchlorate[1]	0.006 mg/L
Tetrachloroethylene (PCE) [2]	MCL of 5 µg/L
Trichloroethylene (TCE) [2]	MCL of 5 µg/L
PFAS (PFOS and PFOA) [2]	Response Level (RL) of 40 ng/L PFOS and 10 ng/L PFOA

Notes

[1] Source: Water Quality Control Plan: Los Angeles Region Basin Plan for the Coastal Watershed of Los Angeles and Ventura Counties Basin Plan Standards can vary by watershed management zone. Range shown where applicable.

[2] Source: SCV Water 2020 Water Quality Report

µg/L = micrograms per liter
MCL = maximum contaminant level
mg/L = milligrams per liter
ng/L = nanograms per liter
PFAS = per- and polyfluoroalkyl substances
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate

8.9.2.2 Salts and Nutrients

Minimum thresholds pertaining to salts and nutrients measured in representative wells are as follows (see Table 8-1):

- Concentrations of TDS, chloride, nitrate, and sulfate that exceed WQOs and basin-wide assimilative capacity described in the 2016 SNMP in 20 percent of wells monitored in each management zone.

Recognizing that drinking water standards in the LARWQCB Basin Plan are not the only regulatory standard that must be met and that agricultural uses of water are sensitive to concentrations of salts and nutrients, the minimum thresholds for avoiding degradation of groundwater quality also relies on WQOs and assimilative capacities described in the 2016 SNMP (GSSI, 2016). The purpose of the SNMP was to determine the current (ambient) water quality conditions in the Basin and to ensure that all water management practices, including the use of recycled water, are consistent with the WQOs. The SNMP provides the initial framework for water management practices to ensure protection of beneficial uses and allow for the sustainability of groundwater resources consistent with the Basin Plan. The SNMP divides the Basin into six subunits known as management zones (see Figure 8-6):

- Management Zone 1 (MZ-1) - Santa Clara-Mint Canyon
- Management Zone 2 (MZ-2) - Placerita Canyon
- Management Zone 3 (MZ-1) - South Fork
- Management Zone 4 (MZ-4) - Santa Clara-Bouquet and San Francisquito Canyons
- Management Zone 5 (MZ-5) - Castaic Subunit
- Management Zone 6 (MZ-6) - Saugus Formation

Five of these subunits (Management Zones 1 through 5—Santa Clara-Mint Canyon Subunit, Placerita Canyon Subunit, South Fork Subunit, Santa Clara-Bouquet and San Francisquito Canyon Subunit, and Castaic Subunit) are shallow alluvial groundwater subunits, while the sixth subunit (Management Zone 6) consists of the Saugus Formation.

During the SNMP development process, ambient concentrations and assimilative capacities for TDS, chloride, nitrate, and sulfate were established for all six of the management zones shown in Figure 8-6.

Each of the management zones (except Management Zone 6) has established WQOs for TDS, chloride, nitrate, and sulfate. For Management Zone 6, the LARWQCB recommended the interim use of the most conservative basin objective of the alluvial management zones for the calculation of assimilative capacity for TDS, chloride, and nitrate. However, due to the lack of supporting historical data for sulfate, no decision has been made with regards to the WQO for sulfate in Management Zone 6.

Management Zone 1 was split into two zones to isolate a localized area that may be associated with point source contamination associated with the former Whittaker-Bermite site. The area in Management Zone 1 with elevated TDS and sulfate levels was designated as Management Zone 1a while the remaining area affected by the Whittaker-Bermite site was designated as Management Zone 1b. Average groundwater concentrations and assimilative capacities were calculated for each of these zones separately.

In the SNMP, the average TDS, chloride, nitrate, and sulfate concentrations for each management zone were determined by preparing concentration contours of the median concentration values from wells in each management zone. The average groundwater concentration values were determined based on the areal and vertical distribution of the median concentration contours. The average median concentration value for each constituent in each management zone was considered to be the ambient groundwater concentration. The ambient concentration for each constituent was subtracted from the specific WQO for that constituent and management zone to determine the available assimilative capacity.

Calculated ambient groundwater concentrations are provided in Table 8-4 below, along with each management zone's WQO presented in the SNMP. The WQOs for each constituent and management zone presented in this table are considered the minimum thresholds for salts and nutrients in each management zone. In cases where the ambient water quality exceeds the WQO, the ambient water quality is considered the minimum threshold.

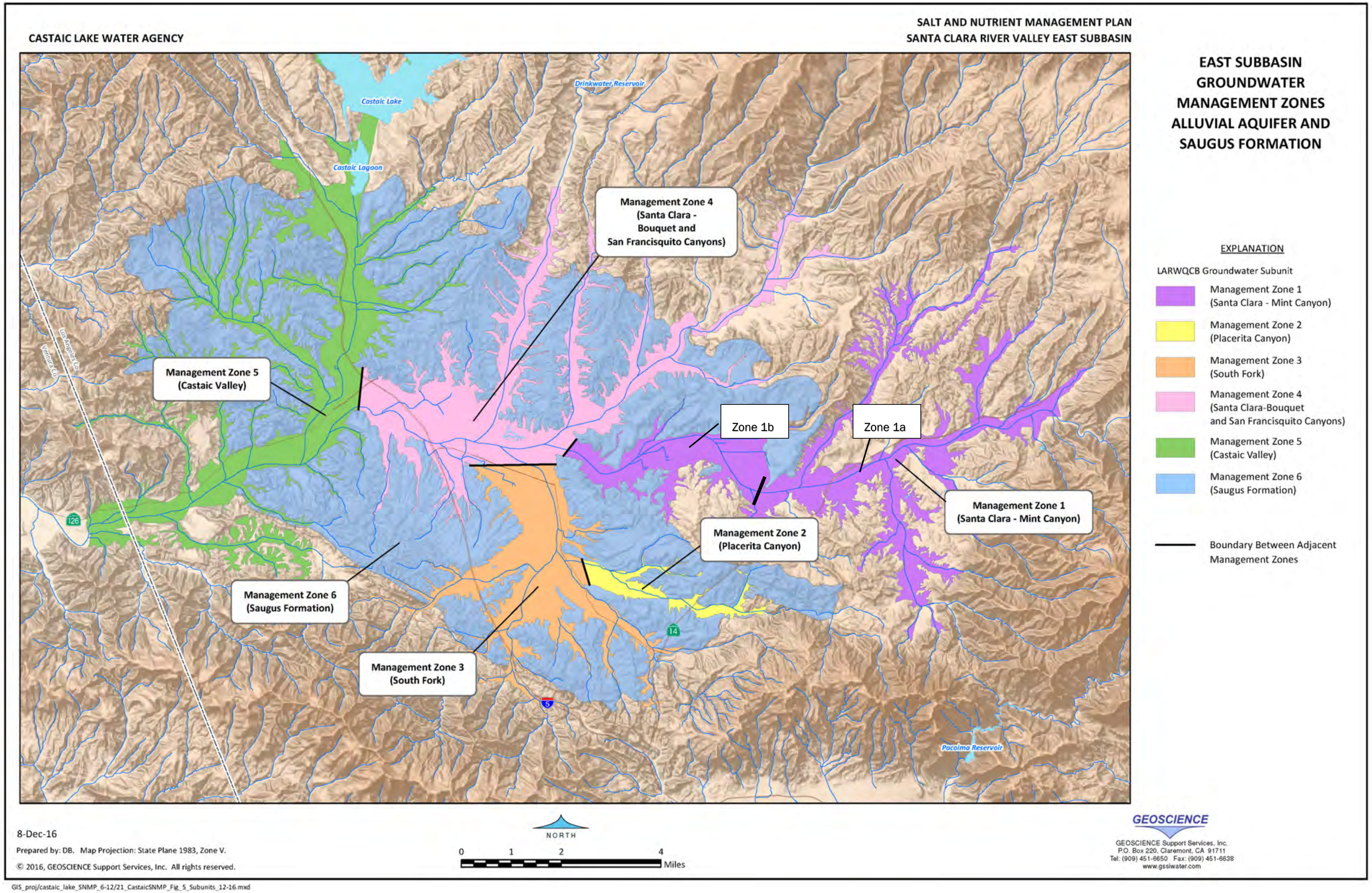

Figure 8-6. Management Zones from the Salt and Nutrient Management Plan

Table 8-4. Ambient Groundwater Concentrations and Basin Water Quality Objectives for Agricultural Beneficial Uses

Management Zone	Groundwater Subunit	Water Quality Status Comparison	TDS (mg/L)	Chloride (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)
1a	Santa Clara-Mint Canyon	Water Quality Objective	800	150	45	150
		Ambient Water Quality	728	89	20	138
1b	Santa Clara-Mint Canyon	Water Quality Objective	800	150	45	150
		Ambient Water Quality	833	72	21	269
2	Placerita Canyon[1]	Water Quality Objective	700	100	45	150
		Ambient Water Quality	NA	NA	NA	NA
3	South Fork[1]	Water Quality Objective	700	100	45	200
		Ambient Water Quality	NA	NA	NA	NA
4	Santa Clara-Bouquet and San Francisquito Canyons	Water Quality Objective	700	100	45	250
		Ambient Water Quality	710	77	16	189
5	Castaic Valley	Water Quality Objective	1,000	150	45	350
		Ambient Water Quality	727	77	8	246
6	Saugus Formation[2]	Water Quality Objective	700	100	45	NA
		Ambient Water Quality	636	28	14	235

Notes

Source: Salt and Nutrient Management Plan Santa Clara River Valley East, Draft Final (GSSI, 2016)

Red values indicate exceedances of WQOs.

[1] Insufficient data to establish trend.

[2] WQOs have not been established for the Saugus Formation. Therefore, at the recommendation of the LARWQCB, the most conservative of the alluvial management zone WQOs was used for calculation of assimilative capacity for TDS, chloride, sulfate, and nitrate.

mg/L = milligrams per liter

TDS = total dissolved solids

LARWQCB = Los Angeles Regional Water Quality Control Board

WQO = water quality objective

8.9.2.3 Relationship between Individual Minimum Thresholds and Other Sustainability Indicators

The groundwater quality minimum thresholds were set based on regulatory standards and WQOs established by the Basin Plan and SNMP for protecting beneficial uses.

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

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

8.9.2.4 Effects of Minimum Thresholds on Neighboring Basins

The Fillmore and Piru Subbasins are hydrologically downgradient of the Basin; thus, groundwater generally flows from the Basin into the Fillmore and Piru Subbasins. Hypothetically, poor groundwater quality in the Basin could flow into the Fillmore and Piru Subbasins, affecting the ability to achieve sustainability in those subbasins. The degraded groundwater quality minimum threshold is set to prevent unreasonable movement of poor-quality groundwater or further degrade groundwater quality that could impact overall beneficial uses of groundwater. Therefore, it is unlikely that the groundwater quality minimum thresholds established for the Basin will prevent the Fillmore and Piru Subbasins from achieving sustainability.

8.9.2.5 Effects of Minimum Thresholds on Beneficial Uses and Land Uses

- **Agricultural land uses and users.** The degraded groundwater quality minimum thresholds generally benefit the agricultural water users in the Basin. For example, setting the minimum threshold for salts and nutrients at the WQOs for each management zone in the Basin described in the SNMP ensures that a supply of usable groundwater will exist for beneficial agricultural use.
- **Urban land uses and users.** The degraded groundwater quality minimum thresholds generally benefit the urban water users in the Basin because there are existing regulatory programs and agencies that ensure there is an adequate supply of good quality groundwater for municipal use.

- **Domestic users.** The degraded groundwater quality minimum thresholds for municipal wells benefit the domestic water users in the Basin because these uses share the aquifer with municipal water supply wells. In addition, water quality standards for contaminants, salts, and nutrients are intended to be protective of drinking water uses.
- **Ecological land uses and users.** Although the degraded groundwater quality minimum thresholds do not directly benefit ecological uses, it can be inferred that the degraded groundwater quality minimum thresholds will not adversely impact ecological water uses in the Basin because concentrations of constituents of concern are not likely to increase substantially from what they are now, or prior to what they were when SGMA was enacted in January of 2015. This is because the Basin is not in overdraft; therefore, drawing poor quality water into the Basin from marine bedrock formations or from deeper zones is not anticipated. In addition, the thresholds are consistent with the SNMP water quality objectives. Preventing constituents of concern from migrating will prevent unwanted contaminants from impacting ecological groundwater uses.

8.9.2.6 Relevant Federal, State, or Local Standards

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

8.9.2.7 Methods for Quantitative Measurement of Minimum Thresholds

Degraded groundwater quality minimum thresholds will be directly measured from existing or new municipal, domestic (if landowners participate in monitoring), or agricultural supply wells included in the monitoring program. Exceedances of regulatory standards and WQOs presented in Tables 8-4 and 8-5 will be assessed on an annual basis in accordance with the monitoring program (see Section 7).

8.9.3 Measurable Objectives

8.9.3.1 Measurable Objectives Pertaining to Contaminants

Improving groundwater quality is not a requirement under SGMA; however, protecting it from getting worse is important to the beneficial users and uses of the resource in the Basin so that pumping can be maintained at desired levels. Thus, the measurable objective as it relates to contamination is to maintain pumping for beneficial uses consistent with volumes quantified in the applicable UWMP for wet, normal, dry, and multiple dry years. Non-municipal pumping—including private domestic, golf courses, agricultural users, and contaminant remediation pumping—will also be maintained at or above the pumping levels identified in Table 8-5 (from Table 4-6 in the 2020 UWMP).

The measurable objective pertaining to groundwater quality for private domestic and agricultural wells will be approximately equal to or better than baseline water quality established by the groundwater monitoring program for these wells (as discussed previously, a baseline does not exist; therefore, this is a data gap that must be filled).

8.9.3.2 Measurable Objectives Pertaining to Salts and Nutrients

The measurable objective pertaining to salts and nutrients is equivalent to basin-wide WQOs (as described by use type, i.e., agricultural, domestic, municipal) and basin-wide assimilative capacity as described in the Salt and Nutrient Management Plan. (Note, as discussed in Section 7, a data gap exists for private wells that needs to be filled consistent with the Salt and Nutrient Management Plan Monitoring Program.)

8.9.4 Interim Milestones

Interim milestones show how the GSA anticipates moving from current conditions to meeting the measurable objectives. For contaminants, the interim milestone for each 5-year GSP update will be a demonstration that municipal groundwater production is consistent with the UWMP quantities and operational flexibility is not unduly constrained. At the first 5-year GSP update, there will be a demonstration that a monitoring network for private domestic and agricultural wells has been established and baseline water quality has been obtained for these users. After the first 5-year update, there will be a demonstration that applicable water quality standards and WQOs are not exceeded in private domestic and agricultural wells due to pumping or GSA management actions.

Table 8-5. Projected Groundwater Production (Normal Year)

	Groundwater Pumping (AF)[1]					
	2025	2030	2035	2040	2045	2050
Purveyor						
Alluvium	21,430	28,050	30,790	30,790	30,790	30,790
Saugus Formation	17,450	9,900	9,900	9,900	9,900	9,900
Total Purveyor	38,380	37,950	40,690	40,690	40,690	40,690
Agricultural and Other[2]						
Alluvium	11,540	9,150	6,410	6,410	6,410	6,410
Saugus Formation	1,200	1,200	1,200	1,200	1,200	1,200
Total Agricultural and Other	12,740	10,350	7,610	7,610	7,610	7,610
Basin						
Alluvium	32,970	37,200	37,200	37,200	37,200	37,200
Saugus Formation	18,650	11,100	11,100	11,100	11,100	11,100
Total Basin	**51,620**	**48,300**	**48,300**	**48,300**	**48,300**	**48,300**

Notes

Source: 2020 Santa Clarita Valley Urban Water Management Plan, Final (KJ, 2021).

[1] Includes both existing and planned pumping. A breakdown of both existing and planned pumping by individual purveyors is shown in Appendix E of the UWMP. The distribution of pumping does not represent a formal allocation of water resources among the retail purveyors.

[2] Agricultural and other small private well pumping, including Newhall Land, Robinson Ranch Golf Course, Wayside Honor Rancho, Valencia Golf Course, and the Whittaker-Bermite Corporation facility. Values in Alluvium reflect reduction of up to 7,038 AF associated with the assumed development under the Newhall Ranch Specific Plan.

AF = acre-feet

AFY = acre-feet per year

Alluvium = Alluvial Aquifer

Basin = Santa Clara River Valley Groundwater Basin, East Subbasin

8.10 Land Subsidence Sustainable Management Criterion

8.10.1 Undesirable Results

Conditions that may lead to an undesirable result include a shift in pumping locations or substantial increase in pumping beyond what has been observed, which could lead to a substantial decline in groundwater levels that could potentially cause subsidence in excess of the minimum thresholds.

Significant and unreasonable rates of land subsidence in the Basin are those that lead to a permanent (inelastic) subsidence of ground surface elevations that impact groundwater supply, land uses, infrastructure, and property interests. For clarity, this SMC adopts two related concepts:

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

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

- Substantially interferes with surface land uses.
- Land surface deformation that impacts the use of critical infrastructure and roads.
- Pumping results in land subsidence greater than minimum thresholds at 10 percent of monitoring locations.

Currently, ground surface elevation is being monitored at two continuous global positioning system sites in the Basin as reported by UNAVCO from its Data Archive Interface.[53] Since the beginning of data collection in the early 2000s, the net vertical displacement is positive (0.05 feet). This means that the land surface has actually risen (positive displacement) or stayed the same. The ground surface elevation change (less than 0.2 feet vertical change over the last 20 years) seen at the two UNAVCO stations cannot be correlated with groundwater extractions and is likely due to tectonic activity. In addition, InSAR data provided by DWR shows that meaningful land subsidence did not occur in the Basin during the period between June 2015 and June 2019. A review of LA County benchmark elevation data indicates that, since the 1980s, some locations in the Basin have risen while others have fallen. The available data suggest that tectonic activity is causing much of the elevation changes and the extent to which any change in land surface elevation has been caused by past pumping is unclear (see Appendix C for additional discussion of subsidence).

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[53] The UNAVCO Data Archive Interface is available at http://www.unavco.org/data/data.html. (Accessed January 19, 2021.)

Should potential subsidence be observed, the GSA will first assess whether the subsidence may be due to (1) pumping, (2) tectonics, and (3) elastic processes (subsidence that will recover with rising groundwater). If inelastic subsidence is caused by groundwater extraction, the GSA will undertake a program to correlate the observed subsidence with measured groundwater elevations and identify areas that may be subject to differential subsidence that may cause damage to infrastructure or property. See Section 9.5.4.3 for further discussions of the actions that will be taken if minimum thresholds are reached for this sustainability indicator.

Staying above the minimum threshold (provided that subsidence was caused by groundwater extraction) will avoid the subsidence-related undesirable result and protect the beneficial uses and users from impacts to infrastructure and interference with surface land uses.

8.10.2 Minimum Thresholds

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

The subsidence minimum threshold for subsidence is as follows:

- The subsidence measured between June of one year and June of the subsequent year shall be no more than an average of 0.1 foot in any single year and a cumulative 0.5 foot in any 5-year period observed at 10 percent or more monitoring locations.

As justification for this minimum threshold, a methodology was developed to approximately estimate the magnitude of subsidence that may occur in the planning and implementation period of the GSP (see Appendix C). There was a short period between the winter of 2015/2016 and the winter of 2018/2019 for which a comparison of observed land surface elevation from DWR's InSAR Dataset could be compared to groundwater level declines in the area of the Basin where clay beds exist in the Saugus Formation and where the potential for future subsidence is the most probable as a result of increased pumping. As described in the *Subsidence Technical Memorandum* (Appendix C), the central portion of the Basin in the vicinity of well V-201 is where groundwater levels are predicted by the groundwater model to be lowest in the future. In this area, a groundwater level decline of 15 feet was measured between the winter of 2015/2016 and the winter of 2018/2019. The InSAR data showed a corresponding reduction in ground surface elevation of approximately 0.032 feet. If the change in ground surface elevation shown in the InSAR data is related to groundwater extraction, this equates to approximately 0.01 feet of subsidence per 5 feet of groundwater elevation decline. As stated previously, it is not known whether the observed reduction in ground surface elevation is related to pumping or to tectonics.

It is anticipated that groundwater elevations could be lower in the future as the Basin Operating Plan is implemented at full build out of the Basin to meet future demands during extended drought periods. The groundwater flow model was used to estimate future groundwater levels in the Basin. The approximate difference between long-term average historical groundwater levels observed in well V-201 and future projected groundwater levels is estimated to be on the order of 150 feet. When considering historical low groundwater levels (e.g., 1993) measured at well V-201, the difference between measured groundwater levels and the predicted lowest dry year/drought groundwater levels in the future is approximately 70 feet. Depending on which of the two water level differences is used, the approximate amount of subsidence that could occur in the future ranges from between 0.3 feet of subsidence for the 150 feet of groundwater level decline to approximately 0.14 feet for the 70 feet of decline. This estimate assumes that the InSAR measured reduction in land surface elevation used in the calculations is a direct result of groundwater extraction, which may not be the case. It is also not known the time frame over which this estimated subsidence might occur, as (1) it is understood that subsidence effects can be delayed and (2) because the rate of subsidence can be affected by the duration that groundwater levels are below the historical low.

Based on this evaluation, the minimum threshold for subsidence has been preliminarily set at a rate of 0.1 feet in any single year with a maximum subsidence of 0.5 feet over any 5-year period. Due to the considerable uncertainty associated with estimating subsidence rates in the Basin and the lack of a complete data set from which to estimate subsidence, the GSA plans to conduct robust subsidence monitoring as described in Section 7 and consider adjusting thresholds should monitoring data indicate that this is advisable and warranted.

8.10.2.1 Relationship between Individual Minimum Thresholds and Other Sustainability Indicators

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

- **Avoid Chronic Lowering of Groundwater Levels.** Subsidence minimum thresholds will not result in significant or unreasonable groundwater levels.
- **Avoid Chronic Reduction of Groundwater Storage.** The subsidence minimum thresholds will not change the amount of pumping and will not result in a significant or unreasonable change in groundwater storage.
- **Avoid Degraded Groundwater Quality.** The subsidence minimum thresholds will not cause a change in groundwater flow directions or rates, and, therefore, will not result in a significant or unreasonable change in groundwater quality.
- **Avoid Depletion of Interconnected Surface Waters.** The groundwater level subsidence minimum thresholds will not change the amount or location of pumping and will not result in a significant or unreasonable depletion of interconnected surface waters.
- **Avoid Seawater Intrusion.** This sustainability indicator is not applicable in the Basin.

8.10.2.2 Effects of Minimum Thresholds on Neighboring Basins

The ground surface subsidence minimum thresholds are set to prevent any long-term subsidence that could harm groundwater supply, land uses, infrastructure, and property interests. Therefore, the subsidence minimum thresholds for the Basin will not prevent the downstream Fillmore and Piru Subbasins from achieving sustainability.

8.10.2.3 Effects of Minimum Thresholds on Beneficial Uses and Land Uses

The subsidence minimum thresholds are set to prevent subsidence that could harm groundwater supply, land uses, infrastructure, and property interests. Available data indicate that there is currently little to no groundwater pumping-caused subsidence occurring in the Basin that affects infrastructure and that local soils, geology, and predicted future groundwater level changes are unlikely to cause undesirable results or exceedance of minimum thresholds. Therefore, there is no likely negative impact on any beneficial user.

8.10.2.4 Relevant Federal, State, or Local Standards

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

8.10.2.5 Methods for Quantitative Measurement of Minimum Thresholds

Minimum thresholds will be assessed using a combination of DWR-supplied InSAR data and subsidence monitoring stations (described in the monitoring plan, Section 7).

8.10.3 Measurable Objectives

8.10.3.1 Methodology for Setting Measurable Objectives

The measurable objectives are set based on maintaining current conditions and changes are measured by a combination of DWR-supplied InSAR data and subsidence monitoring stations.

8.10.3.2 Measurable Objectives for the Basin

The measurable objectives for subsidence represent target subsidence rates in the Basin. Available information does not suggest the occurrence of permanent subsidence in the Basin. Therefore, the measurable objective for subsidence is maintenance of current average ground surface elevations with the understanding that ground surface elevations have been observed to fluctuate up and down over time, depending on location.

8.10.4 Interim Milestones

Interim milestones show how the GSA anticipates moving from current conditions to meeting the measurable objectives. Interim milestones are set for each 5-year interval following GSP adoption.

Subsidence measurable objectives are set at the current condition of no long-term subsidence. Therefore, there is no change between current conditions and sustainable conditions. For this reason, the interim milestones are identical to the minimum thresholds and measurable objectives.

8.11 Depletion of Interconnected Surface Water Sustainable Management Criterion

8.11.1 Undesirable Results

As noted above, the groundwater model of the Basin indicates that undesirable results from chronic lowering of groundwater levels and reduction of groundwater in storage are not expected to occur in the future. Conceptually, undesirable results could occur if groundwater pumping exceeded recharge for a prolonged period either across the Basin or in a particular area of the Basin where lowering of water levels would cause an impact. In addition, conditions that could lead to undesirable results include the following:

- Drought periods that are longer in duration or more intense than simulated climate change factors provided by DWR.
- Reductions in long-term recharge to the Basin beyond what is anticipated in the plan (i.e., less recharge during non-drought periods).
- Reductions in the quantity of treated wastewater being discharged to the river, which could reduce river flow rates and the rate of recharge to the underlying Alluvial Aquifer.
- Based on emergency interruptions, not being able to access imported or banked water supplies and thereby needing to pump for multiple years at annual volumes beyond those described in the Basin Operating Plan.

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

- GDE identification work performed by ESA (see Section 5.2)
- Assessment of potential impacts to GDEs prepared by ESA (see Appendix E)

- Identification of interconnected surface water (see Section 7.6)
- Groundwater elevation monitoring data and results from the groundwater flow model that examined effects of future pumping, land use, hydrology, and climate change

Avoiding adverse impacts on beneficial uses of interconnected surface water present in the Basin and preserving existing habitat are the focus of this sustainability indicator. This is based on the following observations about basin conditions:

- Direct uses of surface water (for recreation, irrigation, or municipal purposes) are not present or expected as a future significant beneficial use in the Basin.
- As discussed in Section 8.3.3.5, historical data and modeling analyses show there is (and will continue to be) more water in the river than was the case under pre-urbanized conditions, which will continue to benefit the downstream Piru Subbasin.

In summary, (1) no future direct diversions of surface water are expected to occur in the Basin, (2) historical data show there is (and will continue to be) more water in the river than was the case under pre-urbanized conditions, and (3) significant and unreasonable surface water depletion arising from groundwater use in the Basin are not expected to occur within the Basin. Therefore, the sustainability criterion for depletion of interconnected surface water is focused on avoiding undesirable results consisting of significant and unreasonable effects on GDEs and sensitive species, which are the beneficial users of surface water in the Basin.

The California Department of Fish and Wildlife (CDFW) has published guidelines[54] for considering whether effects to GDEs and interconnected surface waters (ISWs) are significant. CDFW's approach suggests answering the following questions in the GSP:

Groundwater Dependent Ecosystems:

1. How will groundwater plans identify GDEs and address GDE protection?
2. How will GSAs determine if GDEs are being adversely impacted by groundwater management?
3. If GDEs are adversely impacted, how will groundwater plans facilitate appropriate and timely monitoring and management response actions?

Interconnected Surface Waters:

1. How will groundwater plans document the timing, quantity, and location of ISW depletions attributable to groundwater extraction and determine whether these depletions will impact fish and wildlife?
2. How will GSAs determine if fish and wildlife are being adversely impacted by groundwater management impacts on ISW?
3. If adverse impacts to ISW-dependent fish and wildlife are observed, how will GSAs facilitate appropriate and timely monitoring and management response actions?

CDFW has outlined specific Management Considerations to be integrated into the GSP:[55]

- ✓ Data Gaps and Conservative Decision-Making Under Uncertain Conditions
- ✓ Adaptive Management
- ✓ Prioritized Resource Allocation
- ✓ Multi-Benefit Approach

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[54] *Fish & Wildlife Groundwater Planning Considerations*, CDFW, 2019.

[55] Groundwater Planning Considerations, CDFW, 2019.