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Brian Villalobos, PG, CHG, CEG
Principal Geohydrologist

Lauren Wicks, PG
~~Project~~ Senior Geohydrologist

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UPPER SAN LUIS REY VALLEY GROUNDWATER SUSTAINABILITY PLAN
2027 AMENDMENT

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2a	San Luis Rey Valley Groundwater Basin Groundwater Sustainability Plan Public Involvement Plan

2b Administrative Draft GSP Written Comment and Response Matrix and Supporting Exhibits

2c Administrative Draft 2027 GSP Amendment Written Comment and Response Matrix and Supporting Exhibits (Placeholder)

3a Well Logs used for Cross-Section Development

3b GSP Water Quality Sampling Results and Water Quality Laboratory ~~Analyses~~Reports~~: Upper San Luis Rey Sub-Basin Initial Monitoring Network~~

3c Technical Memorandum: Groundwater Dependent Vegetation Assessment for the Groundwater Sustainability Plan for the Upper San Luis Rey Valley Groundwater Sub-Basin

3d Technical Memorandum: Development and Calibration of Upper San Luis Rey Groundwater Model

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4a Technical Memorandum: Analysis to Determine Potential Well Impacts Relative to Sustainable Management Criteria – Upper San Luis Rey Valley Groundwater Subbasin

5a Water Level Measurement Field Form

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6a Ordinance No. 100-08: An Ordinance of the Yuima Municipal Water District Adopting a Drought Response Conservation Program

7a Technical Memorandum: Upper San Luis Rey Valley Groundwater Management Authority Cost of Service Study

Acronyms, Abbreviations, and Initialisms

Abbrev.	Description
acre-ft/yr	acre-feet per year, also AFY
AFY	acre-feet per year, also acre-ft/yr
amsl	above mean sea level
ASR	Aquifer Storage and Recovery
BMP	best management practice
CalWATRS	California Water Accounting, Tracking, and Reporting System
CASGEM	California Statewide Groundwater Elevation Monitoring Program
CCR	California Code of Regulations
CCTAG	Climate Change Technical Advisory Group
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
CLIP	California Laboratory Intake Portal
COC	chain of custody
County	San Diego County
CSD	Community Services District
DAC	Disadvantaged Community
DDW	California Division of Drinking Water
DEH	Department of Environmental Health
DI	deionized
DO	dissolved oxygen
DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources
EB	equipment blank
ELD	Enhanced Leak Detection
EPA	United States Environmental Protection Agency (also USEPA)
ESA	European Space Agency
ET	evapotranspiration
EWMP	Efficient Water Management Practice
eWRIMS	Electronic Water Rights Information Management System
ft	feet
FRWR	Federal Reserved Water Right
gal/ft	gallons per foot

GAMA	Groundwater Ambient Monitoring and Assessment program
GDE	Groundwater Dependent Ecosystem
Geoscience	Geoscience Support Services, Inc.
GIS	Geographic Information System
gpm	gallons per minute
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HSPF	Hydrologic Simulation Program - Fortran
IDA	Improvement District "A"
IID	Imperial Irrigation District
IM	Interim Milestone
InSAR	Interferometric Synthetic Aperture Radar
IRWM	Integrated Regional Water Management
ISW	Interconnected Surface Water
JPA	Joint Powers Agreement
LAFCO	San Diego Local Agency Formation Commission
LAR	Land Area Representation
MCL	maximum contaminant level
meq/L	milliequivalents per liter
Metropolitan	Metropolitan Water District of Southern California
µg/L	micrograms per liter
mg/L	milligrams per liter
mL	milliliter
MNM	Monitoring Network Module
MO	~~Management~~ Measurable Objective
MT	Minimum Threshold
mV	millivolts
MWC	Mutual Water Company
MWD	Municipal Water District
N	nitrogen
NO_3	nitrate
NOAA	National Oceanic and Atmospheric Administration
NRCS	~~National~~ Natural Resources Conservation Service
NTU	nephelometric turbidity units
NWCC	National Water and Climate Center
NWI	National Wetlands Inventory
NWIS	National Water Information System
ORP	redox potential
Pauma MWD	Pauma Municipal Water District
PDWW	Public Drinking Water Watch

PHG	Public Health Goal
PPE	personal protective equipment
PRISM	Parameter-elevation Regression on Independent Slopes Model
PUD	Public Utilities District
PVGSA	Pauma Valley Groundwater Sustainability Agency
QA/QC	quality assurance and quality control
RAC	Regional Advisory Committee
RAWMP	Regional Agricultural Water Management Plan
RCA	Recommended Corrective Action
RCD	Upper San Luis Rey Resource Conservation District
Regional Board	~~San Diego County~~ California Regional Water Quality Control Board, San Diego Region
RMS	Representative Monitoring Site
RP	reference point
RWMG	Regional Water Management Group
SANDAG	San Diego Association of Governments
SanGIS	San Diego Regional GIS Data Source
SAP	Sampling and Analysis Plan
SCAG	Southern California Association of Governments
SCS	SCS Engineers
SDAC	Severely Disadvantaged Community
SDCFB	San Diego County Farm Bureau
SDWIS	Safe Drinking Water Information System
SEC	Specific electrical conductance
SLRIWA	San Luis Rey Indian Water Authority
SLRMWD	San Luis Rey Municipal Water District
SGMA	Sustainable Groundwater Management Act
SMC	Sustainable Management Criteria
Subbasin	Upper San Luis Rey Valley Groundwater Subbasin (unless used with Pala or Pauma to denote specific Subbasin areas)
SSURGO	Soil Survey Geographic Database
SWM	Stanford Watershed Model
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TDS	total dissolved solids
TSAWR	Transitional Special Agricultural Water Rate
UR	Undesirable result
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency (also EPA)
USFS	United States Forest Service

USGS	United States Geological Survey
USLR	Upper San Luis Rey
USLRGM	Upper San Luis Rey Groundwater Model
USLRGMA	Upper San Luis Rey Groundwater Management Authority
USLRRCD	Upper San Luis Rey Resource Conservation District
UWMP	Urban Water Management Plan
VIC	Variable Infiltration Capacity
VID	Vista Irrigation District
~~VOC~~	~~volatile organic compound~~
Water Authority	San Diego County Water Authority
WDFN	Water Data for the Nation
~~Authority~~	
WQIP	Water Quality Improvement Plan
WUE	Water Use Efficiency
WY	water year
YMWD	Yuima Municipal Water District

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UPPER SAN LUIS REY VALLEY GROUNDWATER SUSTAINABILITY PLAN
2027 AMENDMENT

0.0 Executive Summary (§354.4(a))

0.1 Introduction

On September 16, 2014, Governor Jerry Brown signed into law a three-bill legislative package, composed of AB 1739, SB 1168, and SB 1319, collectively known as the Sustainable Groundwater Management Act (SGMA), providing California with a framework for sustainable groundwater management for the first time in its history. SGMA aims to ensure the reliability and quality of critical groundwater resources throughout the state. Recognizing that groundwater is most efficiently managed at the local level and each groundwater basin is different, the intent of SGMA is to facilitate and strengthen local control and management of groundwater basins. For groundwater basins designated as medium or high priority, SGMA requires the formation of a Groundwater Sustainability Agency (GSA), responsible for developing and implementing a Groundwater Sustainability Plan (GSP) that considers the interests of all beneficial uses and users of groundwater in the basin. SGMA also requires that these basins reach and maintain sustainability within 20 years following plan implementation.

Sustainable groundwater management is defined as the *"…management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results…"* (Water Code Section 10721 (v)). SGMA has identified six sustainability indicators which refer to effects caused by groundwater conditions occurring throughout a basin that, when significant and unreasonable, cause undesirable results (Water Code Section 10721(x)). These are:

- Reduction of Groundwater in Storage
- Chronic Lowering of Groundwater Levels
- Seawater Intrusion
- Degraded Water Quality
- Land Subsidence
- Depletion of Interconnected Surface Water

The goal of the GSP is to ensure that groundwater continues to be available to everyone who uses it far into the future.

The Upper San Luis Rey (USLR) Valley Groundwater Subbasin (or Subbasin) is a medium-priority basin. As a result, the Upper San Luis Rey Groundwater Management Authority (USLRGMA), formerly the Pauma Valley GSA, was formed and consists of Yuima Municipal Water District (YMWD), Pauma Municipal Water District (Pauma MWD), Pauma Valley Community Services District (CSD), San Luis Rey Municipal Water District (SLRMWD), and the Upper San Luis Rey Resource Conservation District (USLRRCD). The GSA was created to help, not hinder, the effective use of groundwater, and developed this GSP for achieving long-term groundwater sustainability in the Subbasin.

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The initial GSP was submitted to the California Department of Water Resources (DWR) in January 2022. DWR issued an approval of the GSP on January 18, 2024, which included some Recommended Corrective Actions (RCAs) to enhance the GSP and facilitate future evaluations (DWR, 2024; included here as Appendix 1b). This GSP Amendment incorporates additional data about current conditions, refines the previous monitoring network, provides additional clarification and discussion about Sustainable Management Criteria (SMC), addresses RCAs from DWR's review of the original GSP, and incorporates additional regulatory requirements. Changes to the GSP, particularly regarding responses to DWR's RCAs, are documented in the 2027 Periodic Evaluation for the USLR Valley Groundwater Subbasin, which is being submitted as a companion document to this GSP Amendment.

The goal of the GSP is to ensure that groundwater continues to be available to everyone who uses it far into the future. The Plan considers the best available scientific data and local knowledge of the Subbasin to describe Subbasin conditions, including the geology of the Subbasin and groundwater levels within it. The Plan also establishes sustainability goals for the Subbasin and outlines steps and potential management actions to ensure sustainability.

The primary sections of the GSP include:

- **Executive Summary** provides a succinct summary of the contents of the GSP.
- **Section 1.0 – Introduction** provides an introduction to the GSP, including objectives of the GSP, agency information, and GSP organization.
- **Section 2.0 – Plan Area** describes the geographic setting, existing water resources planning and programs, relationship of the GSP to other general-plan documents within the Subbasin area, and additional GSP components such as land use plans, well and project permitting processes, control of saline water, and current groundwater projects.
- **Section 3.0 – Basin Setting** describes the physical components of the USLR Valley Groundwater Subbasin and provides a hydrogeologic conceptual model for the understanding of groundwater conditions in the subbasin and development of groundwater budgets.
- **Section 4.0 – Sustainable Management Criteria** describes the sustainability goals set by the GSA, defines undesirable results (URs), minimum thresholds (MTs), measurable objectives (MOs), and interim milestones (IMs).
- **Section 5.0 – Monitoring Network** describes the ~~initial~~ monitoring network established and monitored during ~~development~~ implementation of the GSP, recommendations for monitoring network modifications ~~following Plan implementation~~ to improve data coverage in data gap areas, assess sustainability criteria, and evaluate impacts from proposed projects and management actions, and outlines monitoring protocols and field sampling procedures.
- **Section 6.0 – Projects and Management Actions** provides a framework to achieve the sustainability goal for the USLR Valley Groundwater Subbasin by listing potential management actions and/or projects that may be utilized to ensure long-term sustainability, mitigate potential undesirable results, and potentially increase sustainable yield of the subbasin through additional or supplemental recharge.

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- **Section 7.0 – Plan Implementation** describes the GSP implementation process, including estimated costs, sources of funding, a preliminary schedule, methodology for annual and five-year reporting, and how progress evaluations will be made over time.

0.2 Plan Area

0.2.1 General Setting and Jurisdictional Area

San Luis Rey Valley Groundwater ~~B~~Subbasin, located in San Diego County, extends from the confluence of the San Luis Rey River and Paradise Creek, continuing downstream through four valleys (Pauma, Pala, Bonsall, and Mission) and ending at the Pacific Ocean in the City of Oceanside (Figure 0-1). It is classified as subbasin 9-007.01 by ~~the California Department of Water Resources' (DWR)~~ Bulletin 118 (DWR, 2016). Assembly Bill No. 1944, Chapter 255 (AB 1944, 2018), an act to amend Section 10721 of and to add Section -10722.5 to the Water Code, defines the boundary that divides the Upper and Lower San Luis Rey Valley Groundwater Subbasins.

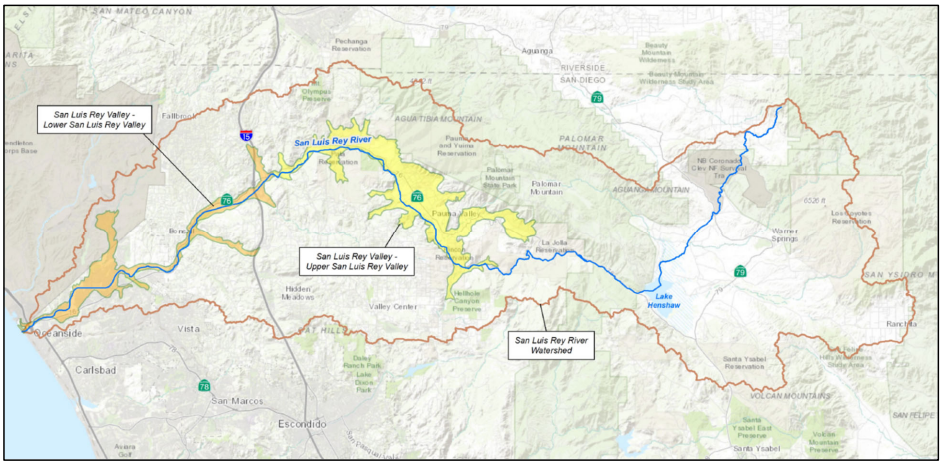

Figure 0-~~10~~ 1. Upper San Luis Rey Valley Subbasin Setting

The USLR Valley Groundwater Subbasin can be further subdivided into two subbasins: the Pauma Subbasin and the Pala Subbasin (Figure 0-2). The Pauma Subbasin extends from the confluence of the San Luis Rey River and Paradise Creek to the Agua Tibia Narrows near the confluence of the San Luis Rey River and Frey Creek. The Pala Subbasin extends from the Agua Tibia Narrows to Monserate Narrows. Based on prior decisions by the State of California, groundwater in Pala Subbasin, located downstream of Frey Creek, has been determined to be a subterranean stream flowing through known and definite channels (SWRCB, 2002).

SGMA specifically excludes subterranean streams from its requirements. However, while subterranean streams are generally excluded from SGMA, Assembly Bill 1944 was put forth to include the area of the subbasin downstream from Frey Creek (i.e., Pala Subbasin) as part of SGMA for the purposes of

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groundwater sustainability. AB 1944 does not alter any existing water right. Therefore, the GSP components address both the Pauma and Pala Subbasins.

There are several water agencies within the Plan Area that serve areas within the subbasin. In addition, the Plan Area includes several Sovereign Tribal Nations that have autonomy over their lands and follow Federal environmental laws and regulations. The La Jolla Band of Luiseno Mission Indians, Rincon Band of Luiseno Mission Indians, Pauma Band of Luiseno Mission Indians, and Pala Band of Luiseno Mission Indians monitor water resources on their respective reservations (RWMG, 2018).

0.2.1.1 Land and Water Use

Land use within Pauma subbasin is predominantly irrigated agriculture/parks/golf (~~52~~49%), followed by ~~27~~28% open space/ water, ~~17~~19% residential, and 4% commercial/ industrial/ public facilities. In Pala Subbasin, land use is approximately ~~42~~44% open space/ water, ~~38~~35% irrigated agriculture/ parks, 12% residential, and 8% commercial/ industrial/ public facilities. Likewise, the majority of water use within the subbasin is for agricultural purposes (within the YMWD service area, approximately 91% of the water goes to agricultural use). Sources of water within the USLR Subbasin include groundwater, surface water, and imported water.

- **Groundwater** is produced primarily from the alluvial- (sediment-) filled valley areas, with ~~minor~~ contributions from hard rock/fractured aquifer systems along the edges of and underlying the groundwater subbasin. In 2002, the State Water Resources Control Board (SWRCB) determined that water within Pauma Subbasin, while hydraulically connected to the San Luis Rey River, is percolating groundwater and not part of the river flow as it filters through the ground (Decision 1645). Through the same SWRCB Decision 1645, Pala Subbasin was found to be confined subterranean San Luis Rey River streamflow through known and defined channels. However, for the purposes of SGMA, the technical assessment of groundwater conditions and evaluation of the appropriate management strategies will be applied to the Pala Subbasin with understanding that the GSP has no authority over water rights ~~there~~in tribal reservation areas.
- **Surface water** flow in the San Luis Rey River, which runs through the USLR Valley Groundwater Subbasin, is largely controlled by operations at Henshaw Dam, which is owned and operated by Vista Irrigation District (VID). The majority of this water is diverted for treatment and use within VID and City of Escondido services areas, as well as for deliveries to the Rincon Band of Luiseno Indians. Several other entities within the USLR Valley Groundwater Subbasin also hold active surface water diversion rights, which are available to view on the California Water Accounting, Tracking, and Reporting System (CalWATRS ~~Electronic Water Rights Information Management System (eWRIMS)~~).
- **Imported water** use in the Subbasin is made available through YMWD, who receives Colorado River and State Water Project (SWP) supplies via a membership with the San Diego County Water Authority (Water Authority). The Water Authority takes delivery of water from Metropolitan Water District of Southern California (Metropolitan) and transports the water to the YMWD delivery point near Couser Canyon Road in Valley Center, just north of Lilac Tunnel.

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0.2.2 Water Resources Monitoring and Management Programs

While local districts ~~have~~ generally maintained records within their individual service areas prior to GSP development, there ~~is currently~~was no unified monitoring plan in the Pauma/ Pala Subbasins. This GSP recommends a unified monitoring program to provide accurate and needed information regarding regional groundwater conditions throughout the two subbasins (Section 5.0 Monitoring Network). In addition, future involvement of the local ~~Tribal~~ tribal entities may allow the beneficial incorporation of additional monitoring locations and Subbasin coverage.

~~In addition, r~~Regulatory guidelines, planning recommendations, and other existing documents are currently used to broadly manage Plan Area groundwater and the groundwater surrounding the USLR Valley Subbasin. These management programs and studies have been developed by multiple agencies and organizations for a variety of purposes, but none of them have been specifically developed for the USLR Valley Subbasin. This GSP outlines a localized focus for sustainable groundwater management.

0.2.3 General Plan and Related Land Use Planning

Future land use in the USLR Valley Groundwater Subbasin is anticipated to remain predominantly agricultural. Previous estimates of population growth in the Pauma Subbasin have been on the order of 0.5% per year, or less (Weinberg and Jacoby, 2016a). Considering that only about 2.5% of total Pauma Valley demand is residential, the increase in population growth is expected to be negligible with respect to overall water demand. However, any unforeseen changes in land and/or water use will need to be taken into consideration in future GSP reporting and groundwater management.

0.2.4 Notice and Communication

Under the requirements of SGMA, GSAs must consider interests of all beneficial uses and users of groundwater when developing and implementing a GSP. As a result, the GSP ~~development~~ needs to consider effects to other stakeholder groups in or around the groundwater basin with overlapping interests. These interests include, but are not limited to, holders of overlying groundwater rights (including agriculture users and domestic well owners), public water systems, local land use planning agencies, environmental users, surface water users, federal government, California Native American tribes, and disadvantaged communities (DACs).

The GSA would like to hear from well owners and other stakeholders on how ongoing communication and participation could be enhanced in the future.

The development of a GSP is a collaborative process involving all interested stakeholders. Public input is critical to the success of the USLR Valley Subbasin GSP and was a key component of its development. Notification and communication activities for the development of this GSP were guided by the Public Involvement Plan and included several public workshops to review progress throughout the development of the GSP and allow an avenue for incremental feedback. Stakeholder meetings, including in-person and virtual options, have continued during GSP implementation through USLRGMA Board meetings and GSP workshops. Meeting agendas and associated information are made available on the USLRGMA website for stakeholder and tribal review. While the GSA's efforts to do community outreach have been proactive, the GSA would still like to hear from well owners and other stakeholders on how ongoing communication

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and participation could be enhanced in the future. Continued outreach is planned through future projects and management actions ~~and programs~~.

0.3 Basin Setting

0.3.1 General Setting

As mentioned previously, the USLR Groundwater Subbasin includes the Pauma and Pala Subbasins and encompasses approximately 19,200 acres in San Diego County (Figure 0-2). The valley areas are separated by narrow, steep-walled canyons and underlain by unconsolidated sediments that serve as storage for groundwater. Elevation ranges from approximately 250 ft above mean sea level (amsl) in valley areas to over 5,700 ft amsl in the surrounding watershed area. The majority of land in the groundwater subbasin is used for agriculture, consisting primarily of citrus, avocados, and sub-tropical fruits. The main surface drainage feature in the area is the San Luis Rey River, which flows in a northwesterly direction through Pauma Subbasin and into Pala Subbasin, where it turns to the southwest and flows through the Monserate Narrows and into downgradient Bonsall Subbasin. Vegetation in the Plan Area includes chaparral, coastal sage scrub, and oak woodland.

The general climate of the area is Mediterranean, with warm, dry summers and mild winters, although temperatures do occasionally fall below freezing. Most precipitation falls between the months of November and April with infrequent rain the rest of the year (particularly in summer months). Precipitation is also two to three times greater in the surrounding hills and mountain areas than in the valley areas. Periods of drought (below-average rainfall) punctuated by wet periods are common, making year-to-year rainfall highly variable. Average annual precipitation for the period from 1943 through ~~2020~~ 2025 is approximately 24.3 inches at the Lake Henshaw precipitation station, which has the most complete and extensive precipitation record available in the vicinity of the USLR Valley Groundwater Subbasin. Since this station is located at a higher elevation than the majority of the groundwater subbasin, precipitation in the valley areas is expected to be less.

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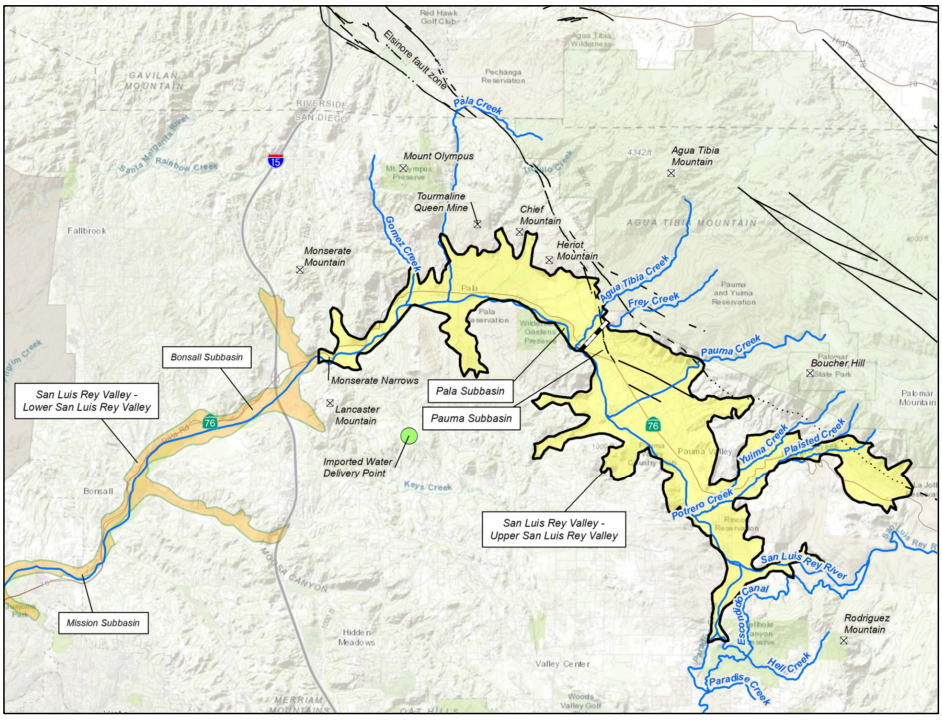

Figure 0-~~2~~20 ~~2~~. Geographic Setting

0.3.2 Geology

The USLR Valley Groundwater Subbasin lies within the Peninsular Ranges Physiographic Province of Southern California, which is characterized by mountainous ridges and hills surrounding valleys and basins. The Peninsular Ranges have been subject to a range of tectonic forces, including faulting, tilting, regional uplift, and subsequent erosion. The main structural feature in the Plan Area is the Elsinore fault zone, which runs northeast of the Valley (Figure 0-2). The Elsinore fault zone represents the westernmost onshore branch of the San Andreas fault system and extends over 200 km from the southern Los Angeles Basin into Mexico (where it becomes known as the Laguna Salada fault). No major earthquakes have occurred along the Elsinore Fault in the USLR Valley Groundwater Subb~~B~~asin since the establishment of the Pala Mission in 1816.

The Pala and Pauma Valleys are underlain by valley fill consisting of unconsolidated flood plain and alluvial materials (collectively referred to as “alluvium”) deposited by running water and/or weathering and gravity processes. Valley fill is surrounded by and underlain by crystalline bedrock, which is locally fractured (Figure 0-3). The main geologic units found in the USLR Valley Groundwater Subbasin include (from oldest to youngest):

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- Bedrock: crystalline rock which provides only limited amounts of groundwater through fractures and joints.
- Older Alluvium: slightly cemented (consolidated) material deposited by surface water flow in the central Subbasin area. Important source of groundwater.
- Lakebed Deposits: silt and clay material thought to be deposited during the last Ice Age when blockage of the San Luis Rey River resulted in an ancient lake covering much of Pauma Subbasin. The fine-grained nature of this geologic unit can restrict groundwater percolation from above.
- Alluvial Fan Deposits: alluvial material of mixed size (fine-grained to very coarse-grained, including boulders) located primarily along the northeastern flanks of the mountains. They generally have lower groundwater yields than the other alluvial materials but are an important source of groundwater recharge.
- Younger Alluvium: recent river channel deposits found along the central Subb~~b~~asin area.

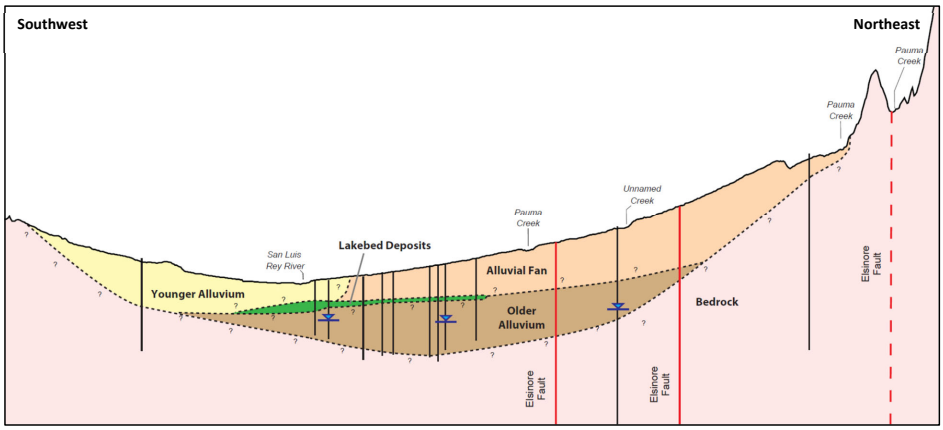

Figure 0-~~3~~0-~~3~~. Geologic Cross-Section through Pauma Subbasin

0.3.3 Hydrology

0.3.3.1 Basin Boundaries

During the course of developing this GSP, it has been found that the current basin boundaries (as defined through DWR) do not adequately represent the true extent of the groundwater subbasin based on geologic contacts and topographic changes indicating the presence of crystalline bedrock. A process for redefining or refining groundwater basin or subbasin boundaries has been provided to local agencies through SGMA. However, a modification period has not been available since the development of this GSP and there is no updated information on DWR's website on when another modification period might open. ~~the next basin boundary modification period is not expected before 2022.~~ This GSP has been prepared using the currently-defined subbasin boundaries but sets the foundation for future modifications that would allow the groundwater subbasin boundaries to coincide with the geologic conditions present in the

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subbasin – particularly along the edges. The proposed boundaries were based on available geologic mapping supplemented by topographic information and aerial imagery.

0.3.3.2 Groundwater Occurrence and Aquifer Systems

The majority of groundwater in the USLR Valley Groundwater Subbasin is produced from the porous flood plain and alluvial material representing valley fill. Productivity generally decreases with decreasing thickness of unconsolidated material. Alluvial sediments in valleys are generally thickest under the San Luis Rey River. In Pauma Valley, sediments may be up to 600 ft thick in localized areas of the northeast portion of the subbasin (Layne, 2010). However, these locations with greater sediment depth typically coincide with alluvial fan deposits, which tend to be less productive. The Pauma and Pala Subbasins are hydraulically connected, with groundwater from the upgradient Pauma Subbasin flowing into Pala Subbasin.

Information from GSP monitoring efforts has confirmed localized perched conditions in Pauma Subbasin above a fine-grained clay and silt layer representing lakebed deposits from paleo Lake Pauma. However, most of the wells in this area are drilled through the perched layer to the underlying principal aquifer.

There are also quite a few wells within the valley and foothill areas that tap fracture systems in underlying and surrounding crystalline bedrock. However, due to the typically reduced capacity of these bedrock units to transmit reliable or significant quantities of groundwater to wells, bedrock is not considered to be a~~n~~ separate aquifer unit within the Plan Area. However, these units may contribute some water to the overlying alluvial aquifer system in the form of mountain front recharge and pumping from the bedrock is accounted for in the groundwater flow model and water budgets.

The aquifers in the Pauma and Pala Subbasins are used for domestic, agricultural, commercial, and municipal water supply purposes. The majority of urban areas are supplied water by water agencies but there are some private wells that provide water for domestic use. The majority of private pumping is used for agricultural irrigation.

0.3.3.3 Groundwater Recharge and Discharge

Identifying sources and locations of groundwater recharge and discharge is an essential component of the hydrogeologic conceptual model as well as for the development of water budgets for the USLR Valley Groundwater Subbasin. General sources of groundwater inflow (recharge) and outflow (discharge) are summarized in the following table.

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Table 0-1. USLR Valley Groundwater Subbasin Inflows and Outflows

	Term	Description
Groundwater Recharge	Recharge from Mountain Front Runoff	Includes both recharge from ungaged surface runoff and subsurface inflow through fractures and faults in the surrounding bedrock. It is assumed to occur along the contact between upgradient outcrops of bedrock and downgradient unconsolidated valley materials.
	Areal Recharge from Precipitation	Refers to the process by which a portion of precipitation falling on the ground surface within the Subbasin infiltrates downward beyond the root zone where evapotranspiration (ET) may occur. This deep percolation is assumed to eventually recharge the groundwater system. It is assumed to occur fairly evenly across the valley floor.
	Streambed Percolation	Recharge to groundwater from streamflow percolation. Occurs in the San Luis Rey River and tributary systems when surface flow is present.
	Return Flow from Applied Water	Refers to the amount of water that returns to the groundwater aquifer after application of water to the land surface in the form of irrigation, from leaks in water lines, or septic seepage. This includes the use of groundwater, surface water, and imported water. Occurs throughout the subbasin and varies by application.
	Recycled Water Spreading	The percolation of treated effluent from water treatment facilities. Occurs at the Pauma Valley Treatment Plant, ~~Pauma~~ Casino Pauma wastewater treatment plant, and Pala wastewater treatment plant.
Groundwater Discharge	Groundwater Pumping	Pumping of groundwater through wells – represents the primary source of discharge from the USLR Valley Groundwater Subbasin. Pumping records were requested from Subbasin stakeholders as part of the GSP effort and were received from many of the water purveyors in the Subbasin and several large agricultural entities. The remaining unreported groundwater pumping was estimated to be water use not met by reported pumping, based on available well information, land use and crop type/coverage through time obtained from the County Department of Planning and Land Use, or other estimates of water use from previous studies.
	Rising Water Discharge to Surface Flow and Subsurface Outflow	A stream gains or loses water depending on groundwater elevation relative to stream elevation. When stream levels are higher than groundwater levels, the stream loses water to the aquifer through percolation; when groundwater levels rise above stream or land surface elevations, the stream gains water from the aquifer. This is known as rising water. In the USLR Valley Groundwater Subbasin, the main area of rising water is at and before the Monserate Narrows, at the end of Pala Subbasin. Groundwater underflow outflow to Bonsall Subbasin also occurs in the river sediments running through the Monserate Narrows.
	Evapotranspiration (ET)	Includes the consumption of surface and groundwater through evaporation and transpiration by plants. In general, groundwater ET decreases with decreasing groundwater elevation and is the highest in areas where groundwater level elevations approach or exceed the ground surface (where plants can access groundwater).

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0.3.3.4 Current and Historical Groundwater Conditions

Contours of groundwater elevation were developed based on available observed water level data and model-calculated surfaces. Current groundwater contours (~~2020~~Fall 2025) are shown on Figure 0-4. The groundwater elevation contours represent lines of equal elevation on the groundwater surface. Groundwater flow occurs perpendicular (i.e., at 90°) to the elevation contours. As indicated by the figure, there are few available water level data in Pala Subbasin to constrain water level contours, highlighting the need for additional water level data and potential groundwater monitoring.

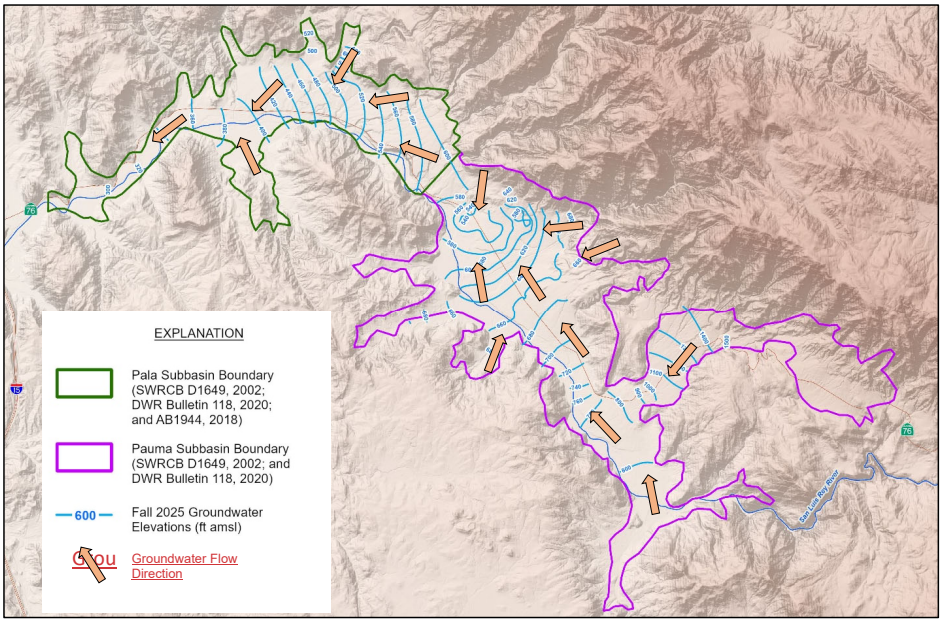

Figure 0-~~40~~-4. Groundwater Elevation and Flow Directions (~~2020~~2025)

Hydrographs, or plots of water level measurements through time, were also assembled from available information. Typical hydrographs for Pauma and Pala Subbasins are shown on Figure 0-5. As shown on the plots groundwater levels in Pauma Subbasin show declines in earlier time periods, such as the late 1980s through the early 1990s. It is thought that these water level declines indicate an increase in agricultural production in the area at a time when imported water deliveries to the subbasin were still relatively small. Declines in groundwater levels are also typically more pronounced in the alluvial fan areas of the subbasin and tend to be more consistent along the axis of the valleys. ~~While less data are available in the Pala Subbasin, the Barona Tribal Authority reported historical low groundwater levels at certain wells in the late 1990s and early 2000s (County, 2010).~~ Declines in water levels were ~~also~~ observed in the 1940s and 1950s (Howes, 1955). More recently, observed groundwater elevations reached observed lows near the end of a drought period from 2012 through 2016. ~~Declines in groundwater levels are also typically more pronounced in the alluvial fan areas of the subbasin and tend to be more consistent along~~

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~~the axis of the valleys.~~ Limited data from Pala Subbasin indicate that groundwater levels may be fairly stable, particularly in downgradient areas where depth to water becomes shallower.

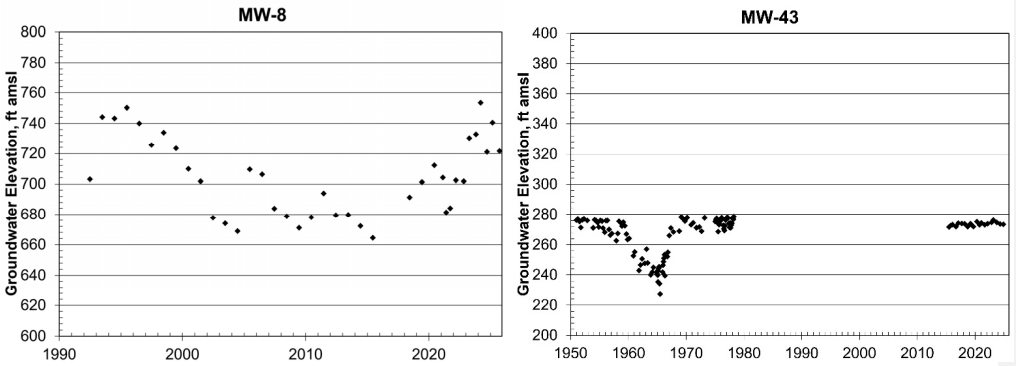

Figure 0-~~5~~0-~~5~~. Typical Groundwater Hydrographs for Pauma Subbasin (left) and Pala Subbasin (right)

Starting in the early 2000s, water level elevations in Pauma Subbasin generally begin to respond more to trends in precipitation (groundwater elevations stabilize under average hydrologic conditions, increase under wet hydrologic conditions, and decrease when hydrologic conditions are dry). In the last ~~five to~~ ten years in particular, groundwater levels in many parts of the S~~s~~ubbasin show recovery. This coincides with average to wet hydrologic conditions and the increased use of imported water (averaging approximately ~~3~~4,~~8~~600 ~~-~~acre-ft/yr over the last 10 years).

Therefore, following a period of decline averaging approximately 1 to 4 ft/yr over the last 30 years, groundwater levels in the USLR Groundwater Subbasin ~~appear to have become fairly balanced~~flattened out and have recovered significantly over the last 10 years or so. In addition, many wells show recent recovery – likely due to a stabilization in land use and the increasing use of supplemental water through imported water deliveries. However, given the current water demand and use, this implies that the continued maintenance of groundwater levels in the subbasin may rely on the continued use of imported water.

0.3.3.5 Groundwater Quality

Most common water quality contaminants in San Diego County include elevated nitrate, naturally occurring radionuclides, total dissolved solids (TDS), and bacteria. Most common sources of anthropogenic contamination include leaking underground fuel tanks, sewer and septic systems, agricultural applications, and facilities with excess animal waste. At present, there are no sites under regulatory clean-up within the USLR Groundwater Subbasin. Within the USLR Valley Groundwater Subbasin, the main constituents of concern are TDS, nitrate, and perchlorate.

TDS is a measure of salinity which accounts for all dissolved solids in water (as milligrams per liter [mg/L]) including organic and suspended solids and is commonly analyzed to determine general suitability for human consumption. A TDS concentration of 500 mg/L is the secondary standard for drinking water

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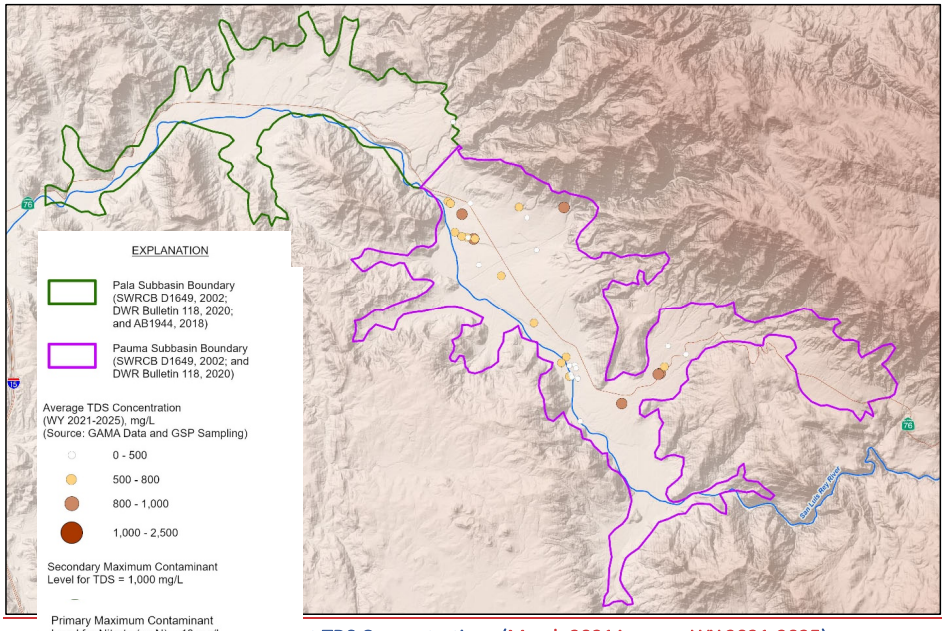
established by the U.S. EPA and State Water Resources Control Board. A TDS of greater than 1,000 mg/L is generally considered to be brackish water and not suitable as a potable supply without treatment or blending. The groundwater quality objectives for TDS in the Pauma and Pala Subbasins are 800 and 900 mg/L, respectively. TDS concentrations in the USLR Valley Groundwater Subbasin were evaluated based on available water quality data and recent groundwater quality sampling as part of the ~~initial~~ GSP monitoring network ~~to establish a baseline for groundwater conditions~~. Historically, TDS in the subbasin ranges from 19.6 mg/L to 1,~~950~~400 mg/L. Current TDS samples (from water year (WY) 2021 through 2025) indicate concentrations ranging from 19~~2~~0 mg/L to 1,~~400~~100 mg/L (Figure 0-6). ~~Current ambient TDS concentration in Pauma Subbasin, taken to the be the median concentration of average water quality in wells with at least three water quality readings from 2015 through 2020, is 607 mg/L.~~



nt TDS Concentrations (~~March 2021~~Average WY 2021-2025)

Nitrate is commonly associated with the industrial process of manufacturing synthetic fertilizers and with agricultural activities, septic systems, confined animal facilities, and wastewater treatment facilities. However, nitrate in water can also be naturally occurring. Nitrate in drinking water is a health concern to both humans and animals, and the State has established an MCL of 10 mg/L for nitrate as nitrogen (N). The State's Public Health Goal (PHG) for nitrate as NO_3 is 45 mg/L (SWRCB, 2020). Historically and currently, nitrate (as N) in the USLR Subbasin ~~ranges~~ has ranged from ~~0.02 mg/L~~non-detect to ~~29.4~~62 mg/L (Figure 0-7). The highest nitrate concentrations occur in the upper portion of the Pauma Subbasin, generally above Sycamore Canyon. This area has been identified as the Upper Pauma Nitrate/Perchlorate-Affected Area based on historical (pre-2015) and recent nitrate and perchlorate data showing elevated concentrations in this localized portion of the Subbasin. Review of available nitrate and groundwater level

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data indicates that increasing nitrate trends in several wells in this area are correlated with rising groundwater levels. This relationship suggests that at least a portion of the observed nitrate increase may reflect remobilization of nitrate stored in the vadose zone from historical (pre-2015) and ongoing agricultural and septic sources as the water table rises. ~~Current samples indicate nitrate (as N) concentrations ranging from 1.6 mg/L to 32 mg/L (Figure 0-7). Current ambient nitrate (as N) concentration in Pauma Subbasin is 5.8 mg/L (or 25.8 mg/L nitrate as NO_3).~~

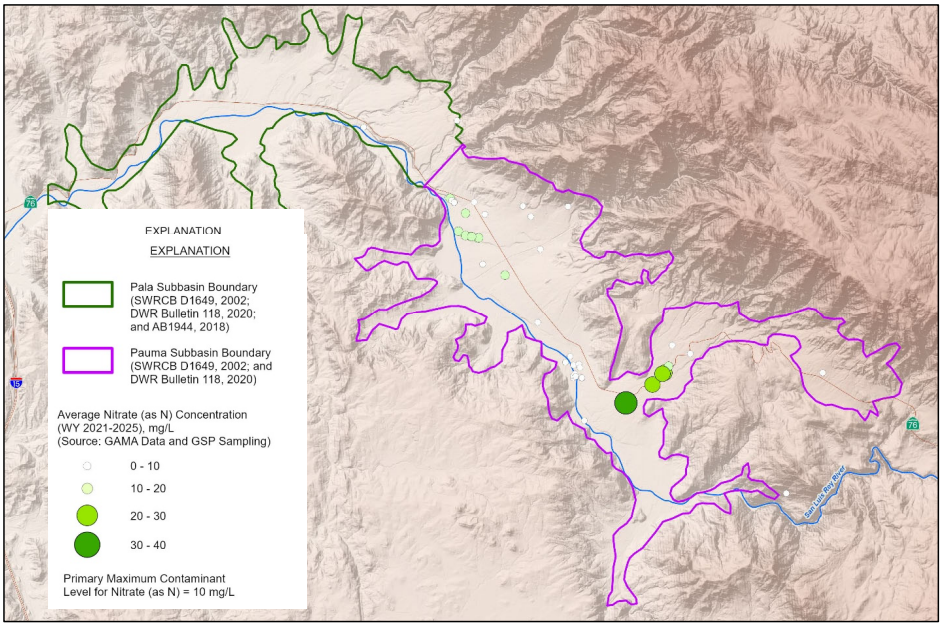

Figure 0-~~7~~0-~~7~~. Current Nitrate (as N) Concentrations (~~March 2021~~Average WY 2021-2025)

Perchlorate in groundwater is typically associated with aerospace and military operations, specifically the manufacturing, testing, and disposal of rocket propellants, explosives, and fireworks, but can also be associated with the use of particular fertilizers in agricultural areas. Perchlorate exists within certain areas of the Subbasin, particularly within the Upper Pauma Nitrate/Perchlorate-Affected Area, where measured concentrations have exceeded the MCL of 6 micrograms per liter (µg/L). The co-occurrence of elevated nitrate and perchlorate in the Upper Pauma Nitrate/Perchlorate-Affected Area is consistent with a common or related agricultural source. Historically and currently, perchlorate in the subbasin has ranged from non-detect to 23 µg/L (Figure 0-8). Unlike nitrate, available perchlorate data in the Upper Pauma Nitrate/Perchlorate-Affected Area do not show a clear relationship with groundwater levels. Instead, perchlorate concentrations appear to be generally stable or decreasing. These trends are consistent with cessation or substantial reduction of historical perchlorate loading and possible natural attenuation processes.

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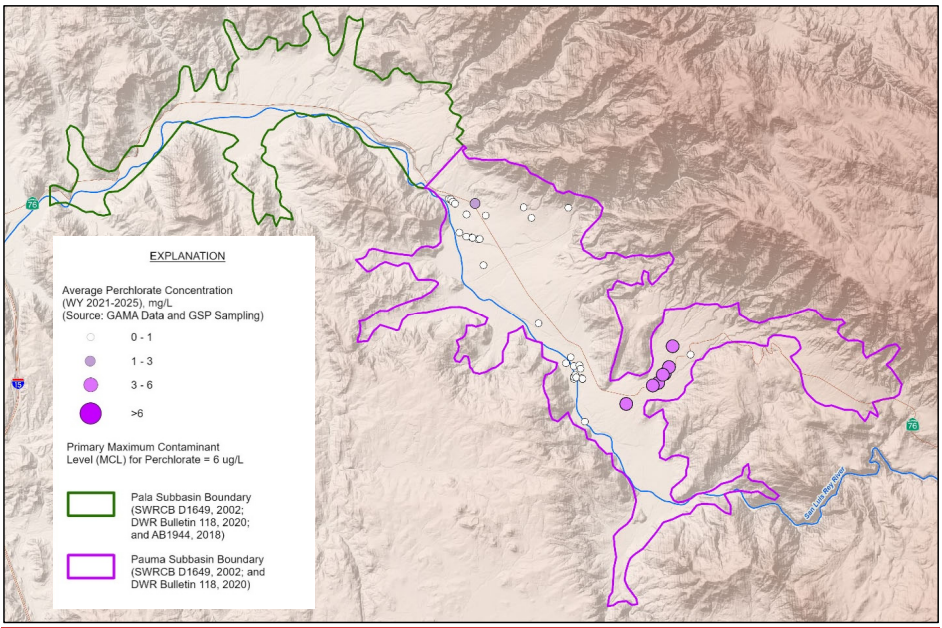

Figure 0-8. Current Perchlorate Concentrations (Average WY 2021-2025)

It is important to note that continuous water quality records within the subbasin are very limited. Recent data (within the last 10 years) is primarily only available in the Pauma Subbasin. The majority of historical data available (from the California Division of Drinking Water's (DDW's) water quality databases) – particularly those in Pala Subbasin and areas overlying reservation lands – represent older records which may not reflect current conditions. ~~The most recent g~~Groundwater sampling ~~event for the establishment of~~during GSP development and implementation, which provides the most recent water quality data, ~~monitoring network baseline conditions~~ took place primarily in the Pauma Subbasin and upper portion of Pala Subbasin based on access to wells.

0.3.3.6 Interconnected Surface Water Systems

Given the depth to groundwater in much of the Subb~~b~~asin, percolation from streamflow is ~~thought to be~~ largely in free fall conditions; that is, the streams are not in direct hydraulic connection with the underlying water table and aquifer system so that surface recharge must percolate through the unsaturated zone before becoming accessible to groundwater pumping. This is especially true for tributaries to the San Luis Rey River (e.g., stream channels crossing alluvial fans). While there are areas within the Subbasin where groundwater has been known to enter the San Luis Rey River (such as in the downgradient Pala Subbasin area where there is standing water), not enough stream flow or groundwater level information near stream channels is available to definitively delineate gaining or losing stream reaches – that is, where streams are interconnected or disconnected from underlying groundwater. This has been identified as a

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data gap area and additional data collection ~~following GSP implementation~~ will help to develop a better understanding of interconnected surface water (ISW)~~s~~ in the Subbasin.

In lieu of surface water and groundwater monitoring data detailing the interconnectivity of surface water with the underlying groundwater system, the USLR watershed and groundwater flow models were used to estimate the portion of streamflow depletion attributable to groundwater pumping by comparing net stream gains over baseline model conditions with a no-groundwater-pumping scenario for the same time period. The model results indicate that from the top of the Subbasin down, the San Luis Rey River passes through three regimes: 1) the river is losing throughout Pauma Subbasin and the upper portion of Pala Subbasin, until the confluence with Marion Creek; 2) the river is transitional in the middle of Pala Subbasin, between Marion Creek and Pala Creek; and 3) the river is persistently gaining in the lower portion of Pala Subbasin, below the confluence with Pala Creek. The results also indicate that groundwater pumping results in simulated depletion of surface water in both the Pauma and Pala Subbasins. However, depletion is highest in years with more precipitation since depletion requires water in the stream and there is more surface water available in wetter years.

0.3.3.7 Groundwater Dependent Ecosystems

The California Department of Fish and Game reported that riparian vegetation adjacent to the river may have historically supported large populations of wildlife, but no records of fish and wildlife existing in the river prior to construction of Henshaw Dam (in 1922) were found in the Department of Fish and Game files (Case Study Report #76). Since construction of the dam, flows between the dam and Escondido Canal are likely insufficient to support fishery habitat. The USLRRCD has several conservation easements for Arroyo Toads in the USLR Valley Groundwater Subbasin, but these habitat areas are primarily dependent on seasonal surface water and the vernal pools created after storm events and do not appear to be maintained by shallow groundwater. Helix Environmental conducted a desktop study to assess the possibility of groundwater dependent ecosystems (GDEs) in the USLR Valley Groundwater Subbasin, but dependency needs to be verified through field investigation and additional data collection.

0.3.3.8 Seawater Intrusion

Saline water intrusion is typically observed in groundwater basins in closer proximity to the coast (e.g., in downstream reaches of the Lower San Luis Rey Valley Groundwater Subbasin), where lowering of groundwater levels from pumping can reverse the groundwater flow gradient and allow ocean water to flow inland to lower groundwater elevations. Given the distance of the USLR Valley Groundwater Subbasin from the coast, the possibility of saltwater intrusion from the ocean is not considered a threat.

0.3.3.9 Land Subsidence

Land subsidence due to groundwater withdrawal is a long-term, gradual phenomenon that can have lasting effects, even after cessation of pumping. Typically, subsidence occurs as the result of the compaction of fine-grained aquifer units (e.g., clays) due to dewatering of the sediment pores from excessive pumping or groundwater withdrawal, but depends largely on the thickness of clay layers and the length of time declines in water levels have been experienced or observed. Thick layers of clay necessary for land subsidence have not been observed in the USLR Valley Groundwater Subbasin. The only significant accumulation of fine-grained sediments are those from paleo Lake Pauma, which have a maximum thickness of about 10 ft and are not continuous throughout the entire Subbasin. Substantial

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long-term declines in groundwater elevations have also not been observed, nor have there been any accounts of historical land subsidence or features associated with subsidence (e.g., ground fissuring). Therefore, subsidence potential in the USLR Valley Groundwater Subbasin is considered to be a very low risk.

0.3.3.10 Water Budget Information

A water budget is an accounting of all water that flows into and out of a specified area (i.e., recharge and discharge), including any resulting water storage change. This may be expressed as:

Inflow = Outflow +/- Change in Groundwater Storage

Water budgets were established for the USLR Valley Groundwater Subbasin using a calibrated ~~surface water~~watershed and groundwater model. The USLR Groundwater Model, which was updated for the 2027 GSP Amendment, ~~(USLRGM)~~ includes an integrated watershed, or surface water, modeling component that accounts for ~~surface water~~land surface processes and was calibrated to available surface flow data from 1991 through September 202~~0~~5. The groundwater model component includes ~~three~~ four model layers representing the major geologic units found in the subbasin (three for the alluvial material and one for the underlying bedrock) and was calibrated to observed groundwater elevations for the same period. Model calibration refers to the process of iteratively changing aquifer parameters (like fluid transmission rates or hydraulic conductivity) within physically reasonable limits to obtain a good match between model-predicted water levels (or streamflow in the case of the ~~surface water~~watershed modeling component).

~~Surface water~~Watershed and groundwater modeling inflow and outflow terms were developed based on the best available data and information (either directly or estimated based on typical modeling methodology). The use of a calibrated groundwater model provides a valuable tool for estimating water budgets since data availability is limited in the subbasin – both geographically (through space) and temporally (through time). The model provides an important check for inflow and outflow term estimates because annual values for these terms must collectively be able to produce simulated water levels and surface flow that closely match observed values. Water budgets were established for historical, current, and future conditions as follows:

- The **historical water budget** for the USLR Valley Groundwater Subbasin was evaluated over the model calibration period from WY ~~January~~ 199~~1~~2 through ~~December~~ 202~~5~~0. This ~~30~~34-year period represents generally average hydrologic conditions (with an average precipitation of 24.~~8~~ 5 inches per year compared to a long-term average of 24.3 inches per year from 1943 through ~~2020~~2025) and includes both dry and wet hydrologic periods. In addition, it represents the period of time for which information – such as water level and pumping data – becomes more readily available.
- The **current water budget** for the USLR Valley Groundwater Subbasin was determined using the same approaches used for the historical water budget, but over the last five years (i.e., WY ~~2016~~ 2021 through ~~2020~~2025). Hydrology (i.e., precipitation) during this period is ~~slightly higher than~~also approximately the same as the long-term average precipitation observed at Henshaw Dam: 2~~5.7~~4.2 inches versus 24.3 inches. However, several wet years within this period have

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helped~~This above average rainfall~~ contribute~~s~~ additional groundwater recharge and less groundwater demand.

- Since land use in the USLR Valley Groundwater Subbasin is not anticipated to change much and no projects or significant changes in water use are currently known, the **future water budget** for the USLR Valley Groundwater Subbasin was evaluated using current land use conditions and the average pumping/imported water use over the last five years. These operational conditions were evaluated over a ~~60~~50-year period (i.e., WY ~~2022~~ 2026 through ~~2081~~2075) of average hydrology representing the period from WY 199~~1~~2 through 202~~0~~5 repeated ~~twice~~approximately 1.5 times.

Average annual inflow and outflow for the USLR Valley Groundwater Subbasin for the various water budget periods are summarized in the following table~~s~~.

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Table 0-2. ~~Upper San Luis Rey~~USLR Valley Groundwater Subb~~B~~asin – Average Annual Groundwater Budgets

	Term	Historical (WY 199~~12~~-202~~05~~)	Current (WY ~~2016~~2021-~~2020~~2025)	Projected (WY ~~2022~~2026-20~~81~~75)
		Annual Average [acre-ft/yr]		
Inflow	Recharge from Mountain Front Runoff	2,976~~7,051~~	3,289~~9,262~~	3,297~~7,051~~
Inflow	Areal Recharge from Precipitation	3,184~~3,790~~	3,194~~4,942~~	3,028~~3,790~~
Inflow	Streambed Percolation	8,297~~6,007~~	9,573~~10,662~~	8,515~~6,914~~
Inflow	Return Flow from Applied Water	2,610~~2,689~~	2,125~~2,320~~	2,287~~2,483~~
Inflow	Recycled Water Spreading	243~~228~~	321~~295~~	321~~295~~
Inflow	**Total Inflow**	**17,309~~19,765~~**	**18,502~~27,481~~**	**17,450~~20,532~~**
Outflow	Groundwater Pumping*	12,969~~14,263~~	10,861~~12,235~~	11,131~~13,659~~
Outflow	Subsurface Outflow	4,316~~4,780~~	4,361~~5,008~~	4,378~~4,858~~
Outflow	Evapotranspiration (ET)	1,942~~2,269~~	1,757~~2,126~~	1,911~~2,123~~
Outflow	**Total Outflow**	**19,227~~21,313~~**	**16,979~~19,369~~**	**17,421~~20,641~~**
	Change in Groundwater Storage	**-1,918~~-1,548~~**	**1,522~~8,111~~**	**27~~-109~~**

* Pumping is inclusive of the entire Subbasin, including pumping on tribal-owned lands.

Table 0-~~3~~4. ~~Upper~~ USLR Valley Groundwater Subbasin – Average Annual Surface Water Budgets

	Term	Historical (WY 1992-2025) [acre-ft/yr]	Current (WY 2021-2025) [acre-ft/yr]	Projected (WY 2026-2075) [acre-ft/yr]
Inflow	Tributary Inflow	15,147	16,351	16,191
Inflow	Runoff	9,702	9,771	9,845
Inflow	Rising Groundwater	4,888	4,110	4,830
Inflow	**Total Inflow**	**29,737**	**30,231**	**30,866**
Outflow	Streambed Percolation	13,184	13,683	13,345
Outflow	Stream Outflow	16,552	16,547	17,521
Outflow	**Total Outflow**	**29,736**	**30,230**	**30,866**

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As shown in ~~the t~~Table 0-2 above, annual change in groundwater storage during the period from WY 199~~1~~2 through 202~~0~~5 was estimated to be -1,~~548~~ 918 acre-ft/yr. This storage decline is reflected in observed water levels in the Subbasin, especially Pauma Subbasin, which show general groundwater declines from the 1990s until the last 10 years or so. The change in storage estimated under current water budget conditions also supports the water levels observed throughout much of the Subbasin, which indicate a recovery in recent water levels and groundwater storage. A combination of ~~above~~ average precipitation and increased use of imported water has allowed groundwater storage to recover by ~~over~~ nearly 8,000 acre-ft/yr for the last five years. A continuation of current water use practices in the Subbasin for the next ~~60~~ 50 years, assuming average hydrologic conditions, is anticipated to continue to be sustainable, with essentially no change in groundwater storage (a slight increase of approximately 30 acre-ft/yr)~~cause additional groundwater storage declines of approximately 100 acre-ft/yr~~. This indicates that current pumping conditions are approximately equal to the sustainable yield of the Subbasin. Additional groundwater management actions, such as water conservation or imported water use (see Section ~~4~~6.0) may be able to increase the amount of water available for additional groundwater pumping~~mitigate the slight projected depletion of groundwater storage~~. However, as mentioned previously, any changes in projected water use (especially increased pumping) will cause changes in the projected water budget that will need to be addressed through additional projects and/or management actions.

Groundwater modeling indicates that the Upper San Luis Rey Valley Groundwater Subbasin is currently being operated within sustainable limits.

0.3.3.10.1 Estimate of Sustainable Yield

Sustainable yield is defined by Assembly Bill 1944 as the maximum quantity of water, calculated over a base period representative of long-term conditions in the Subbasin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result. In the USLR Valley Groundwater Subbasin, the chronic lowering of groundwater levels and significant and/or unreasonable reduction of groundwater storage would represent the primary undesirable results, with potential associated undesirable results to ISW and land subsidence. Therefore, sustainable yield for the USLR Valley Groundwater Subbasin was considered to be the amount of groundwater pumping achievable with no change in groundwater storage and is summarized in the following table.

Table 0-~~4~~3. Estimates of Sustainable Yield for the Upper San Luis Rey Valley Groundwater Subbasin

Period	Groundwater Pumping	Change in Storage [acre-ft/yr]	Sustainable Yield
Historical Period (WY 1992 – 2025) ~~Historical Period (1991 – 2020)~~	13,000 ~~14,300~~	-1,900 ~~-1,500~~	11,100 ~~12,700~~
Current Period (WY 2021 – 2025) ~~Current Period (2016 – 2020)~~	10,900 ~~12,200~~	1,500 ~~8,100~~	12,400 ~~20,300~~
Projected Period (WY 2026 – 2075) ~~Projected Period (2022 – 2081)~~	11,100 ~~13,700~~	0 ~~-100~~	11,100 ~~13,600~~

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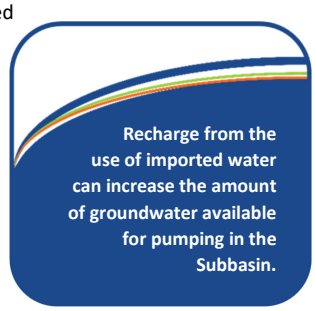
The historical sustainable yield value of ~~12~~11,~~7~~100 acre-ft/yr represents an estimate of pumping that will result in no long-term depletion of groundwater storage for representative, long-term average hydrologic conditions. However, sustainable yield is not a constant value. Due to changes in annual precipitation – and therefore natural recharge – sustainable yield can be assumed to fluctuate annually. In addition, sustainable yield varies depending on cultural conditions in the subbasin, such as changes in land use within the subbasin and irrigation practices, water supply sources (native vs. supplemental), and water management programs (increased use of recycled water or surface water, etc.). This is apparent in estimates of sustainable yield using current groundwater budgets. Under the conditions experienced over the last five years, sustainable yield is estimated to be closer to ~~20~~12,~~300~~ 400 acre-ft/yr. If current water use and land use continues into the future, sustainable yield is estimated to be approximately ~~13~~11,~~600~~ 100 acre-ft/yr.



Future changes in these conditions should be considered through periodic future updates of sustainable yield estimates. An opportunity to refine sustainable yield estimates for the USLR Valley Groundwater Subbasin is provided through future SGMA-required reporting. These reports will incorporate additional metered flows, providing a better indication of actual groundwater pumping, and supplemental water levels established by the proposed monitoring network (Section 5.0).

0.3.3.10.2 Quantification of Overdraft

A groundwater basin is generally regarded as being in overdraft when pumping exceeds natural and artificial groundwater recharge. As presented above, the preliminary estimate of sustainable yield for the USLR Valley Groundwater Subbasin is approximately ~~12~~11,~~700~~ 100 acre-ft/yr. This value indicates that historical pumping rates of 1~~3~~4,~~300~~ 000 acre-ft/yr were in excess of sustainable yield by approximately 1,~~500~~ 900 acre-ft/yr. This additional pumping resulted in observed water level and groundwater storage declines. Current pumping, however, is estimated to be below the estimated historical sustainable yield of ~~12~~11,~~700~~ 100 acre~~-~~ft/yr. Lower pumping rates, in conjunction with average to wet hydrological conditions, ~~has~~ have contributed to increases in groundwater levels seen in many parts of the Subbasin within the last ~~five to~~ ten years. It is important to note that these pumping and sustainable yield numbers still need to be verified through additional data collection and model refinement. Additional pumping data can be used to verify pumping estimates and associated assumptions and allow for the refinement and recalibration of the groundwater model that will, in turn, improve confidence in sustainable yield estimates.

0.4 Sustainable Management Criteria

DWR states *that "SGMA requires local agencies to develop and implement GSPs that achieve sustainable groundwater management by implementing projects and management actions intended to ensure that the basin is operated within its sustainable yield by avoiding undesirable results"* (DWR, 2016). A GSP must also develop quantitative sustainability criteria that allow a GSA to define, measure, and track sustainable management for the sustainability indicators introduced in Section 0.1. However, based on the hydrogeologic conceptual model, seawater intrusion ~~and subsidence are~~is not likely to occur in the USLR

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Subbasin and no sustainability management criteria were therefore developed for ~~these~~ this criteriona~~.~~. Evidence of or potential for ~~land subsidence and~~ seawater intrusion will be reevaluated and/or verified ~~in the five-year report~~during Periodic Evaluations (every five years).

Sustainability criteria include the following:

- Undesirable Result (UR) – significant and unreasonable conditions for any of the six sustainability indicators.
- Minimum Threshold (MT) – numeric value used to define undesirable results for each sustainability indicator.
- Measurable Objective (MO) – specific, quantifiable goal to track the performance of sustainable management.
- Interim Milestone (IM) – target value representing measurable groundwater conditions, in increments of five years, set by the GSA as part of the GSP.

The sustainability goal for the USLR Subbasin is to manage and preserve its groundwater resource as a sustainable water supply. To the greatest extent possible, the goal is to preserve historic operations of beneficial use in the Subbasin as well as allow for future planned uses as conceived by the GSA and Subbasin stakeholders. The sustainability goal will be accomplished by achieving the following objectives:

- Operate the USLR Subbasin groundwater resource within the sustainable yield.
- Implement projects and management actions as needed and as feasible to reduce USLR Subbasin groundwater demands, increase efficient use of current supplies, maximize use of supplemental water supplies, and mitigate undesirable results.
- Actively monitor the USLR Subbasin and adaptively manage projects and management actions to ensure the GSP is effective and that undesirable results are avoided.

Sustainable management involves the use and management of groundwater without causing undesirable results, but it does not necessarily include reversing natural undesirable conditions. In the USLR Subbasin, no undesirable results are currently present nor have been reported historically. Proposed management actions outlined the GSP will further ensure that undesirable results do not occur in the subbasin going forward. Sustainability criteria were developed for representative monitoring sites (RMSs) for each applicable sustainability indicator, as described below.

0.4.1 Chronic Lowering of Groundwater Levels and Reduction of Groundwater in Storage

Groundwater elevations are used as a proxy for groundwater storage in the USLR Valley Groundwater Subbasin. Therefore, the reduction of groundwater in storage is evaluated using the groundwater level SMCs. The selected RMSs for groundwater levels and storage, shown in Figure 0-9, ~~within Pauma Subbasin, which represent a subset of the wells in the preliminary monitoring program (Figure 0-8). These wells~~ were chosen to provide a sufficient distribution throughout the subbasin (though the majority of wells are located in the Pauma Subbasin due to accessibility limitations) and~~,~~ have known well construction details~~, are operational/pumping wells that may be impacted by undesirable results, and have screened intervals representative of aquifer material~~. Wells screened within the alluvial material were prioritized during the selection of RMSs, but the availability of wells to monitor limited the ability to

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do this in certain areas of the Subbasin. Evaluation of groundwater conditions at these sites will be used to show progress towards sustainability, provide early identification of potential problems as they might arise, and allow for timely appropriate decisions to be made regarding additional or modified management actions and projects.

At the moment, wells in the monitoring network are largely represented by municipal and agricultural supply wells. The updated and recalibrated USLR Groundwater Model was used to verify that proposed MTs did not adversely affect other nearby wells, especially domestic wells. ~~It is acknowledged that current sustainability criteria may not be protective of all domestic wells in the basin for which information is largely unavailable. Therefore, additional data will need to be collected following implementation of the GSP to understand where these wells are located, how they operate, and what historical conditions have been in order to determine how beneficial use at these locations can be protected.~~ Overall, the analysis of potential well impacts indicated that the MTs will prevent extensive depletion of supply. However, data are still limited in areas of the Subbasin – particularly related to domestic wells and verified well information. Water level SMCs will be reevaluated at the next periodic evaluation and adjusted as necessary, to accommodate new information about domestic wells and water use to ensure protection of domestic users, including those in the identified DAC area and in tribal areas. ~~At the five-year review period, it may be necessary to adjust sustainability management criteria for water levels to accommodate new information about domestic wells and water use.~~

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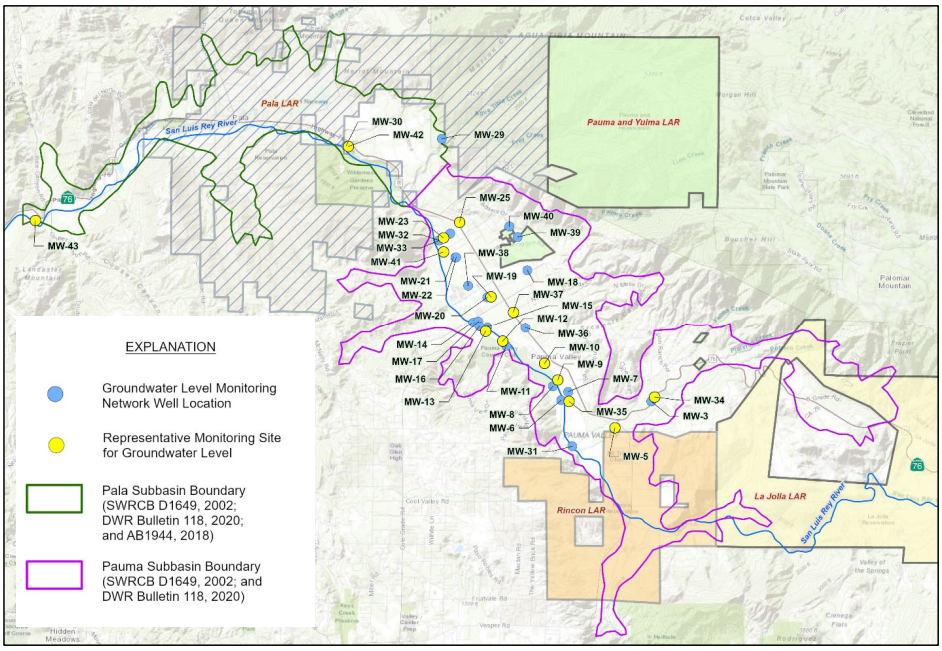

Figure 0-~~90~~ ~~8~~. Wells in ~~Current~~ Groundwater Level Monitoring Network and Representative Monitoring Sites

~~A s~~Summari~~es~~y of the ~~sustainability criteria as relevant to USLR Subbasin and as guided by the Sustainability Goal~~SMCs for groundwater elevations and storage ~~is~~are provided in the table below.

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Table 0-54. ~~Upper San Luis Rey Groundwater Subbasin –~~ Summary of Sustainable Management Criteria – Groundwater Elevation and Storage

Sustainability Indicator	Undesirable Result	Minimum Threshold	Measurable Objective	Interim Milestone
Groundwater Levels	Groundwater levels significantly below the lowest observed or inferred elevation following the 2012-2016 drought in representative wells. May be indicated when two consecutive exceedances occur in each of two consecutive years, in 25% or more of the RMSs.~~Groundwater levels at the elevation of current pump settings in representative wells (wells with known construction details and historical water level elevations)~~	Set approximately 5 ft below the lowest observed or inferred elevation following the 2012-2016 drought period to account for measurement uncertainty and/or resolution.~~Set at wells by operators as lowest operational level[1]~~	Elevation representing approximately three years of groundwater in storage (approximately 46,000 acre-ft above MT elevations, which generally corresponds to 50 ft above MTs, depending on location in Subbasin).~~Elevation representing 3 years of groundwater in storage (approximately 50 ft above MT elevations)[1]~~	Since recent water levels are at or above MOs for water level, IMs have been set at the MO for each RMS.~~IMs for wells with water levels below the MOs will be determined at 5-year reporting after consistent data collection, refinement of groundwater model, and updated analysis of basin storage to evaluate, if appropriate, the quantity of water needed to reach MO elevations~~
Groundwater in Storage	Groundwater levels used as a proxy.~~Groundwater in storage when water levels are at the elevation of current pump settings~~ ~~Groundwater in storage at MTs for groundwater levels~~ ~~3 years of groundwater in storage (approximately 54,000 acre-ft)~~ ~~To be determined at 5-year reporting period based on refinement of groundwater model and analysis of basin storage from expanded data collection~~			
~~Interconnected Surface Water/ Groundwater~~	~~Groundwater levels fall below the lowest groundwater level since 2015 in identified areas with potentially dependent vegetation~~	~~Lowest groundwater level since 2015 in identified areas with potentially dependent vegetation~~	~~Maintain seasonal groundwater levels since 2015 in identified areas with potentially dependent vegetation~~	~~Based on model-simulated hydrographs, none may be needed. This will need to be confirmed through additional monitoring~~
~~Groundwater Quality~~	~~TDS and Nitrate above Basin Objectives (800 mg/L for TDS, 45 mg/L for Nitrate as NO_3)~~	~~Basin Objectives~~	~~TDS and Nitrate as NO_3 at current ambient concentrations (assumed to be the median of available basin wide concentrations: 607 mg/L for TDS, 25.8 mg/L for Nitrate as NO_3)~~	~~Current TDS and Nitrate concentrations are at the measurable objectives~~
~~Subsidence~~	~~Not applicable~~	~~Not applicable~~	~~Not applicable~~	~~Evidence of or potential for land subsidence will be reevaluated in the 5-year report~~
~~Seawater Intrusion~~	~~Not applicable~~	~~Not applicable~~	~~Not applicable~~	~~The absence of seawater intrusion will be verified in the 5-year report~~

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0.4.2 Degradation of Water Quality

The SMC framework is based primarily on applicable drinking water regulations and San Diego Basin Plan water quality objectives. However, the framework also recognizes that portions of the Subbasin contain existing or legacy (pre-2015) water quality impairment. In these areas, continued exceedance of a drinking water benchmark in an already affected well is not, by itself, interpreted as a potential new SGMA undesirable result. Instead, already affected wells are evaluated using site-specific degradation thresholds and sentinel monitoring to determine whether conditions are materially worsening or whether affected groundwater is migrating into areas where water quality is currently less affected. Specifically, an area of increased nitrate and perchlorate concentrations representing preexisting conditions was identified in the Pauma Subbasin, referred to as the Upper Pauma Nitrate/Perchlorate-Affected Area.

Groundwater quality in the Subbasin is influenced by historical and ongoing land uses, imported water quality, septic system loading, agricultural practices, evapoconcentration, and reduced natural recharge associated with surface water diversions outside the direct control of the GSA. The water quality SMCs are therefore intended to identify and respond to significant and unreasonable degradation associated with groundwater conditions managed under the GSP. They are not intended to establish a regulatory cleanup program, supersede the authority of the Regional Water Quality Control Board (RWQCB), RWQCB Division of Drinking Water (DDW), San Diego County (County) Environmental Health, or other regulatory agencies, or require the GSA to remediate water quality impacts caused by historical land use, ongoing permitted activities, septic systems, imported water quality, or other sources outside the GSA's authorities.

The water quality RMS network is shown in Figure 0-10 and primarily represents active public supply wells completed in the principal alluvial aquifer and subject to existing drinking water monitoring obligations. DDW-reported TDS, nitrate, and perchlorate data from these wells will be used when available. Supplemental GSP sampling will be conducted, as needed, during the fall monitoring event when DDW data are not available for a given year, when a required constituent is not included in DDW reporting, or when confirmation, follow-up, or sentinel monitoring is needed following an exceedance or management trigger.

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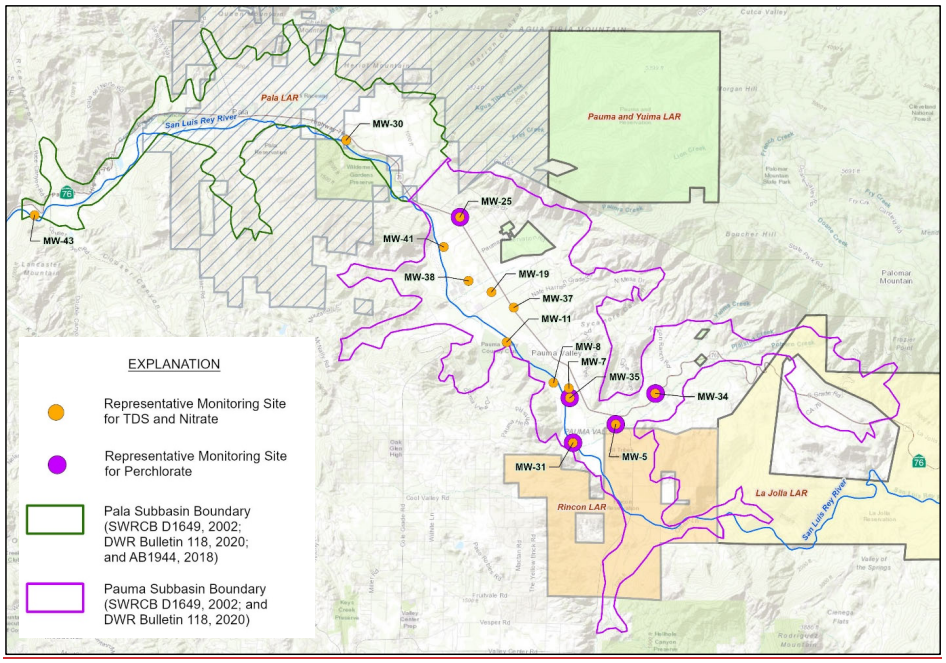

Figure 0-10. Representative Monitoring Sites for Groundwater Quality

A summary of the SMCs for groundwater quality is provided in the table below.

Table 0-~~6~~5. Summary of Sustainable Management Criteria – Groundwater Quality

Undesirable Result	Minimum Threshold	Measurable Objective	Interim Milestone
When groundwater management activities cause or contribute to significant and unreasonable degradation of groundwater quality that impairs, or substantially threatens to impair, the long-term viability of beneficial uses and users in the Subbasin. May be indicated when average annual concentrations at 25% or more of the RMSs exceed MTs for two consecutive annual monitoring events over at least two years, after confirmation sampling and data review (per constituent).	**TDS:** Average annual concentrations above the upper secondary maximum contaminant level (SMCL) of 1,000 mg/L. **Nitrate:** Average annual concentrations of nitrate (as N) above maximum contaminant levels (MCL) or levels associated with preexisting degraded groundwater in the Subbasin (within the Upper Pauma Nitrate/Perchlorate-Affected Area). **Perchlorate:** Average annual concentrations above historical maximum observed values (within the Upper Pauma Nitrate/Perchlorate-Affected Area), above the MCL of 6 µg/L (downgradient well with observable perchlorate), or concentrations above non-detect (directly downgradient of the affected area).	**TDS:** San Diego Basin Plan Water Quality Objectives. **Nitrate**: MCL. **Perchlorate:** MCL for wells with measurable perchlorate, non-detect for those without.	Recognizing that the GSA has little, if any, control over water quality drivers in the Subbasin, IMs have been set equal to the MOs for the duration of the implementation period.

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0.4.3 Interconnected Surface Water

Very few measurements of surface flow are available in Pauma and Pala Valleys. Therefore, current understanding of surface water and groundwater interactions in the USLR Subbasin are informed by reported observations, near-river groundwater levels (where data are available), and the model-estimated location, quantity, and timing of streamflow depletion associated with groundwater pumping using the USLR Groundwater Model. Although the model analysis provides useful information regarding potential depletion, data limitations and consequential uncertainty do not allow for the definition of a specific rate or volume of streamflow depletion that would result in significant and unreasonable impacts to downstream beneficial users, potential GDEs, or habitat areas.

For these reasons, ISW SMCs using groundwater elevations at selected RMSs located along or near the San Luis Rey River have been established as a proxy. Groundwater levels are the most reliable, repeatable, and currently available monitoring data for evaluating whether groundwater conditions near potentially interconnected reaches are worsening. Maintaining groundwater levels above historical low conditions (represented by Fall 2016 conditions) at water level RMSs and at these selected sites is expected to prevent material worsening of hydraulic conditions that could increase depletion of ISW relative to the range of conditions experienced historically and during GSP implementation. ISW-related projects and management actions have been added or revised to address data gap issues that limit the ability to assess the depletion of ISW within the USLR Valley Groundwater Subbasin.

Five RMSs for the evaluation of ISW using groundwater levels as a proxy were selected from the broader groundwater level monitoring network and are located along or near the San Luis Rey River where available monitoring points provide the best existing information regarding groundwater conditions near the river, as shown in Figure 0-11.

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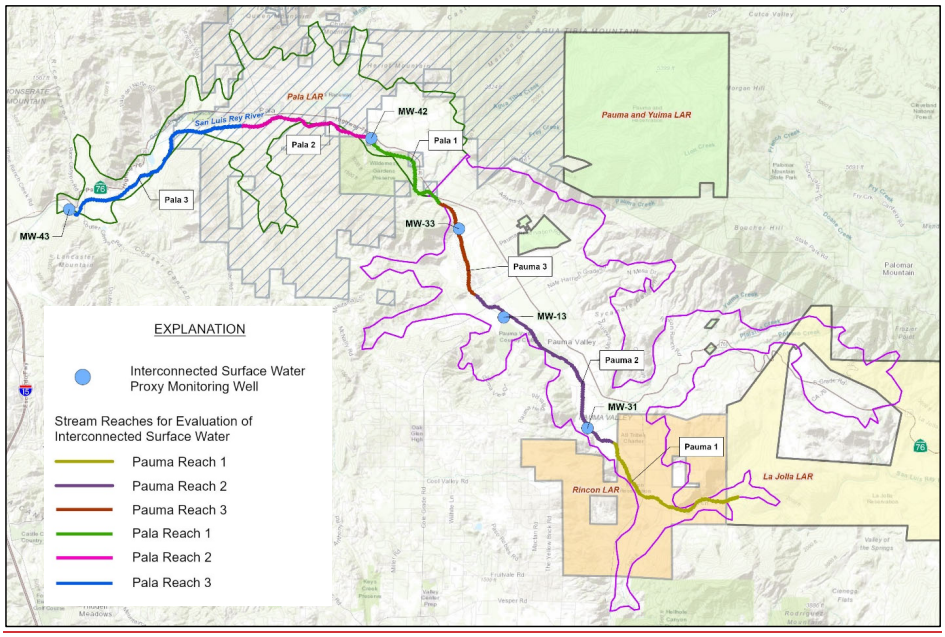

Figure 0-11. Representative Monitoring Sites for Interconnected Surface Water

A summary of the SMCs for ISW is provided in the table below.

Table 0-~~7~~6. Summary of Sustainable Management Criteria – Interconnected Surface Water

Undesirable Result	Minimum Threshold	Measurable Objective	Interim Milestone
When groundwater pumping in the Subbasin causes a significant and unreasonable reduction in surface water flow, surface water persistence, or shallow groundwater conditions that support beneficial uses and users of surface water. May be indicated when groundwater elevations fall below the ISW proxy MTs for two consecutive monitoring events in each of two consecutive water years (reach specific): • Three or more of the five ISW proxy wells, • Both Pala ISW proxy wells, or • Two or more of the three Pauma ISW proxy wells.	Set approximately 5 ft below the lowest observed or inferred elevation following the 2012-2016 drought period to account for measurement uncertainty and/or resolution.	Elevation representing approximately three years of groundwater in storage.	Since recent water levels are at or above proxy MOs for water level, IMs have been set at the MO for each RMS.

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0.4.4 Land Subsidence

Land subsidence is considered as a sustainability indicator for the USLR Valley Subbasin because SGMA requires evaluation of potential significant and unreasonable land subsidence caused by groundwater extraction. However, available information indicates that the Subbasin is at relatively low risk for pumping-induced land subsidence. The Subbasin is small and relatively shallow, with no known documented history of significant pumping-induced land subsidence and no identified record of damage to infrastructure, land use, drainage, or flood-control features attributable to subsidence.

The Subbasin's land subsidence monitoring network will rely primarily on DWR's statewide InSAR dataset available through the SGMA Data Viewer and related DWR tools. RMSs for subsidence were selected throughout the Subbasin using specific InSAR grids as the monitoring sites. Points were chosen to represent the area of greatest risk for subsidence (corresponding to the Paleo Lake Pauma footprint area, which has a documented and consistent fine-grained layer and also coincides with an area of significant groundwater production) and substantial infrastructure within the Subbasin. Subsidence RMSs are shown in Figure 0-12.

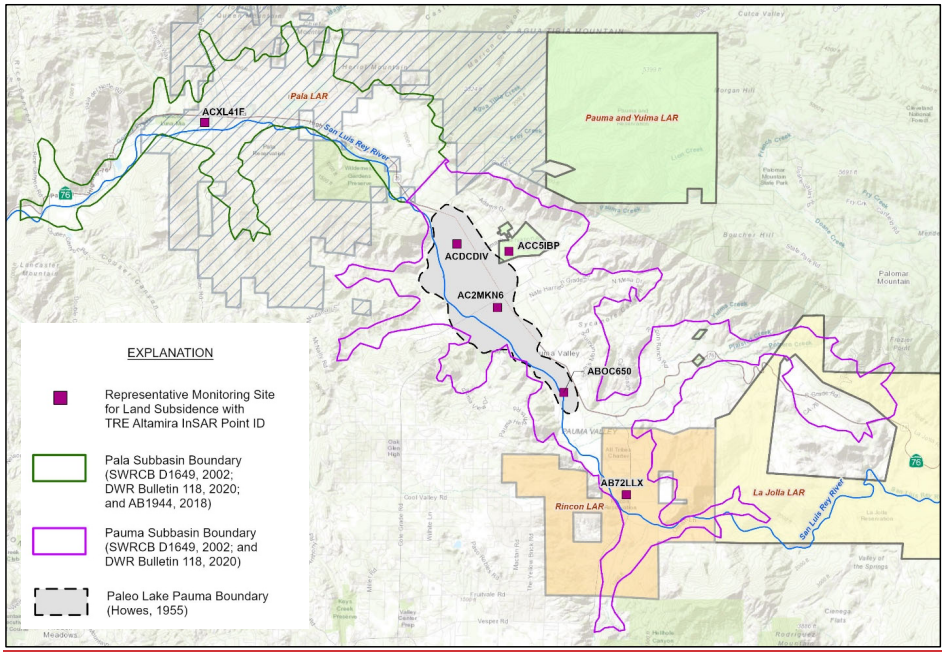

Figure 0-12. Representative Monitoring Sites for Land Subsidence

A summary of the SMCs for land subsidence is provided in the table below.

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Table 0-~~8~~6. Summary of Sustainable Management Criteria – Land Subsidence

Undesirable Result	Minimum Threshold	Measurable Objective	Interim Milestone
Subsidence caused by groundwater extraction that substantially interferes with land use, surface water conveyance, flood control, drainage, roads, utilities, structures, or other critical infrastructure. May be indicated when confirmed exceedances of the MT occur at two or more RMSs or when a confirmed exceedance at a single RMS causes or is reasonably expected to cause significant and unreasonable impacts to major infrastructure, drainage, flood-control features, or other beneficial uses of the land surface.	0.1 ft of vertical displacement in one year, or 0.2 ft of vertical displacement over five years, based on annual InSAR data.	Zero vertical displacement	Zero vertical displacement

0.5 Monitoring Network

Groundwater monitoring is key to SGMA compliance as it provides the basis to evaluate groundwater level trends for sustainability and can be used to demonstrate measured progress toward achieving sustainability goals through implementation of the GSP. ~~During development of the GSP, a~~Available ~~well~~ information was reviewed to identify ~~wells~~ monitoring locations in the groundwater Subbasin that would provide a good foundation for characterizing current groundwater conditions for each groundwater sustainability indicator and which could be used for future, on-going monitoring after GSP implementation. ~~30 existing wells were identified that were available for the monitoring and sampling conducted in 2021 for the GSP (Figure 0-8). These include pumping wells owned and operated by various water agencies and private agricultural operations. At present, no de minimis users have come forward in response to requests for well information or following discussion at GSP workshops. Using existing wells reduces GSP implementation costs by minimizing costs associated with drilling new monitoring wells.~~

The monitoring network for the USLR Valley GSP was designed to provide sufficient data from the Subbasin to establish current (ambient) conditions for basin characterization and demonstrate short-term, seasonal, and long-term trends in groundwater and related surface water conditions. ~~After~~ During implementation of the GSP, the monitoring network will also provide representative data to evaluate GSP sustainability indicators and objectives, including groundwater levels, groundwater storage, water quality, ~~and~~ depletions in ~~interconnected surface water~~ISW, and land subsidence, in accordance with the specific sustainability goals established by the GSA. A periodic re-evaluation of the representative monitoring sites (RMSs) will be conducted as data are collected and analyzed.

0.5.1 Data Gaps

Available data was limited to those available on public sites (e.g., CASGEM, GAMA, USGS, etc.) and provided ~~as part of the~~in response to data requests made during the development and implementation of the GSP. No information for wells on tribal land was provided and data for shallow domestic users are needed. Tribal cooperation and data sharing with regards to tribal wells, tribal surface water diversions, and groundwater levels in the Pala Subbasin will be ~~paramount~~ important if the ~~PVGSA~~ USLRGMA is to

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evaluate and prevent undesirable results while fully respecting FRWR in the Pala Subbasin. Collection of additional data, including information on domestic wells, surface water flows, water level, water quality, pumping, and ~~precipitation~~ other data, from existing or new monitoring locations will greatly improve understanding of Subbasin conditions and allow the ~~PVGSA~~ USLRGMA to revise estimates of sustainable yield, evaluate ~~sustainability criteria~~SMCs, and track ongoing progress towards maintaining groundwater basin operations within sustainable limits.

0.5.2 Recommendations

Potential recommendations and/or changes to the current monitoring network include:

- ~~Adding additional dedicated monitoring well(s) to data gap areas.~~
- Incorporating ~~existing wells into the monitoring network to provide additional coverage in data gap areas~~monitoring wells within reservation areas, which represent the main remaining data gap areas. Potential water level and water quality monitoring points within these areas would significantly improve the ability to assess sustainability efforts across the entire USLR Valley Groundwater Subbasin to confirm appropriate SMCs are in place to protect beneficial use and ensure federally reserved water rights are being respected.
- Refining the current network during future updates to streamline sampling and make more efficient use of monitoring efforts.
- Install stream and surface flow gauging station(s) to understand surface conditions and ~~interconnected groundwater/surface water~~provide necessary information for the evaluation of the depletion of ISW.
- ~~.~~Investigate feasibility of adding dedicated monitoring points throughout the Subbasin to provide near-river information for the evaluation of ISW and GDEs.
- Install transducers in near-river wells to provide detailed water level information on system response to precipitation events.
- Collect field observations of surface water conditions to support annual interpretation of ISW depletion.
- Conduct field monitoring to evaluate riparian habitat and degree of groundwater dependence.
- ~~Evaluate the feasibility of installing a California Irrigation Monitoring Information System (CIMIS) station within the Subbasin to provide localized climate information.~~

0.5.3 Sampling and Analysis Plan (SAP)

This SAP provided in the GSP outlines all field sampling procedures (groundwater level measurement and water quality sample collection methodology), Quality Assurance and Quality Control (QA/QC), and reporting procedures to be used for the GSP monitoring program. Static groundwater levels and water quality will be measured twice per year: once in the spring and once in the fall, to represent seasonal high and seasonal low, respectively. Additional monitoring events may be conducted on an as needed basis to monitor areas of interest.

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0.6 Projects and Management Actions

As discussed in the Basin Setting, the USLR Groundwater Subbasin is generally operating sustainably under current water demand and water supply conditions. While groundwater levels show a period of decline from the 1990s through the early 2000s, increased imported water usage in conjunction with average to wet hydrological conditions have contributed to the stabilization ~~or~~ and increase in groundwater levels within the last ~~five to~~ ten to fifteen years. However, future unanticipated increases in water demand and/or reduced imported water supplies could result in the subbasin falling out of sustainable management. Projects and management actions that support the efficient use of groundwater resources and increase Subbasin recharge will help the USLR Groundwater Subbasin remain sustainable through normal and drought hydrologic conditions.

0.6.1 Current Management Actions

- Agricultural Management Plan and Best Management Practices (BMPs): During development of the GSP, input from representative agricultural users indicated that growers have already enacted water conservation techniques such as using micro sprinklers/drip for irrigation, adjusting watering timing/schedules, regulating irrigation system pressure, and the removal or canopy reduction of low-producing areas – all of which are outlined in the 2016 San Diego Regional Agricultural Water Management Plan (RAWMP) prepared by the San Diego County Farm Bureau (SDCFB).
- Drought Response Conservation Program: Currently, efforts to reduce water demand in the subbasin through conservation are increased during times of drought. For example, YMWD institutes a drought response conservation program to delay or avoid implementing measures such as water rationing or more restrictive water use regulations pursuant to a declared water shortage emergency. Recent water consumption data have also indicated that YMWD customers ~~have~~ reduced water usage ~~from~~ 7 to 16% ~~over the last year alone (~~from 202~~0~~1 ~~versus~~ to 202~~0~~)1 alone.
- Groundwater Level and Water Quality Monitoring: Groundwater level and water quality monitoring programs are essential for effective management of groundwater resources and evaluating sustainability. While local districts ~~have~~ generally maintained records within their individual service areas prior to GSP development, a unified monitoring effort will provide a holistic view of the subbasin and allow the GSA to identify and adapt to changing conditions before undesirable results are encountered. In addition, it is hoped that future involvement of local tribal entities may allow for even greater understanding of groundwater conditions through the incorporation of additional monitoring locations – to the benefit of all users.

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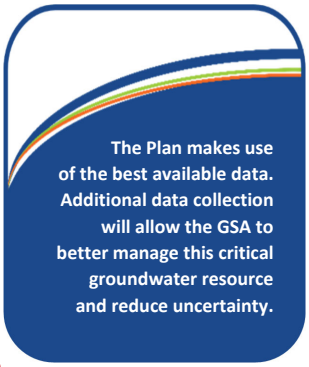
0.6.2 Additional Data Collection



Since understanding the amount of groundwater pumping in the Subbasin is a crucial aspect in establishing long-term sustainability, the GSA plans to initiate pumping record collection efforts ~~upon~~ during implementation of the GSP. This would include registration of each groundwater extraction facility within the management area of the GSA, and annual reporting of groundwater extractions (with the exception of de minimis users and federally reserved tribal lands). This management action would compliment the use of groundwater extraction fees and associated charges that are currently being used by the GSA to create a local source of funding for ongoing GSP implementation. ~~Efforts are anticipated to be voluntary at first but, recognizing the importance of understanding pumping amounts for managing long-term sustainability, a metering program will likely be evaluated.~~ Updated pumping records will allow estimates of sustainable yield to be refined and update and recalibrate the integrated ~~surface water~~watershed and groundwater model of the subbasin, which can be used to evaluate effects of proposed projects and management actions through feasibility studies.

0.6.3 Potential Future Management Actions/Projects

The GSA intends to take an adaptive management approach in the USLR Groundwater Subbasin. Frequent assessment of progress towards maintaining sustainability would allow the GSA to proactively enact management actions and/or projects as needed to curb any potential issues before they lead to undesirable results. If Subbasin monitoring indicates that additional action is necessary, the GSA will research the feasibility of implementing supplementary management actions and/or projects. For planning purposes, proposed projects and management actions have been grouped into four tiers, generally corresponding to the order of potential implementation (i.e., projects and management actions in Tier 1 are anticipated to be considered before those in Tier 2, etc.). Potential projects are listed below.

Tier 1 Projects/Management Actions

- Convening an Interactive Tribal Work Group
- Convening a Drought Resilience Work Group
- Domestic well vulnerability assessment for wells in the Upper Pauma Nitrate/Perchlorate-Affected Area
- Outreach and coordination with the Irrigated Lands Group/San Diego Farm Bureau
- Installation of streamflow gage in the USLR Valley Groundwater Subbasin
- Investigate potential alternative monitoring sites for ISW
- Installation of transducers in wells being used to monitor ISW
- Initiation of field observations of standing water and wetted area within the San Luis Rey River
- Explore the feasibility of using remote sensing or aerial imagery to evaluate riparian vegetation as an indicator of surface water/shallow groundwater
- Adaptive groundwater management
- Ongoing groundwater level and water quality monitoring

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- Agricultural management plan and best management practices
- ~~Install local CIMIS station~~
- Water conservation activities
  - Community outreach
  - Irrigation efficiency and best management practices
  - Use of pumping fees
- Outreach to San Diego County to layout a framework for GSA collaboration
- Pumping record collection
- Well registration and meter installation

Tier 2 Projects/Management Actions

- Water conservation activities:
  - Rebate programs
  - Rainwater capture
  - Crop swap programs
  - Low impact development standards for new or retrofitted construction
  - Leak detection assessment
  - Voluntary fallowing
  - Identify new sources of funding for all potential management actions
- Indirect recharge through decreased evapotranspiration

Tier 3 Projects/Management Actions

- In-lieu groundwater recharge
- Outreach to VID/City of Escondido/Rincon to explore potential supplemental water supplies for in-lieu use or managed recharge
- Stormwater and/or dry weather capture
- Aquifer Storage and Recovery (ASR)/managed aquifer recharge

Tier 4 Projects/Management Actions

- Groundwater pumping curtailment/allocation (although recognized as an effective tool for achieving groundwater sustainability, pumping restrictions represent a last resort effort and would only be considered by the GSA in the event that other projects and management actions are unable to allow the subbasin to be managed within sustainability goals).

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0.7 Plan Implementation

Implementation of the GSP requires robust administrative and financing structures, with adequate staff and funding to ensure compliance with SGMA. A conceptual planning-level cost of about $10,218,500 ~~$8,566,000~~ was estimated for planned activities during the ~~first~~ next five years of implementation, or an estimated cost of approximately $2,043,700 ~~1,713,000~~ per year. This cost estimate reflects routine administrative operations, monitoring, public outreach, reporting, and potential implementation of select Tier 1 basin-~~-~~wide and area-specific management actions, pending funding.

California Water Code Sections 10730 and 10730.2 provide GSAs with the authority to impose certain fees, including fees on groundwater pumping. The GSA has used this authority to develop a permanent source of funding. Subbasin pumpers, excluding those on federally reserved tribal lands and de minimis users, are charged an annual wellhead fee of $300 per well and a pumping fee of $24.59 per acre-ft of water pumped from the Subbasin. These fees establish a reliable, local revenue source to fund ongoing GSP implementation in the Upper San Luis Rey Valley Subbasin. Development of these fees included public outreach and notification, along with meetings and public hearings to educate and solicit input on the proposed fee structure. The fees became effective for the 2024-25 fiscal year, with the first payment due by December 15, 2024. Pumpers are provided a self-certification form to document their groundwater pumping or are charged per best-estimate assumptions outlined in the Cost-of-Service Study (Appendix 7a). Pumpers that are not anticipated to be subject to the fee are requested to self-certify that they only pump for domestic purposes which would be de minimis to the USLR Groundwater Subbasin. ~~The GSA is developing a Joint Power Authority (JPA) that will go into place within one to two months following GSP submittal. JPA member agencies will cover initial costs until a permanent source of funding is established (e.g., water use tax or fee) to be developed as a Tier 1 action. The GSA plans to conduct focused public outreach and hold meetings to educate and solicit input on the proposed fee structure and plan to begin developing the fee structure as soon as administratively feasible after GSP adoption.~~

In addition, the GSP calls for GSAs to routinely provide information to the public about GSP implementation and progress towards sustainability and the need to use groundwater efficiently. This includes providing annual reports and ~~five-year reporting~~periodic evaluations. SGMA regulations require the GSA to evaluate this GSP at least every five years and whenever the Plan is amended and provide a written assessment to the DWR. The GSP calls for a website to be maintained as a communication tool for posting data, reports and meeting information. The website may also include forms for on-line reporting of information needed by the GSAs (e.g., annual pumping amounts) and an interactive mapping function for viewing Subbasin features and monitoring information.

The Plan is a living document that will continue to be updated as additional/better data become available.

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1.0 Introduction (§354.2)

On September 16, 2014, Governor Jerry Brown signed into law a three-bill legislative package, composed of AB 1739, SB 1168, and SB 1319, collectively known as the Sustainable Groundwater Management Act (SGMA), providing California with a framework for sustainable groundwater management for the first time in its history. SGMA aims to ensure the reliability and quality of critical groundwater resources throughout the state. Recognizing that groundwater is most efficiently managed at the local level and each groundwater basin is different, the intent of SGMA is to facilitate and strengthen local control and management of groundwater basins. For groundwater basins designated as medium or high priority, SGMA requires the formation of a Groundwater Sustainability Agency (GSA), responsible for developing and implementing a Groundwater Sustainability Plan (GSP) that considers the interests of all beneficial uses and users of groundwater in the basin. SGMA also requires that these basins reach and maintain sustainability within 20 years following plan implementation.

The Upper San Luis Rey Groundwater Management Authority (USLRGMA), formerly known as the Pauma Valley Groundwater Sustainability Agency (PVGSA), developed and submitted a GSP for the Upper San Luis Rey (USLR) Valley Groundwater Subbasin (or Subbasin) to the Department of Water Resources (DWR) in January 2022 (PVGSA, 2022). DWR issued an approval of the GSP on January 18, 2024, which included some Recommended Corrective Actions (RCAs) to enhance the GSP and facilitate future evaluations (DWR, 2024; included here as Appendix 1b). This GSP Amendment incorporates additional data about current conditions, refines the previous monitoring network, provides additional clarification and discussion about Sustainable Management Criteria (SMC), addresses RCAs from DWR's review of the original GSP, and incorporates additional regulatory requirements. Changes to the GSP, particularly regarding responses to DWR's RCAs, are documented in the 2027 Periodic Evaluation for the USLR Valley Groundwater Subbasin, which is being submitted as a companion document to this GSP Amendment. This 2027 Amendment is submitted to DWR according to GSP Regulation §355.10 and replaces the original 2022 GSP.

1.1 GSP Objectives

The ~~Upper San Luis Rey (~~USLR~~)~~ Valley Groundwater Subbasin is a medium-priority basin. As a result, the ~~Pauma Valley GSA (PVGSA)~~USLRGMA, consisting of Yuima Municipal Water District (YMWD), Pauma Municipal Water District (Pauma MWD), Pauma Valley Community Services District (CSD), San Luis Rey Municipal Water District (SLRMWD), and the Upper San Luis Rey Resource Conservation District (USLRRCD), ~~developed~~ has adopted this GSP for achieving long-term groundwater sustainability in the Subb~~b~~asin. It considers scientific data and local knowledge of the Subb~~b~~asin and describes Subbasin conditions, including the geology of the Subbasin and groundwater levels within it. The Plan also establishes sustainability goals for the Subbasin and outlines steps and potential management actions to ensure sustainability.

1.2 GSP Organization and Preparation Checklist

Organization of this GSP generally follows the outline provided by ~~the California Department of Water Resources (~~DWR~~)~~. A description of each section is provided below. The SGMA regulation relevant to each

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subsection is specified in parentheses at the end of each sub-heading and a complete checklist is included as Appendix 1a.

- **Executive Summary** provides a succinct summary of the contents of the GSP.
- **Section 1.0 – Introduction** provides an introduction to the GSP, including objectives of the GSP, agency information, and GSP organization.
- **Section 2.0 – Plan Area** describes the geographic setting, existing water resources planning and programs, relationship of the GSP to other general-plan documents within the Subbasin area, and additional GSP components such as land use plans, well and project permitting processes, control of saline water, and current groundwater projects.
- **Section 3.0 – Basin Setting** describes the physical components of the USLR Valley Groundwater Subbasin and provides a hydrogeologic conceptual model for the understanding of groundwater conditions in the subbasin and development of groundwater budgets.
- **Section 4.0 – Sustainable Management Criteria** describes the sustainability goals set by the GSA, defines undesirable results (URs), minimum thresholds (MTs), measurable objectives (MOs), and interim milestones (IMs).
- **Section 5.0 – Monitoring Network** describes the ~~initial~~ GSP monitoring network ~~established and monitored during development of the GSP~~, identifies ~~recommendations for monitoring network modifications following plan implementation to improve data coverage in~~ data gap areas and makes recommendations to address them to improve the~~,~~ assessment of sustainability criteria~~,~~ and evaluate~~e~~ion of impacts from proposed projects and management actions, and outlines monitoring protocols and field sampling procedures.
- **Section 6.0 – Projects and Management Actions** provides a framework to achieve the sustainability goal for the USLR Valley Groundwater Subbasin by listing potential management actions and/or projects that may be utilized to ensure long-term sustainability, mitigate potential undesirable results, and potentially increase sustainable yield of the subbasin through additional or supplemental recharge.
- **Section 7.0 – Plan Implementation** describes the GSP implementation process, including estimated costs, sources of funding, a preliminary schedule, methodology for annual and ~~five-year~~periodic evaluation reporting, and how progress ~~evaluations~~ will be ~~made~~ assessed over time.

1.3 Agency Information (§354.6)

1.3.1 Mailing Address (§354.6(a))

Upper San Luis Rey Groundwater Management Authority
P.O. Box 984~~Pauma Valley Groundwater Sustainability Agency~~
~~P.O. Box 177~~
Pauma Valley CA 92061-0177

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1.3.2 Organization and Management Structure (§354.6(b), (c))

Prior to the development of the 2022 GSP, t~~T~~he PVGSA formed under a Memorandum of Understanding (MOU) for the Development of a Groundwater Sustainability Plan for the San Luis Rey Valley Groundwater Basin, dated June 27, 2017. This structured MOU was later amended and restated. A Joint Powers Authority (JPA) was formed in May 2022 with the same member agencies as under the MOU to act as the GSA. The GSA is now known as the USLRGMA. This authority consists of: ~~Several amendments to this MOU have been made effective since, establishing the current GSA consisting of:~~

- Two voting members from Yuima Municipal Water District (YMWD)
- Two voting members from Pauma Municipal Water District (Pauma MWD)
- Two voting members from Pauma Valley Community Services District (Pauma Valley CSD)
- One voting member from San Luis Rey Municipal Water District (SLRMWD)
- Two voting members from Upper San Luis Rey Resource Conservation District (USLRRCD)
- Two voting "Director-at-Large" members from the San Luis Rey Indian Water Authority (SLRIWA)[1]
- ~~One At-Large Agricultural Community Director representing the private pumping community.Yuima Municipal Water District (YMWD)~~
- ~~Pauma Municipal Water District (Pauma MWD)~~
- ~~Pauma Valley Community Services District (Pauma Valley CSD)~~
- ~~San Luis Rey Municipal Water District (SLRMWD)~~
- ~~Upper San Luis Rey Resource Conservation District (USLRRCD)~~

The USLRGMA, as the new GSA for the Subbasin, has also adopted the USLR Valley Groundwater Subbasin GSP and provided notification to DWR.

Contact: Lance Andersen, ~~PVGSA~~USLRGMA
Address: P.O. Box 984~~P.O. Box 177~~, Pauma Valley CA 92061-0984
Phone: 619-320-8874
Email: admin@uslrgma.com ~~amy@yuimamwd.com~~

A copy of the Joint Powers Agreement, the MOU, and subsequent amendments for the development of the PVGSA and USLRGMA are available on the USLRGMA website: https://uslrgma.com/~~A copy of the MOU and subsequent amendments for the development of the PVGSA are available on the YMWD website: https://www.yuimamwd.com/newdev/65-services/143-gsp~~

An Executive Team was created in the 2017 MOU to work on and manage the GSP development, which consisted of two voting members appointed by each Party with the authority from the appointing agency's Governing Body to act on behalf of that agency. Additional agencies, entities and/or individuals with specific knowledge about SGMA or groundwater management, and public agencies and/or governmental

[1] Please note that the SLRIWA has chosen to not participate in the USLRGMA and has not appointed representatives to their voting seats.

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agencies with jurisdiction that overlie the USLR Subbasin were also invited to participate in Executive Team meetings. The ~~San Luis Rey Indian Water Authority~~SLRIWA, Pauma Municipal Water District, Valley Center Municipal Water District, and Rainbow Municipal Water District were also invited to participate in the Executive Team as ex officio Members. Additional information regarding the decision-making process is provided in Section 2.5.1.

1.3.3 Legal Authority of the GSA (§354.6(d))

Parties of the ~~PVGSA~~ USLRGMA have each declared to be a GSA per Section 10723.8 of SGMA, as documented in the June 27, 2017, MOU and amendments and the June 13, 2022, Joint Powers Agreement, with the intent of collectively developing and implementing a single GSP to sustainably manage groundwater in the USLR Subbasin. These local agencies are authorized to manage groundwater per Water Code §10721(n) and SGMA throughout the USLR Valley Groundwater Subbasin other than on tribal reservation or federal lands.

DWR's GSP Assessment Staff Report (2024) notes that each of the USLRGMA's member agencies is a local public agency characterized in materials submitted to DWR as satisfying the definition of a "local agency" under SGMA[2].

~~Members have agreed to a cost sharing methodology for initial GSP development and implementation.~~ Additional information on costs associated with plan implementation is provided in Section 7.0.

1.3.3.1 Full Respect of Federal Reserved Water Rights (FRWRs)

The ~~PVGSA~~ USLRGMA and its members agree that federally reserved water rights (FRWRs) must be respected in full under SGMA. The federally recognized tribes within the Pauma Valley watershed assert that they possess FRWRs held in trust by the United States, including to unquantified amounts of groundwater appurtenant to their respective reservations. The ~~PVGSA~~ USLRGMA is committed to accommodating, to the extent permitted by law, the current or future exercise of any adjudicated FRWRs for use on tribal reservation lands.

[2] The DWR GSP Assessment Staff Report goes on to note that:
"A comment letter from the San Luis Rey Indian Water Authority (SLRIWA) claimed the Upper San Luis Rey Resource Conservation District did not fit this definition and on that grounds questioned the validity of the GSA. The Department's role in processing GSA notices is largely ministerial. Notices submitted by public agencies claiming to possess water supply, water management, or land use responsibilities within the applicable groundwater basin are generally presumed by the Department to be valid and the entity eligible to become a GSA. Also, an April 25, 2022 joint response letter from the Department and SWRCB to the SLRIWA further addressed this issue, explaining that a recent LAFCO municipal services review cited by the SLRIWA found the "Upper San Luis Rey RCD is currently authorized to provide two … functions … [one of which is] water conservation…." and found that the "RCD's water conservation service function involves economizing water resources for maximum beneficial uses." The LAFCO findings further substantiates that the RCD appears eligible to participate in a GSA based on its water conservation function, which is a "water management responsibility", making it a "local agency" under SGMA. (Water Code, § 10721(n).)" (DWR Staff Report page 8, footnote 45).

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The GSA has considered tribal interests in the development and ongoing implementation of the USLR Valley Groundwater Subbasin GSP. Two voting member seats in the USLRGMA have been reserved for SLRIWA representation. In addition, the GSA informs the SLRIWA of all Board meetings, projects and management action efforts, and other announcements. Several attempts have been made to establish an Interactive Tribal Work Group with the goal of encouraging tribal participation, promoting basin balancing maintenance activities, and ensuring that FRWRs are protected (see Section 6.3.1). While no response has been received to-date, efforts to organize a meeting with key tribal representatives will be continued during GSP implementation.



In lieu of tribal participation and information regarding groundwater conditions in reservation areas, the GSA will continue to use the methodology and available data presented in this GSP to estimate conditions and potential impacts to tribal users. Estimates of tribal pumping are included in all evaluations of water budgets and water usage in the Subbasin. In addition, available monitoring points in the Subbasin will continue to be monitored. In particular, the revised monitoring network presented in this 2027 GSP Amendment includes water level and water quality monitoring locations on either side of the Pala Reservation, which allows the GSA to evaluate groundwater conditions entering and leaving that portion of the Subbasin. Monitoring locations are also located on either side of the Pauma Reservation. Through the establishment of appropriate SMCs at these near-tribal boundary monitoring locations, groundwater conditions in the intervening area are anticipated to remain protective of beneficial uses and users to the extent such conditions are influenced by groundwater management activities within areas subject to GSA monitoring and management authority. Although the Rincon and La Jolla Reservations also remain outside the GSA's direct monitoring and management authority, they are located in upgradient portions of the Subbasin and are therefore not expected to experience significant adverse effects from downgradient groundwater management activities that remain compliant with established SMCs at downgradient Representative Monitoring Sites (RMSs). This approach allows the GSA to continue implementing the GSP using the best available data while respecting jurisdictional limitations and FRWRs.

1.4 References

DWR (CA Department of Water Resources), 2024. State of California Department of Water Resources Sustainable Management Program Groundwater Sustainability Plan Assessment Staff Report. Exhibit A of the Statement of Findings Regarding the Approval of the San Luis Rey Valley – Upper San Luis Rey Valley Subbasin Groundwater Sustainability Plan, dated January 18, 2024. Available at: https://sgma.water.ca.gov/portal/gsp/assessments/76.

PVGSA (Pauma Valley Groundwater Sustainability Agency), 2022. Upper San Luis Rey Valley Groundwater Sustainability Plan. Prepared by Geoscience Support Services, Inc., dated January 2022. Available at: https://sgma.water.ca.gov/portal/gsp/preview/76.

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2.0 Plan Area (§354.8)

The Plan Area section describes the geographic setting of the USLR Valley Groundwater Subbasin, existing water resources planning and programs, the relationship of the GSP to other general-plan documents within the Subbasin area, and additional GSP components such as land use plans, well and project permitting processes, control of saline water, and current groundwater projects.

2.1 General Setting and Jurisdictional Area (§354.8(a),(b))

The San Luis Rey Valley Groundwater Basin, located in San Diego County, extends from the confluence of the San Luis Rey River and Paradise Creek, continuing downstream through four valleys (Pauma, Pala, Bonsall, and Mission) and ending at the Pacific Ocean in the City of Oceanside (Figure 2-1). The Plan Area represents the USLR Valley Groundwater Subbasin and encompasses approximately 19,200 acres in the eastern section of the San Luis Rey Valley Groundwater Basin (Figure 2-2). It is classified as Ssubbasin 9-007.01 by ~~the California Department of Water Resources' (DWR)~~ Bulletin 118 (DWR, 2016). The groundwater Ssubbasin boundaries were updated in 2018 (~~to be~~ published in the 2020 ~~5 year~~ update of Bulletin 118) as part of the basin modification process provided for under SGMA[3]. Assembly Bill No. 1944, Chapter 255 (AB 1944, 2018), an act to amend Section 10721 of and to add Section 10722.5 to the Water Code, defines the boundary that divides the Upper and Lower San Luis Rey Valley Groundwater Subbasins. Under SGMA, the USLR Valley Groundwater Subbasin was designated a medium priority basin.

The USLR Valley Groundwater Subbasin can be further subdivided into two subbasins: the Pauma Subbasin and the Pala Subbasin. The Pauma Subbasin extends from the confluence of the San Luis Rey River and Paradise Creek to the Agua Tibia Narrows near the confluence of the San Luis Rey River and Frey Creek. The Pala Subbasin extends from the Agua Tibia Narrows to Monserate Narrows. Based on prior decisions by the State of California, groundwater in Pala Subbasin, located downstream of Frey Creek, has been determined to be a subterranean stream flowing through known and definite channels (SWRCB, 2002).

SGMA specifically excludes subterranean streams from its requirements. However, while subterranean streams are generally excluded from SGMA, Assembly Bill 1944 was put forth to include the area of the subbasin downstream from Frey Creek (i.e., Pala Subbasin) as part of SGMA for the purposes of groundwater sustainability management, notwithstanding the State Water Board's prior characterization of the Pala Subbasin as surface water flowing within relatively permanent bed and banks. AB 1944 does not alter any existing water right. Therefore, the GSP components address both the Pauma and Pala Subbasins. Section 3.0 (Basin Setting) describes the hydrogeologic setting of the USLR Valley Groundwater subbasin along with its hydrologic connection between adjacent basins.

[3] During the course of developing this GSP, it has been determined that the current (2018/2019) basin boundaries do not appear to adequately represent the true extent of the USLR Groundwater Subbasin; areas of connected alluvial material are left outside basin boundaries in parts of the basin while other locations currently characterized as part of the subbasin are contained in foothill areas of surrounding hard rock and bedrock areas that are thinly covered by surface alluvium and otherwise appear to be hydrologically disconnected from the main subbasin alluvial aquifer system(s). This is discussed in greater detail in Section 3.0 (Basin Setting) and recommendations are provided for a future basin modification request ~~in 2022~~.

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Figure 2-3 shows jurisdictional boundaries of water agencies overlying the USLR Valley Groundwater Subbasin. Within many of these service areas are parcels of land that rely on private wells for water supply. Water agencies serving areas overlying the Plan Area include (LAFCO, 2021):

- Pauma MWD
- Pauma Valley Mutual Water Company (MWC)
- Peppercorn MWC
- Rainbow MWD
- San Luis Rey MWD
- Valley Center MWD
- Yuima Municipal Water District (YMWD)

The San Diego County Water Authority (Water Authority) is also present within the Plan Area but is not actively serving areas overlying the Plan Area. However, it does provide wholesale imported water. In addition, Mootamia MWD, located within the Pauma Valley MWC boundaries, serves to protect groundwater rights.

YMWD encompasses the following MWCs and community services districts (CSDs):

- Mutual Water Companies
  - Rancho Pauma MWC
  - Rancho Estates MWC
  - Lazy H MWC
  - Pauma Ridge Mutual
  - Rincon Oaks Water Service
  - Three Party Water Company
- Community Services Districts
  - Rincon Ranch Road CSD
  - Pauma Valley CSD

Also present within the Plan Area are several Sovereign Tribal Nations that have autonomy over their lands, follow Federal environmental laws and regulations (RWMG, 2018). The Tribes provide domestic and irrigation water for their various enterprises, including casino and agricultural operations, and monitor water resources on their respective reservations. The GSA has limited water production and other information regarding ~~Tribal~~ tribal water use. Tribal lands are shown on Figure 2-4, denoted by the Bureau of Indian Affairs Land Area Representations (LARs), and include:

- La Jolla Band of Luiseno Mission Indians
- Rincon Band of Luiseno Mission Indians
- Pauma Band of Luiseno Mission Indians
- Pala Band of Luiseno Mission Indians

California protected areas within the Plan Area, also shown on Figure 2-4, include (CCED, 2020; CPAD, 2020):

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- Wilderness Gardens Preserve (County of San Diego)
- Granger Preserve (Fallbrook Land Conservancy)
- Plaisted Creek Ecological Reserve (California Department of Fish and Wildlife)
- Cleveland National Forest (United States Forest Service)
- YMWD no public access Open Space
- Tierra Miguel Conservation Easement (Tierra Miguel Foundation, United States Natural Resources Conservation Service)
- California Desert Conservation Area (California Desert District, United States Bureau of Land Management).

The Wilderness Gardens Preserve, acquired in 1973, is the oldest San Diego County Parks and Recreation open space preserve (SDPARKS, 2020). The private, nonprofit Fallbrook Land Conservancy was founded in 1988 and protects both conservation easements and open space preserves, including the Granger Preserve (CCLT, 2020). The Plaisted Creek Ecological Reserve is state owned and managed by the California Department of Fish and Wildlife (SDMMP, 2020). The Cleveland National Forest is the southern-most National Forest in California and is managed by the United States Forest Service (USFS, 2020).

2.1.1 General Land Use Characteristics

2017 2024 land use within the Plan Area was obtained from Southern California Association of Governments based on San Diego Association of Governments (SANDAG) mapping (SCAG, 20192025) and is shown on Figure 2-5. This 2017 2024 land use is used to illustrate existing land use conditions as it is the most recent SCAG publication available (SCAG updates occur approximately every five years). Land use within Pauma Subbasin is approximately 5249% irrigated agriculture/ parks/ golf, 2728% open space/ water, 1719% residential, and 4% commercial/ industrial/ public facilities. In Pala Subbasin, land use is approximately 4244% open space/ water, 3835% irrigated agriculture/ parks, 12% residential, and 8% commercial/ industrial/ public facilities.

According to the DWR Disadvantaged Communities (DAC) Mapping Tool, which relies on U.S. Census data published by American Community Survey, a portion of a severely disadvantaged community (SDAC) block group and a portion of a DAC census tract for 2019 through 2023 haves been identified within the 2018 Bulletin 118 basin area boundaries (see Figure 2-6). This The SDAC block group includes a population of 1,448587 in 443 235 households, for which the median household income is approximately $42,35749,656. As shown on Figure 2-6, the SDAC area is located in the southeastern Pala area and northwest Pauma area, extending into the hilly area surrounding the Wilderness Gardens Preserve. A large portion is also located within the Pala tribal area. The DAC census tract includes a population of 3,066 in 1,194 households, for which the median household income is approximately $69,831. Only a small portion of this census tract area is present within the Bulletin 118 boundary, in the very upper reaches of Pauma Subbasinalluvial fan area in the northeast section of the subbasin, in both Pala and Pauma Subbasins. Based on a review of the geology and drillers logs, this lobe of the basin is not believed to be connected to the main groundwater Subbasin and the principal aquifer (see Section 3.3.1). Letters were sent to all parcels within the Subbasin, including in theseis areas, as part of the initial GSP outreach effort (see Section 2.5 for additional discussion), and a large portions of this the SDAC block group area were is included in Subbasin monitoring. However, there are areas within the SDAC block group that have been

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identified as data gap areas (see Section 5.3). Additional information will need to be collected in data gap areas to fully understand and characterize Subbasin conditions and ensure that sustainable management criteria are protective of users in these areas (see Section 4.0).

2.1.2 Water Source Types and Water Use Sectors

Creating sustainable groundwater management in the USLR Valley Groundwater Subbasin requires the efficient use of all the available water source types utilized by the Plan Area. There are three primary water source types: groundwater, surface water, and imported water. In the YMWD service area, 91% of the water provided is used for agricultural purposes, 2% for residential, and 7% is wholesale.

An overview of the three primary water source types is provided below. Section 3.0 (Basin Setting) further describes water uses in relation to the USLR Valley Groundwater Subbasin water budget.

2.1.2.1 Groundwater

Groundwater in the USLR Valley Groundwater Subbasin is found within the alluvial-filled valley areas (i.e., Pauma and Pala Valleys). The valleys are separated by narrow, steep walled canyons and are underlain by alluvial fill of varying thickness. Pauma Valley is approximately 7.5 miles long and varies in width from approximately one mile to 2.25 miles. The alluvial fill in Pauma Valley comprises river channel deposits and younger alluvium (0 to 130 ft thick), alluvial fan deposits (up to 370 ft), and older alluvium (maximum thickness of 160 ft) (SWRCB, 2002). Pala Valley is bounded by the same basement complex as the Pauma SubbBasin. However, the alluvial fill is not as thick as Pauma Valley and is comprised of river channel deposits and younger alluvium, and alluvial fan deposits.

In 2002, the State Water Resources Control Board (SWRCB) determined that water within Pauma Subbasin, while hydraulically connected to the San Luis Rey River, is percolating groundwater and not part of the river flow as it filters through the ground (Decision 1645). Through the same SWRCB Decision 1645, Pala Subbasin was found to be confined subterranean San Luis Rey River streamflow through known and defined channels. However, for the purposes of SGMA, the technical assessment of groundwater conditions and evaluation of the appropriate management strategies will be applied to the Pala Subbasin with understanding that the GSP has no authority over water rights there.

Groundwater in the USLR Valley Groundwater Subbasin is generally produced from the principal alluvial aquifer found in both Pala and Pauma Subbasins. Outside of the more productive alluvial aquifers, groundwater is produced from fractured crystalline bedrock and semi-consolidated sedimentary deposits that bound and underlie the alluvium. However, yield and storage in these aquifers are can be limited and the bedrock is not considered in this GSP to represent a separate aquifer system, and the aquifers are best suited for meeting domestic water needs that do not require higher flow rates. Groundwater is produced in the Plan Area for use within and outside of the Subbasin and provides an important source of water to meet water demands. In addition to the water agencies listed in the previous section, private groundwater producers also pump groundwater for irrigation, agricultural needs, and other uses.

Groundwater well density within the Subbasin (based on DWR reported wells per section) is shown on Figure 2-7. As shown, the highest density of wells is generally found along the axis of the subbasin, parallel to the San Luis Rey River. According to available well information from DWR, the average domestic well depth in Pala Subbasin is approximately 140 100 ft. Agricultural production wells in Pala average

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approximately 240 280 ft in depth while municipal/public supply wells average approximately 200 240 ft in depth. In Pauma Subbasin, wells tend to be slightly deeper, with average domestic, agricultural production, and municipal/public supply wells averaging approximately 250 280 ft, 350 480 ft, and 370 440 ft in depth, respectively. However, as discussed in the Basin Setting section, well information is somewhat limited. The DWR database this well density and depth information comes from is incomplete and contains data for older wells which may be abandoned. Other well databases also have incomplete records. Therefore, addressing data gaps associated with well locations, construction information (e.g., well depth, screened intervals, etc.), water level conditions, and pumping will be a key area of focuscontinue to be made following during implementation of the GSP. Additional discussion is provided in Section 5.3 and 6.2.2.

2.1.2.2 Surface Water

Upstream of the USLR Valley Groundwater Subbasin lies Henshaw Dam, which controls flow in the San Luis Rey River and has created the reservoir Lake Henshaw. The dam was built in 1923 and is owned and operated by Vista Irrigation District (VID). Water from Lake Henshaw is transported to VID and City of Escondido service areas via the Escondido Canal. The Rincon Band of Luiseno Indians purchases raw water from Escondido and VID, which is also delivered through the Escondido Canal.

Improvement District "A", managed by YMWD, used to operate a catch basin (Yuima Creek) into Dunlap Reservoir and Pettis Reservoir. This catch basin has been destroyed. A second catch (Nate Harrison Canyon) was operated for a number of years into Hegardt Reservoir. However, as the result of overgrowth hampering access, new surface treatment rules, and limited funds and personnel, the basin fell into disrepair. Rapidly rising power and water costs and a fire in 1987 that cleared the area for better access made it feasible for YMWD to make necessary repairs to reactivate this catch and maintenance road. In 2017, an agreement was entered into to refurbish, maintain, and operate the catch system for 20 years, thus effectively exercising riparian rights to creek while separating it from the potable system. Several other entities within the USLR Valley Groundwater Subbasin also hold active surface water diversion rights, which are used to be available to view on the Electronic Water Rights Information Management System (eWRIMS)[4] and are now available on the California Water Accounting, Tracking, and Reporting System (CalWATRS)[5].

2.1.2.3 Imported Water

Several large water agencies within the larger San Luis Rey River Watershed (e.g., Valley Center MWD, Rainbow MWD, and Fallbrook Public Utilities District) are virtually 100% reliant on the availability of imported water (SDIRWM, 2019). Within the USLR Valley Groundwater Subbasin, YMWD receives imported water through Metropolitan Water District of Southern California (Metropolitan) and the San Diego County Water Authority (Water Authority). Additionally, as discussed in Section 2.2.3, the SLRIWA has the ability and authority (though not the obligation) to import 16,000 AFY acre-ft/yr into the Plan

[4] Diversion information available at: https://www.waterboards.ca.gov/waterrights/water_issues/programs/ewrims/
[5] https://calwatrs.waterboards.ca.gov/portal/s/

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Area, above and beyond the supplies of imported water already provided via the Water Authority and Metropolitan Facilities.

2.1.2.3.1 Metropolitan Facilities

Colorado River supplies are transported from Lake Havasu through the Colorado River Aqueduct to Diamond Valley Lake and then to Lake Mathews in Riverside County. Before reaching Lake Mathews, a portion of the water is delivered through the San Diego Canal to Lake Skinner (the major storage facility for San Diego), where it is treated.

State Water Project (SWP) supplies are delivered to Lake Perris, which is the terminus of the 444-mile California Aqueduct. It is then blended with Colorado River water in the San Diego Canal where it flows into Lake Skinner. Metropolitan delivers a blend of Colorado River water and SWP water. The percentage derived from each of the two sources varies from year to year, depending on hydrologic, environmental, and political factors. The Metropolitan Act provides a preferential right for the purchase of water by each of its constituent agencies. The preferential right is calculated using a formula.

2.1.2.3.2 Water Authority Facilities

The Water Authority was organized on June 9, 1944, under the County Water Authority Act. The Water Authority's primary purpose is providing wholesale water to its member agencies within the San Diego region for domestic, municipal, and agricultural uses. The Water Authority consists of ~~24~~ 22 ~~public agency members~~member agencies, including cities, water districts, irrigation districts, municipal water districts, and Camp Pendelton, which collectively serve approximately 3.3 million people. The Water Authority is governed by a 34-member Board of Directors representing its member agencies. The Water Authority is also one of 26 member agencies of the Metropolitan Water District of Southern California (Metropolitan) and is represented on Metropolitan's Board of Directors (Water Authority, 2026a).~~that are each represented by at least one person the Water Authority's Board of Directors. The Water Authority is also a member of Metropolitan.~~

Historically, the Water Authority purchased almost all the water it required from Metropolitan, derived from the Colorado River and SWP, to meet the demand of the member agencies. Delivery of water from Metropolitan occurs through five primary pipelines buried in two rights-of-way called the San Diego Aqueducts (Water Authority, 2008). The delivery points are located about six miles south of the Riverside-San Diego County line. From there, water is distributed through more than 308 miles of pipeline to Water Authority's 22 member agencies (Water Authority, 2026a). However, since the late 1990s, ~~T~~the Water Authority has been in the process of diversifying its supply. Pursuant to the Quantification Settlement Agreement signed October 2003, and its related contracts, the Water Authority obtains conserved water from the Imperial Irrigation District (IID) and ~~will~~ also receive~~s~~ water conserved by the lining of the All-American and Coachella Canals. Recently, the supply portfolio was supplemented with the addition of seawater desalination from the Claude "Bud" Lewis Carlsbad Desalination Plant, which began operating in 2015.

~~Water Authority takes delivery of water from Metropolitan through five primary pipelines buried in two rights-of-way called the San Diego Aqueducts. The delivery points are located about six miles south of the Riverside-San Diego County line. From there, water is distributed through more than 279 miles of pipeline~~

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~~to Water Authority's 24 member agencies through 119 service connections to serve 2.7 million residents in San Diego County (Water Authority, 2008).~~

2.1.2.3.3 Yuima Connection

YMWD is served off the First Aqueduct, Pipeline No. 1, near Couser Canyon Road in Valley Center just north of Lilac Tunnel and receives treated water from Lake Skinner. Delivery requests are made twice daily to the Water Authority based on estimated demands in excess of local water delivery ability. Because these connections can access only treated water supplies from the Skinner Treatment Plant, YMWD's total access to imported water is affected by the capacity limitations of Skinner, which has operated recently at or near its design capacity. Prior to the expansion of the Skinner Filtration Plant in 1991, YMWD also received raw Colorado River water.

2.2 Water Resources Monitoring and Management Programs (§354.8(c),(d),(e))

2.2.1 Existing Monitoring Programs and Networks

Existing monitoring programs and networks in the Plan Area measure and record a variety of data used to understand the USLR Valley Subbasin and study natural and anthropogenic effects on the aquifer system. While local districts ~~have~~ generally maintained records within their individual service areas prior to GSP development, there ~~is currently~~was no unified monitoring plan in the Pauma/ Pala Subbasins. This GSP ~~recommends~~ establishes a unified monitoring program to provide accurate and needed information regarding regional groundwater conditions throughout the two subbasins (Section 5.0, Monitoring Network). In addition, future involvement of the local ~~Tribal~~ tribal entities may allow the beneficial incorporation of additional monitoring locations and Subbasin coverage. This section provides a description of the existing monitoring programs and networks utilized in the Plan Area.

2.2.1.1 Groundwater Monitoring

Within the Plan Area, groundwater levels, groundwater production, and groundwater quality are currently monitored to varying degrees. There is currently no active subsidence monitoring program due to the absence of past instances of subsidence induced damage. Given the geologic and hydrogeologic conditions that exist in the area, it is unlikely that subsidence will occur in the USLR Valley Subbasin. The geologic and hydrogeologic conditions are described in Section 3.0 (Basin Setting).

2.2.1.1.1 Groundwater Level Monitoring

Prior to SGMA, c~~C~~ontinuous groundwater level monitoring ~~occurs~~ occurred within the Plan Area to comply with the 2009 California Senate Bill X7-6 that ~~requires~~ required statewide groundwater elevations, collected through collaboration between local monitoring parties and the DWR, be made available to the public (Geosyntec, 2015). In response to the law, DWR developed the California Statewide Groundwater Elevation Monitoring (CASGEM) Program in 2009 to establish a permanent, locally managed program of routine groundwater monitoring to track seasonal and long-term groundwater elevation trends in all of California's alluvial groundwater basins (Geosyntec, 2015). San Diego County wa~~i~~s the sole Monitoring Entity for the Plan Area ~~having volunteered to~~ providinge groundwater data to CASGEM from four wells in the Pauma/Pala Subbasins (Geosyntec, 2015). Two of these wells were incorporated in the GSP's initial monitoring network and were migrated to the SGMA Portal's Monitoring Network Module (MNM) in

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2022, consistent with SGMA requirements. One other former CASGEM well was added to the GSP monitoring network during the 2027 GSP Amendment. The County currently reports data from four wells in the Pauma/Pala Subbasins.DWR integrated CASGEM with the MNM in summer of 2026 to streamline groundwater elevation data management and reporting processes by consolidating the data into one location.

2.2.1.1.2 Groundwater Production Monitoring

There is currently no requirement to submit annual groundwater production to the State. However, Urban Water Management Plans (UWMPs) must be prepared by urban water suppliers every five years if the supplier either provides over 3,000 acre-ft of water annually or serves more than 3,000 urban connections (DWR, 2021). Each UWMP assesses water resource reliability over a 20-year planning time frame, explains demand management measures and water shortage contingency plans, describes the use and planned use of recycled water, and reports the progress towards the 2020 year targeted 20 percent reduction in per-capita urban water consumption (DWR, 2021). DWR provides guidance for urban water supplies, reviews submitted plans, and summarizes the status of the plans for each five-year cycle to report to Legislature. Within the USLR Valley Groundwater Subbasin, YMWD is a member of the Water Authority, which has established an Integrated Regional Water Management Plan for the greater San Diego region. This plan is discussed in Section 2.2.2.2.

The PVGSA USLRGMA requests production records annually from Subbasin stakeholders, with limited response. A well registration and meter installation program is in the planning stages, pending funding (see Section 6.3), which will significantly improve resolution of Subbasin pumping. The USLRGMA has included the SLRIWA in requested groundwater level monitoring data and pumping data from the SLRIWArequests, but no data have been received to date. PVGSA USLRGMA will continue to outreach to SLRIWA and its tribal members in furtherance of refining and improving the existing data in the subbasin and associated models. Adding this additional groundwater monitoring and level data, should SLRIWA be willing to cooperate in data sharing on or around tribal lands, will enhance the ability of PVGSA USLRGMA to manage the entire subbasin while avoiding taking actions/engaging in omissions that fail to fully respect FRWR.

2.2.1.1.3 Groundwater Quality Monitoring

Groundwater quality within the Plan Area is continuously monitored to meet the California Department of Public Health's (CDPH's) requirements specified in Title 22 of the California Code of Regulations (CCR). All active municipal production wells must comply with CDPH's requirements. Groundwater quality data are collected through many different programs at the state and national levels. An evaluation of data from the groundwater quality monitoring programs described below is provided in Section 3.0 (Basin Setting). Furthermore, groundwater monitoring proposed described in Section 5.0 (Monitoring Network) will provides additional data for ongoing assessment of local Subbasin conditions.

California Department of Toxic Substances Control (DTSC)

In addition to poor ambient water quality, contamination from point sources can also introduce and spread contaminates within an aquifer system. The DTSC protects California's people and environment from toxic substances through the restoration of contaminated resources, enforcement of hazardous waste laws, reduction of hazardous waste generation, and encouragement to manufacture chemically

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safer products. The Envirostor database provides cleanup tracking, access to permitting, and enforcement and investigation efforts. Based on a search of DTSC's Envirostor database, there are currently no sites requiring action that could potentially affect the Plan Area aquifer system.

Safe Drinking Water Information System (SDWIS)

The Safe Drinking Water Act requires states to report drinking water information to the Environmental Protection Agency (EPA). The EPA works to protect human health and the environment at the Federal level. Data provided to the EPA through the Safe Drinking Water Information System (SDWIS) are maintained in a Federal database known as the SDWIS Fed Data Warehouse and are searchable.

State Water Resources Control Board (SWRCB)

The SWRCB maintains several online databases related to water quality.

GeoTracker is an online database that identifies known contamination cleanup sites, leaky underground storage tanks, and permitted facilities such as irrigated lands, oil and gas production, operating permitted underground storage tanks, and land disposal sites.

The Groundwater Ambient Monitoring and Assessment (GAMA) Program is California's comprehensive groundwater quality monitoring program created by the SWRCB in 2000 and expanded by the Groundwater Quality Monitoring Act of 2001. Public access to groundwater quality data from various sources is provided through GeoTracker GAMA on an interactive Google-based map.

2.2.1.2 Subsidence Monitoring

There is currently no active subsidence monitoring program in the Plan Area, nor any. There are no measurements of historical subsidence available. and nNo instances of subsidence induced damage have been identified to date within the USLR Valley Groundwater Subbasin and future subsidence is considered unlikely given Subbasin characteristics . Land subsidence monitoring will likely not be considered in the future due the nature of the aquifer systems in the subbasin (see Section 3.3.4.7 for more information). However, as part of their technical assistance for GSAs, DWR provides vertical displacement estimates from Interferometric Synthetic Aperture Radar (InSAR) data collected by the European Space Agency (ESA) Sentinel-1A satellite and processed by TRE ALTAMIRA Inc. This dataset represents measurements of vertical ground surface displacement beginning predominantly in 2015 and is available through the SGMA Data Viewer website.

2.2.1.3 Surface Water Monitoring

The United States Geological Survey (USGS) has had several gaging stations in the USLR Valley Groundwater Subbasin to monitor streamflow in the San Luis Rey River and main tributaries. Streamflow data are available through the National Water Information System (NWIS)[6]. However, many all of the gages in the subbasin are inactive and have limited data. The only active gage along the San Luis Rey River

[6] https://waterdata.usgs.gov/ca/nwis/rt

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is located in Oceanside (USGS Gage 11042000), approximately 15 miles downgradient of the USLR Valley Groundwater Subbasin.

Water diversions from surface water are also recorded by some diversion rights users and reported in annual reports available through eWRIMSCalWATRS.

2.2.1.4 Climate Monitoring

Weather monitoring stations provide a range of invaluable data, including the precipitation data used to determine a Subbasin water budget. A strategic plan for future water supply needs and steps to prepare for drought conditions can be created with an accurate water budget.

The primary weather station used to calculate mean annual rainfall for the San Luis Rey Valley Subbasin is National Oceanic and Atmospheric Administration (NOAA) Station at Henshaw Dam. The Henshaw Dam Station is southeast of the Plan Area, near Lake Henshaw. Daily precipitation and air temperature data is collectsed at this station. The data record for the Henshaw Dam Station extends as far back as 1941 and continues to the present day. Supplemental precipitation data are also available from two YMWD gaging stations and two sources of private records, provided to aid the development of this GSP. 30-year normal precipitation contours are also available through the PRISM Climate Group, which gathers climate observations from a wide range of monitoring networks, applies sophisticated quality control measures, and develops spatial climate datasets to reveal short- and long-term climate patterns.

During development of the GSP, California Irrigation Management Information System (CIMIS) station data were available at the Temecula, Oceanside, and Escondido gages. The Temecula gage has since been discontinued (in 2024). The USLRGMA established a new CIMIS station within the USLR Valley Groundwater Subbasin in 2025 as part of their proposed projects and management actions, to provide more accurate evapotranspiration (ET) data and inform irrigation system timing for Subbasin growers.

2.2.2 Existing Management Programs and Studies

Regulatory guidelines, planning recommendations, and other existing documents are currently used to broadly manage Plan Area groundwater and the groundwater surrounding the USLR Valley Subbasin. These management programs and studies have been developed by multiple agencies and organizations for a variety of purposes, but none of them have been specifically developed for the USLR Valley Subbasin. This section summarizes the most relevant groundwater management programs and studies in the USLR Valley Subbasin Plan Area.

2.2.2.1 San Diego County Groundwater Ordinance

The San Diego County Groundwater Ordinance[7] provides regulations for the protection, preservation, and maintenance of groundwater resources in San Diego County. This includes reviewing land development applications and evaluating additional groundwater demand. Developments in "Groundwater Impacted Basins" (identified by low yielding wells, developments in excess of available water sources, and/or declining water levels) require a groundwater investigation indicating that groundwater resources are

[7] https://www.sandiegocounty.gov/dplu/docs/GROUNDWATER-ORD.pdf

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sufficient to meet groundwater demands of the project. In addition, any project that proposes the use of groundwater not provided by a Water Service Agency may be subject to residential density controls, groundwater investigations, and well tests. Guidelines for determining the significance of adverse environmental effects a proposed project may have on groundwater resources are also provided by the County[8], which are consistent with California Environmental Quality Act (CEQA) guidelines.

2.2.2.2 Water Quality Control Plan for the San Diego Basin

The 1994 Water Quality Control Plan for the San Diego Basin (Basin Plan) was developed by the California Regional Water Quality Control Board, San Diego Region (Regional Board) in 1994 and adopted by the Regional Board on September 8, 1994. It is a dynamic document and subject to modification based on changing needs and circumstances with changes considered at a minimum of every three years. The most recent set of amendments occurred in 2021. The Basin Plan was created to protect, preserve, and enhance, where possible, water the quality of waters within the San Diego Region and protect the beneficial uses of all regional waters. It is a dynamic document and subject to modification based on changing needs and circumstances with changes considered at a minimum of every three years (Regional Board, 1994). The Basin Plan is divided into chapters reviewing and designating beneficial uses, water quality objectives, implementation, plans and policies, surveillance, monitoring and assessment, and total maximum daily loads. The Basin Plan functions to:

- Designate beneficial surface and groundwater uses in the Region
- Designate narrative and numerical water quality objectives for the reasonable protection of the defined uses
- Establish an implementation plan to protect the beneficial uses of the Region waters
- Describe the monitoring activities used to evaluate the effectiveness of the Basin Plan

The five policy statements listed below form the Regional Board's Water Quality Management Policy for the San Diego Region (Regional Board, 1994):

- An integral part of water quality management includes the water quality objectives, beneficial uses, and water quality control plans and policies adopted by the SWRCB and the Regional Board.
- Water reclamation and reuse shall be executed to the maximum extent feasible.
- Pollution point sources and nonpoint sources shall be controlled to protect designated beneficial uses of water.
- Instream beneficial uses shall be maintained and when practical, restored, and enhanced.
- Throughout the Region, a detailed and comprehensive knowledge of the beneficial uses, water quality, and activities affecting water quality shall be maintained.

[8] https://www.sandiegocounty.gov/dplu/docs/GRWTR-Guidelines.pdf, https://www.sandiegocounty.gov/content/dam/sdc/pds/ProjectPlanning/docs/GRWTR-Report-Format.pdf

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2.2.2.3 San Diego Integrated Regional Water Management Plan

The 2007 San Diego Integrated Regional Water Management Plan established a regional program for protecting, managing, and developing reliable and sustainable water resources in accordance with statewide Integrated Regional Water Management (IRWM) Program Guidelines. IRWM Program Guidelines were first established in 2004 by the SWRCB and DWR and later updated in 2007. The 2007 San Diego IRWM Plan was published under the direction of the Regional Water Management Group (RWMG), comprised of the San Diego County Water Authority, the City of San Diego, and the County of San Diego, and with the assistance of the Regional Advisory Committee (RAC). Formed in December 2006, the RAC is composed of experts to represent disadvantaged communities, regulatory agencies, water suppliers, wastewater agencies, water quality interests, environmental groups, academic institutions, business, and agriculture.

Four Plan goals were developed through a public outreach process by the RWMG and regional stakeholders and outlined in the 2007 San Diego IRWM Plan. The four goals were to 1) optimize water supply reliability, 2) protect and enhance water quality, 3) provide stewardship of natural resources, and 4) coordinate and integrate water resource management. Nine objectives were developed by the RWMG, RAC, and regional stakeholders to accomplish the IRWM Plan goals and measurable targets for each objective were determined. The objectives included:

- Objective A: Maximize stakeholder/community involvement and stewardship
- Objective B: Effectively obtain, manage, and assess water resource data and information
- Objective C: Further scientific and technical foundation of water management
- Objective D: Develop and maintain a diverse mix of water resources
- Objective E: Construct, operate, and maintain a reliable infrastructure system
- Objective F: Reduce the negative effects on waterways and watershed health caused by hydromodification and flooding
- Objective G: Effectively reduce sources of pollutants and environmental stressors
- Objective H: Protect, restore, and maintain habitat and open space
- Objective I: Optimize water-based recreational opportunities

Thirty water management strategies were selected and included in the IRWM Plan to address water resource issues involving water supply conservation, water quality protection, land conservation, runoff management, habitat and ecosystem enhancement, flood management, and recreation (RWMG, 2007). A two-stage prioritization process of Plan-level and Funding-level prioritization was proposed to evaluate the more than 160 water management projects considered and narrow the list before submission of grant applications. Project benefits and impacts monitoring, data management, conformance with Statewide priorities and consistency with local plans, and stakeholder involvement were also important components of the San Diego IRWM Plan.

The San Diego IRWM Plan was updated in 2013 and 2019. The 2013 San Diego IRWM Plan was revised to comply with the DWR's 2016 IRWM Program Guidelines and updated with new water planning studies (SDIRWM, 2020). Both the 2013 and 2019 IRWM Plans provide 1) regional coordination and integration of existing planning efforts, 2) determination of regional and watershed-based priorities for implementation projects, and 3) support for funding plans, programs, projects, and priorities of existing

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agencies and stakeholders (RWMG, 2013 and 2018). The 2019 update has also allowed regional stakeholders to review and adjust Plan goals, objectives, and priorities (RWMG, 2018). The RWMG currently meets bi-weekly and is responsible for the administration and implementation of the San Diego IRWM Program. The RAC meets bi-monthly and assists with IRWM planning and funding applications (SDIRWM, 2020).

2.2.2.4 San Diego County Water Authority Urban Water Management Plan

The Water Authority's 2025 Urban Water Management Plan (UWMP) provides the regional long-term water supply planning framework for the Water Authority service area, including evaluation of projected demands, available supplies, conservation, and water supply reliability through 2050. The UWMP concludes that the Water Authority's existing and planned water supply portfolio is sufficient to meet projected demands under normal, single-dry-year, and multiple-dry-year conditions (Water Authority, 2026b). The Water Authority's supply reliability is based on a diversified portfolio that includes Colorado River supplies, State Water Project supplies, conserved water transfers, canal lining supplies, seawater desalination, recycled water, potable reuse, groundwater development, local surface water, water-use efficiency, and regional storage programs.

The UWMP is relevant to the USLR Valley Groundwater Subbasin because imported water from the regional supply system is an important supplemental supply for portions of the Subbasin and supports reduced reliance on local groundwater during some hydrologic conditions. The Water Authority's long-term planning indicates that regional imported water supplies are expected to remain available to meet projected demands through the UWMP planning horizon, including during dry-year conditions. Continued availability of imported water supports the GSP sustainability strategy by helping maintain operational flexibility, reducing groundwater demand where imported water is used, and supporting long-term water supply reliability for municipal, agricultural, and other beneficial uses in the Subbasin.

~~2.2.2.4~~2.2.2.5 San Diego Regional Agricultural Water Management Plan

In 2016, the San Diego Regional Agricultural Water Management Plan (RAWMP) was prepared by the San Diego County Farm Bureau (SDCFB) and fourteen participating retail water agencies that serve commercial agricultural customers in the northern half of San Diego County (Weinberg and Jacoby, 2016a). The SDCFB is a non-profit membership organization founded in 1914 and works to promote and protect agriculture. The RAWMP describes and documents the San Diego Region's existing and proposed water management programs and activities that affect water use efficiency of the fourteen retail water agencies while complying with requirements of the SWRCB May 15, 2015 Emergency Regulation for Statewide Urban Water Conservation (Weinberg and Jacoby, 2016a). Compliance with the 2015 Emergency Regulation allows urban water supplies to deduct commercial agricultural deliveries from their agency's conservation target.

The San Diego RAWMP was prepared in accordance with the Water Conservation Act of 2009 (SBx7-7), which modified Division 6 of the California Water Code by adding Part 2.55 (commencing with §10608) and replacing Part 2.8 (commencing with §10800) (Weinberg and Jacoby, 2016a). The RAWMP consists of two parts. Part I addresses the Plan requirements from a regional perspective, utilizing regional planning documents such as: the SDCWA's 2010 Urban Water Management Plans (UWMP), the San Diego 2013

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Integrated Regional Water Management Plan, and County of San Diego General Plan documents (Weinberg and Jacoby, 2016a). It also breaks down regional planning to sections including:

- Water Management Facilities
- Terrain and Soils
- Climate
- Operational Characteristics
- Regional Water Shortage Allocation Policies
- Water Use
- Water Supplies and Hydrology
- Water Quality
- Climate Change
- Water Use Efficiency Information

Part II of the San Diego RAWMP provides agency-specific information on Agriculture Water Management Plan requirements for the fourteen water suppliers by refencing 2010 UWMPs and Water and Waste Water Master Plans (Weinberg and Jacoby, 2016b). Each agricultural water supplier possesses its own operating rules and regulations as well as associated policies, which are detailed in Part II. A total of 380,000 acres are serviced by the fourteen participating agencies (including YMWD within the USLR Valley Groundwater Subbasin), of which 44,210 acres are irrigated agricultural lands (Weinberg and Jacoby, 2016a). Part II is organized with the two largest agricultural water suppliers listed first and then alphabetical order for the remaining water supplies.

The fourteen retail water suppliers include:

- Carlsbad Municipal Water District
- City of Escondido
- City of Oceanside
- City of Poway
- Fallbrook Public Utilities District (PUD)
- Olivenhain MWD
- Rainbow MWD
- Ramona MWD
- Rincon del Diablo MWD
- San Dieguito Water District
- Santa Fe Irrigation District

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- Vallecitos Water District
- Valley Center MWD
- YMWD

2.2.3 Legal Decisions

2.2.3.1 Stipulated Judgment: Strub et al. v. Palomar Mutual Water Company

Prior to YMWD's formation in 1963, Pauma Valley's sole source of water was groundwater. Following a period of drought extending back to 1949, coupled with increased agricultural water demands, the water table fell and overdrafts of the underlying Pauma Subbasin lowered groundwater levels as much as 85 feet, forcing the abandonment of some wells and giving rise to increased pumping costs.

The drought also led to a stipulated judgment in the case of *Strub et al. v. Palomar Mutual Water Company* (Palomar MWC) (Superior Court of CA, 1953). This judgment limited Palomar MWC to withdrawal of no more than 1,350 acre-ft/yr from wells in the Pauma Subbasin (below 1,000 ft above mean sea level (amsl) and upstream of Cole Grade Road) for use on the lands it served. After annexing Palomar MWC in 1964, YMWD became successor in interest to Palomar MWC and continues to operate the former Palomar MWC system and properties (now known as Improvement District "A" [IDA]) as an independent water system (California State System No. 3700938). YMWD is responsible for administering IDA's compliance with Strub et al.

2.2.3.2 San Luis Rey Indian Water Rights Settlement Act

The following information is from the SLRIWA website[9]. The SLRIWA was created by the La Jolla, Pala, Pauma, Rincon, and San Pasqual Bands of Mission Indians to ensure their input in the water use and supply of the San Luis Rey River Basin (SLRIWA, 2026).

According to the SLRIWA, the United States, City of Escondido, Escondido MWC, VID, and the La Jolla, Rincon, San Pasqual, Pauma and Pala Bands of Mission Indians entered into a settlement agreement in 1988 once the need to provide the tribes with supplemental water supply was recognized. The San Luis Rey Indian Water Rights litigation originated after substantial diversions from the San Luis Rey River affected water availability on tribal lands, including declining well conditions on the Rincon Reservation in the 1960s. U.S. Congress passed the San Luis Rey Indian Water Rights Settlement Act to settle FRWR claims of the La Jolla, Rincon, San Pasqual, Pauma, and Pala Bands of Mission Indians in San Diego County, California, to authorize the lining of the All-American Canal, and for other purposes. The Settlement Act provided the following for the Indian Bands:

- Authorization for Indian Bands to enter into settlement agreements.
- A federal trust fund of $30 million was created for settlement implementation.
- Supplemental water of 16,000 acre-ft/year for use by the settlement parties to be arranged by the Secretary of the Interior.

[9] https://www.slriwa.org ~~https://www.slriwa.org/documents/statement-for-san-luis-rey-indian-water-authority~~

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The supplemental water source was identified in 2003 and represents is a portion of the water savings produced by projects lining sections of two large earthen canals that convey water from the Colorado River to the Imperial and Coachella Valleys in Southern California. Three additional agreements were needed to make the Colorado River water available for the San Luis Rey settlement. The three agreements were signed by the United States, the La Jolla, Rincon, San Pasqual, Pauma, and Pala Bands of Mission Indians, and other essential parties in 2003 and consist of:

- Allocation Agreement — Tthe allocation of water saved by the lining of the All-American and Coachella Canals will be divided as follows:
  - The first 16,000 acre-ft will be received by the San Luis Rey Settlement Parties annually,
  - The remaining saved water, approximately 77,000 acre-ft/year, is allocated to the San Diego County Water Authority.
- Water Delivery Agreement — Transfer of the conserved Colorado River water from Lake Havasu, located on the border between California and Arizona, to northern San Diego County will be completed by Metropolitan.
- Water Conveyance Agreement — Transfer of the settlement water from northern San Diego County to the San Luis Rey Settlement Parties will be completed by the Water Authority. The Indian Bands may sell any water not needed to Escondido and the VID.
- The San Luis Rey Indian Water Authority (SLRIWA) was created by the La Jolla, Pala, Pauma, Rincon, and San Pasqual Bands of Mission Indians to ensure their input in the water use and supply of the San Luis Rey River Basin (SLRIWA, 2020). According to the SLRIWA website, no settlement water has yet been delivered.

2.3 General Plan and Related Land Use Planning (§354.8(f))

2.3.1 General Plan

The Pala and Pauma Subbasins are part of the County of San Diego's General Plan (County of San Diego, 2015). Planned land use was available through SANDAG (20182026; see Figure 2-8). SANDAG's planned land use and zoning data was developed to provide regional growth forecasts to be used as a planning tool. Existing SANDAG land use data (see Section 2.1.1) were used as the foundation for building the planned land use data. However, the land use codes for current and planned land use are different. For example, the "agriculture" classification for current land use is represented by the more general zoning code "spaced rural residential". The County does not have land use authority for tribal reservations and any land under state or federal jurisdiction. These areas are classified by the County as "no jurisdiction."

Future land use in the USLR Valley Groundwater Subbasin is anticipated to remain predominantly agricultural. Previous estimates of population growth in the Pauma Subbasin have been on the order of 0.5% per year, or less (Weinberg and Jacoby, 2016a). Considering that only about 2.5% of total Pauma Valley demand is residential, the increase in population growth is expected to be negligible with respect to overall water demand. Any future urban development is anticipated to predominately occur in within the area designated as the Pauma Valley Village Boundary. However, since the present Pala and Pauma Subbasins are unable to accommodate current SANDAG population forecasts through 20302050, future

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urban development will be contingent on availability of necessary services, demonstrated need, and environmental factors (County of San Diego, 2015).

2.3.2 Future Water Demand and Supply

Groundwater management is the planned and coordinated local effort of sustaining the groundwater basin in order to meet future water supply needs. As competition for imported water supplies continues to become more intense and as drought, regulatory changes, and potential catastrophic failures threaten imported supplies, groundwater will continue to play a key role in creating a cost-effective and reliable water supply in the Plan Area.

The GSP outlines proposed projects and management actions to manage the Subbasin through varying hydrologic conditions as well as planned extractions and recharge activities. The Subbasin management approach outlined in this GSP will work towards avoiding undesirable results by acting to prevent:

- The chronic lowering of groundwater levels, indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon.
- Significant and unreasonable reduction of groundwater storage.
- Significant and unreasonable degraded groundwater quality.
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.
- Pumping-induced land subsidence.

The Plan Area also functions within a regional context where growth outside of the Subbasin impacts the total water demand and changes in supplies outside the Subbasin impact water availability in the Subbasin; both changes in demand and changes in supply impact the demands placed on Plan Area groundwater. Potential future projects and management actions are discussed in Section 6.0 of the GSP.

2.3.3 Well Permitting Policies and Procedures

In rural regions of San Diego County, water wells are routinely used as the only potable water supply. The San Diego County Department of Environmental Health (DEH) Land and Water Quality Division regulates and issues permits for all water well construction, destruction, and modifications, consistent with DWR regulations. Within the regulatory framework of SGMA, the GSA has no authority to permit well construction activities. Therefore, well permitting will continue to be regulated by the County. However, Paragraph 9 Item 1 of Executive Order N-7-22 required the County to obtain verification from the managing GSA before approving a permit for a new or altered well in a medium- or high-priority basin under SGMA. This verification ensures that the proposed well's groundwater extraction aligns with USLR GSP and does not hinder the achievement of sustainability goals. While this order is no longer in effect (as of 2024), the County has still been consulting with the GSA on all new well permit requests.

Completed well permit applications can be emailed to Wells.DEH@sdcounty.ca.gov or dropped off in-person at 5500 Overland Ave, Suite 210, San Diego, CA 92123. Permit fees can be mailed in, brought in-person, or credit card payments may be provided over the phone for an additional processing fee.

Water well application:

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https://www.sandiegocounty.gov/content/dam/sdc/deh/lwqd/Water%20Well%20Application.pdf

Instructions for paying water well permit fees online:
https://www.sandiegocounty.gov/content/dam/sdc/deh/water/docs/mwp_payment_flyer.pdf

The San Diego County DEH Monitoring Well Program issues all permits and enforces State standards and local ordinances related to the construction, modification, maintenance, and destruction of monitoring wells, inclinometers, vapor probes, cathodic protection wells, and enhanced leak detection systems (ELD).

Once the Monitoring Well Program permit is filled out with the required information, it can be emailed to MonitoringWells.DEH@sdcounty.ca.gov (preferred method), dropped off in-person at 5500 Overland Avenue, Suite 110, San Diego, CA 92123, or mailed to P.O. Box 129261, San Diego, CA 92112-9261. Permit fees can be mailed in, brought in-person, or paid online at http://www.DEHPAY.com.

Monitoring well application:
https://www.sandiegocounty.gov/content/dam/sdc/deh/water/docs/sam_monit_well_permit_appl_interactive.docx

Instructions for paying Monitoring Well Program fees online:
https://www.sandiegocounty.gov/content/dam/sdc/deh/water/docs/mwp_payment_flyer.pdf

2.4 Additional GSP Elements (§354.8(g))

2.4.1 Control of Saline Water Intrusion

Saline, or brackish, water intrusion is the induced migration of saline water into a freshwater aquifer system. The USGS defines parameters for saline water, typically measured by total dissolved solids (TDS) as follows:

- Fresh water - Less than 1,000 ppm (or mg/L)
- Slightly saline water - From 1,000 ppm to 3,000 ppm
- Moderately saline water - From 3,000 ppm to 10,000 ppm
- Highly saline water - From 10,000 ppm to 35,000 ppm

Saline water intrusion is typically observed in groundwater basins in closer proximity to the coast (e.g., downstream reaches of the Lower San Luis Rey Valley Groundwater Subbasin[10]), where lowering of

[10] The neighboring Lower San Luis Rey Valley Groundwater Subbasin has had historical issues with seawater intrusion (prior to the 1960s), between two to six miles inland from the Pacific Coast. Imported water deliveries have since allowed groundwater levels to recover enough to maintain groundwater gradients and limit seawater intrusion (SDIRWM, 2020). Current salinity values are still measuring high in the Lower San Luis Rey Valley Groundwater Subbasin, possibly from a combination of salt loading from storm water and irrigation flows and historical seawater intrusion effects (City of Oceanside et al., 2008). Maintaining control of saline water intrusion

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groundwater levels from pumping can reverse the groundwater flow gradient and allow ocean water to flow inland to lower groundwater elevations. Given the distance of the USLR Valley Groundwater Subbasin from the coast, the possibility of saltwater intrusion from the ocean is not considered an issue and will be discussed only minimally in following GSP sections.

Saline water can also generally be found at depth in alluvial groundwater basins where years of naturally occurring salts have accumulated. Pumping at shallower depths can induce the movement of higher saline water from depth up into freshwater aquifer systems. However, the USLR Valley Groundwater Subbasin is relatively narrow and shallow compared to other alluvial groundwater basins in Southern California, and highly saline water has not been found at depth.

While saline water intrusion is unlikely in the USLR Valley Groundwater Subbasin, historical agricultural use in the Subbasin has caused some areas to exhibit elevated TDS concentrations, on the order of 1,~~500~~ 400 mg/L ~~to 2,500 mg/L~~. A discussion of this and other water quality conditions in the subbasin is provided in Section 3.0 (Basin Setting) and will be addressed as appropriate as part of the sustainability goals of the GSP.

2.4.2 Wellhead Protection and Recharge Areas

The most important recharge sources in the Subbasin are stormflow in the San Luis Rey River and its tributaries, and by imported irrigation water applied on upland areas (DWR, 2003). Ninety percent of the potable water supply for the San Diego Region comes from imported water with an additional approximately ten percent coming from local reservoirs (CRWQCB, 1994). The highest precipitation in San Diego County occurs at the higher mountainous elevations, some of which form the eastern subbasin boundary, however natural recharge in the Plan Area is limited (County of San Diego, 2010).

The Federal Wellhead Protection Program was established by Section 1428 of the Safe Drinking Water Act Amendments of 1986. The purpose of the program is to protect groundwater sources of public drinking water supplies from contamination, thereby eliminating the need for costly treatment to meet drinking water standards. DWR Bulletins 74-81 (DWR, 1981) and 74-90 (DWR, 1991) provide specifications pertaining to wellhead protection, including:

- Methods for sealing the well from intrusion of surface contaminants
- Covering or protecting the boring at the end of each day from potential sources of pollution or vandalism
- Site grading to ensure drainage is away from the wellhead

Continued protection is required to maintain high quality recharge as water wells are routinely used as the only potable water supply in rural regions of San Diego County (SDCDEH, 2020). To protect the Plan Area, future groundwater quality water reclamation practices and imported water quality must continue to be reviewed and future decisions should consider long-term effects on groundwater quality.

is requirement in the Oceanside Narrows through use of minimum threshold groundwater elevations designed to maintain a seaward groundwater gradient in the Mission Basin.

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2.4.3 Migration of Contaminated Groundwater

The regulation of contaminated groundwater flow is critical for protecting groundwater currently in use within the Plan Area. Groundwater contamination can be through anthropogenic activities or naturally occurring. Contamination can come from various activities, including irrigation, pesticide application, septic tanks, industrial sources, stormwater runoff, and disposal sites. Several areas in the USLR Valley Groundwater Subbasin show increased levels of TDS, ~~and~~ nitrate and perchlorate, likely from agricultural legacy.

Several State of California online databases provide information and data on known groundwater contamination sites, including those undergoing current remediation, and groundwater quality for select wells in the subbasin. These databases are discussed in Section 2.2.1.1.3. The only case in the subbasin that ~~is still currently~~was open at the implementation of the GSP represented~~s~~ a former plastics recycling operation, which ~~is~~ was being monitored for lead-impacted soil that has been capped in-place. This case is now closed and there are no new sites.

Increased understanding of contaminated sites and improved cleanup efforts result from open sharing of information on the subbasin groundwater system, contamination sites, and water wells by coordinated local regulatory agencies. Advancements in treatment technologies also have the potential to renew contaminated groundwater into a source of potable or non-potable groundwater. Additional discussion of water quality conditions in the subbasin is presented in Section 3.0 (Basin Setting).

2.4.4 Well Abandonment and Well Destruction Program

Preventing the migration and introduction of surface contaminants to the connected aquifer system by an existing abandoned or incorrectly constructed well requires proper destruction of the well. This typically involves completely filling in a well in accordance with standard procedures. In USLR Valley Subbasin, the San Diego County DEH administers all water well and monitoring well destructions. Procedures for proper well destruction are provided in the California Well Standards, Bulletin 74-90 (DWR, 1991).

2.4.5 Well Construction Policies

As mentioned in Section 2.3.3, the San Diego County DEH Land and Water Quality Division issues permits for all water well construction in the Subbasin, consistent with DWR regulations. Under County regulation, inspections take place during several stages of well construction to ensure all standards listed in the California Well Standards, Bulletin 74-90 (DWR, 1991), are met. Once installation is complete, all drinking water wells are evaluated to confirm compliance with minimum drinking water standards. DEH requires water samples to be collected by a qualified individual with California certification, specialized training, or experience and that well water testing be completed by a certified drinking water laboratory. Water testing results must be submitted to DEH within one year of the testing. A clearance letter authorizing use is issued to the homeowner once the water well is found to be in compliance, after construction is finalized. As of July 1, 2018, the County of San Diego no longer provides water sample services.

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2.4.6 Efficient Water Management Policies

Water conservation is a key part of water demand management and efficient use of water in the Subbasin. The Water Authority, its member agencies, and the SDFB have provided technical and financial support for agricultural water use efficiency (WUE) in the San Diego Region since the 1980s (Weinberg and Jacoby, 2016a). The goal of the program is to provide technical assistance to growers to enable them to irrigate crops as efficiently as possible in order to obtain the maximum economic benefit from limited water resources.

In addition, Ordinance No. 100 – 08 establishes regulations to be implemented during times of declared water shortages or declared water shortage emergencies. It establishes four levels of drought response actions to be implemented in times of shortage, with increasing restrictions on water use in response to worsening drought conditions and decreasing available supplies. In order to help encourage WUE and efficient water management practices (EWMPs), YMWD has implemented both transitional special agricultural water rates (TSAWRs) and commercial agricultural (non-TSAWR) uniform water rates.

Potential additional water use management policies are discussed in Section 6.0 (Projects and Management Actions).

2.4.7 Relationships with State and Federal Regulatory Agencies

The PVGSA USLRGMA has beenwas established to create and implement this formal GSP for the USLR Valley Groundwater Subbasin. The GSP and related reports and documents will be submitted to DWR. Continued coordination and cultivation of new connections with Federal and State agencies is crucial for the continued sustainable management of the subbasin's groundwater. Federal and State agencies provide grant funding and loans, information, and services related to monitoring, water rights, and contamination sites.

The development of working relationships with the following federal and state regulatory agencies should continue to be pursued:

- Federal
  - United States Geological Survey (USGS)
- State
  - Department of Public Health (CDPH)
  - Department of Water Resources (DWR)

2.4.8 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are defined under SGMA as "ecological communities of species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" (23 CCR §351(m)). The USLRRCD has several conservation easements for Arroyo Toads in the USLR Valley Groundwater Subbasin, but these habitat areas are primarily dependent on seasonal surface water and the vernal pools created after storm events. Additional discussion is provided in the Basin Setting section of this GSP (Section 3.3.4.5).

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2.5 Notice and Communication (§354.10)

Under the requirements of SGMA, GSAs must consider interests of all beneficial uses and users of groundwater when developing and implementing a GSP. As a result, the GSP development needs to consider effects toon other stakeholder groups in or around the groundwater basin with overlapping interests. These interests include, but are not limited to, holders of overlying groundwater rights (including agriculture users and domestic well owners), public water systems, local land use planning agencies, environmental users, surface water users, federal government, California Native American tribes, and DACs.

The development of a GSP is a collaborative process involving all interested stakeholders. Public input is critical to the success of the USLR Valley Subbasin GSP and was a key component of its development. Notification and communication activities for the development of this GSP were guided by the Public Involvement Plan (Appendix 2a). The following tactics were implemented used throughout the development and implementation of the GSP:

- **Stakeholder list:** developed, maintained, and updated throughout the GSP process. A list of interested parties was developed from responses to public outreach activities described below.
- **Stakeholder letters:** distributed to every registered parcel owner within the subbasin and posted in community areas, such as the local post office. Two letters were sent out: one on December 4, 2020, and a follow-up letter on January 5, 2021. These letters provided background on SGMA, conveyed the desire of the GSA to include meaningful participation in the development of the GSP, informed stakeholders of the project, and directed them to the project website where they could sign up for regular updates and access posted information. The stakeholder letters included both an English and a Spanish version. The mailing list was developed using multiple sources of land ownership including, but not limited to, SANDAG Parcel Mapping Tool, and private well owner listing maintained by YMWD and the County of San Diego Parcel Tax Rolls. Contained within these lists were owners of all parcels located within the DAC areas indicated on Figure 2-6.
- **Project webpage:** the USLRGMA maintained under the YMWDa website that , the project webpage contains project information and resources, annual reports, frequently asked questions, meeting minutes and agendas, opportunities to provide feedback, and information on how to contact the project team. Available at: https://uslrgma.com/https://www.yuimamwd.com/newdev/65-services/143-gsp.
- **Project fact sheet:** provides general information about SGMA, the PVGSA (now USLRGMA), and development of the USLR Valley GSP. Available on the project webpage.
- **Virtual sStakeholder meetings:** held remotely due to COVID-19, during development of the GSP, these meetings (held remotely due to COVID-19), educated stakeholders and solicited incremental feedback and review of sections of the GSP. During the stakeholder outreach meetings, draft GSP content was reviewed in depth, specific questions were asked of the stakeholder, participation in data collection was requested, and stakeholder questions were noted by the consultant, answered and any suggestions arrived by discussion were included in the GSP. It should be noted that rather than offering contributions to GSP content, most concerns

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of the stakeholders that participated were directly related to potential cutbacks and what their potential water allocation would be in relation to the water budget.

Stakeholder meetings, including in-person and virtual options, have continued during GSP implementation through USLRGMA Board meetings and GSP workshops. Meeting agendas and associated information are made available on the USLRGMA website for stakeholder and tribal review.

- **E-blasts:** sent to participants on the stakeholder list to provide project updates and meeting announcements, request participation in data collection, and provide draft GSP content for review. E-blasts were also sent to the original interested parties list developed by the County of San Diego during the initial process of developing the GSA as well as YMWD customers, which included the documentation sent out in the December 4, 2020, and January 5, 2021, mailed letters.
- **Presentations:** to provide information at meetings held by the GSA and at stakeholder outreach workshops. PDFs of the presentation slides were are made available on the project USLRGMA webpage.
-

Public meetings at which the Plan was discussed or considered by the GSA include:

June 24, 2020	November 15, 2021*January 27, 2021*	February 20, 2024September 15, 2021
July 30, 2020	December 6, 2021March 3, 2021	March 19, 2024October 6, 2021*
August 26, 2020	December 8, 2021*March 24, 2021*	April 16, 2024November 9, 2021
September 23, 2020	January 21, 2022 April 7, 2021	May 21, 2024November 15, 2021*
October 28, 2020	September 20, 2022June 2, 2021	June 18, 2024December 6, 2021
June 24, 2020	October 18, 2022June 16, 2021*	July 16, 2024December 8, 2021*
December 9, 2020	November 15, 2022June 30, 2021	February 25, 2025January 21, 2022
January 27, 2021*	December 20, 2022	March 18, 2025
March 3, 2021	January 17, 2023	June 17, 2025
March 24, 2021*	February 21, 2023	September 16, 2025
April 7, 2021	April 18, 2023	December 16, 2025
June 2, 2021	June 20, 2023	March 17, 2026
June 16, 2021*	August 15, 2023	May 19, 2026
June 30, 2021	September 19, 2023	June 16, 2026
September 15, 2021	October 17, 2023	August 18, 2026*
October 6, 2021*	December 5, 2023	October 20, 2026*
November 9, 2021	January 16, 2024	

*Stakeholder outreach workshops

Following issuance of the administrative draft GSP in November 2021 and the draft GSP Amendment in November 2026, a 45-day public comment period was held. Comments regarding the administrative draft GSP and GSP Amendment received by the GSA and a summary of GSA responses are included as Appendix 2b and Appendix 2c, respectively. Original comment letters have been updated to the GSP portal, available here:

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~~https://sgma.water.ca.gov/portal/gsp/basin/comments/525#f=INITIAL_76https://sgma.water.ca.gov/portal/gsp/init/comments/154~~. The Public Involvement Plan only encompassed the activities and timeline for the GSP development phase; public involvement for the implementation phase of the GSP was included in the Project and Management Actions of the GSP (Section 6.0).

2.5.1 ~~Pauma Valley GSA~~USLRGMA Decision Making Process

~~The GSA Executive Committee is comprised seven (7) members; two voting members appointed by each party plus one ex officio member. All final decisions are on a consensus basis. A consensus as used for this purpose means a majority vote of all voting members of the Executive Team on any given decision.~~

During development of the GSP, ~~The Team established~~ two work groups ~~during the development of the GSP~~were established. Each workgroup consisted of one voting member from each party plus a representative for the ex officio member per work group. The work group was tasked with working with the GSP Consultant and YMWD General Manager to ~~perpetuate~~ support the development of the GSP. The groups assisted with data collection and GSP section development.

Once a section, or significant portion of the GSP was deemed complete, the sections were th~~e~~an brought to the GSA Executive Committee (comprised of 12 members) for review, revisions, and approval to be presented to the public through Stakeholder engagement meetings. For the GSP amendment process, an ad-hoc committee of the JPA Board of Directors was formed to discuss updates and help prepare elements for the GSP Amendment and Periodic Evaluation report. The USLRGMA Board of Directors serves as the decision-making body for GSP implementation.

~~The~~ A~~a~~dministrative drafts of the GSP/Amendments are ~~was completed,~~ reviewed and approved by the ~~Executive Committee~~GSA for release to public for a 45-day review and public comment period. During the 45-day public review and comment period, each of the ~~parties~~members of the Board of Directors also reviewed the Draft GSP/Amendment in preparation for final approval and submittal to the State.

After the 45-day review and public comment period is completed and the GSP/Amendment is finalized, the ~~Executive Committee~~GSA ~~will~~ reviews and approves any changes made and ~~brought~~ brings the GSP/Amendment to ~~each of their respective~~the Board of Directors for approval and submission to the State.

During initial GSP development, t~~T~~he GSA conducted five~~5~~ Stakeholder outreach meetings. At these meetings the consultant discussed the required content of a GSP, presented data collection information, water modeling results, and draft sections of the GSP. Additional workshops and outreach meetings were conducted during the periodic evaluation and GSP amendment process to provide an overview of work to be completed and present preliminary results and/or approaches. At each meeting the public ~~was~~ is ~~allowed~~ encouraged to ask questions and make suggestions about how the sections might be improved by including relevant information. The consultant ~~would~~ then makes revisions ~~to the sections~~ based on discussions during the stakeholder outreach meetings.

During GSP implementation, the public ~~will be~~was notified of important developments or changes in the current status of the Subbasin. The ~~GSA~~ USLRGMA will engage in water conservation and efficiency messaging to all stakeholders of the Subbasin as well as establish a drought resiliency workgroup to assist

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with conservation messaging and stakeholder engagement in drought resilience monitoring of the Subbasin to better avoid the occurrence of undesirable results (see Section 6.0).

The USLR Valley Groundwater Subbasin is comprised of mostly Native American, Hispanic and White residents. In order encourage involvement in the GSP dDevelopment and continued involvement during GSP implementation, the GSA USLRGMA has employedes the use of dual language correspondence to all property owners and tribal nations located within the Subbasin. During the initial GSP development, Sspecial invitations to tribal representatives of all tribes located within the Subbasin and to the San Luis Rey Indian Water AuthoritySLRIWA to attend GSA Executive Team meetings, in addition to stakeholder outreach meetings. were extended during GSP development and Meeting invitations will continue throughout the GSP implementation process. More importantly, the GSA USLRGMA is attempting to developwill convene an Interactive Tribal Work Group to encourage tribal participation, promote basin balancing maintenance activities, and ensure respecting of federal reserve water rights.

The GSA will utilize electronic (email and website postings), traditional mail, and possible social media methods to communicate and inform the public about the GSP implementation process and the necessity to perform any project or management actions as described in the GSP.

2.5.2 Joint Powers Authority (JPA)

Following development of the GSP, tThe PVGSA USLRGMA has developedwas established through a draft JPA, and implementing agreement, consisting of the existing members of the PVGSA, and possibly one or more additional GSA eligible "local agencies". SLRIWA has been offered two voting seats on the JPA (out of a total of ten votes) in order to ensure that FRWR are fully respected, but perhaps more importantly, to facilitate a collaborative and constructive approach to water management, much as pertains in the Santa Margarita system where the Pechanga Tribe has a permanent seat on the Santa Margarita River Watermaster and works collaboratively with its neighbors in the Santa Margarita River watershed.

2.6 References (§354.4(b))

AB 1944 (Assembly Bill No. 1944), 2018. Chapter 255. An act to amend Section 10721 of, and to add Section 10722.5 to, the Water Code, relating to groundwater. Approved by the Governor September 5, 2018. Filed with Secretary of State September 5, 2018.

ACS (American Community Survey), 2025. Census Tract GIS Tiger file: i16 Census Tract DisadvantagedCommunities 2023. Accessed July 17, 2026. https://www.arcgis.com/home/item.html?id=1dda3bb08eee4b4a8b7b667cb0fd9901#overview

CCED (California Conservation Easement Database), 2020. California Conservation Easement Database 2020a shapefiles. Published by GreenInfo Network. Last modified June 17. https://data.cnra.ca.gov/dataset/california-conservation-easement-database

CCLT (California Council of Land Trusts), 2020. "Fallbrook Land Conservancy." Accessed September 21, 2020. https://www.calandtrusts.org/m0embers/fallbrook-land-conservancy/

City of Oceanside, City of Vista, and County of San Diego, 2008. San Luis Rey River Watershed Urban Runoff Management Program. Prepared for California Regional Water Quality Control Board San Diego Region 9. https://www.ci.oceanside.ca.us/civicax/filebank/blobdload.aspx?blobid=26177

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County of San Diego, 2010. County of San Diego Department of Planning and Land Use General Plan Update Groundwater Study. Final. https://www.sandiegocounty.gov/content/dam/sdc/pds/gpupdate/docs/BOS_Aug2011/EIR/Appn_D_GW.pdf

County of San Diego, 2015. Pala/Pauma Subregional Plan – San Diego County General Plan. Amended November 18, 2015 – GPA14-001. https://www.sandiegocounty.gov/pds/docs/CP/Pala_Pauma_CP.pdf

CPAD (California Protected Areas Database) 2020. California Protected Areas Database 2020a shapefiles. Published by GreenInfo Network. Last modified June 17. https://data.cnra.ca.gov/dataset/california-protected-areas-database

DWR (California Department of Water Resources), 1981. Water Well Standards: State of California. Bulletin 74-81, dated December.

DWR, 1991. California Well Standards: Water Wells, Monitoring Wells, Cathodic Protection Wells. Bulletin 74-90 (Supplement to Bulletin 74-81), dated June.

DWR, 2016. California's Ground Water. Bulletin 118 Interim Update 2016.

DWR, 2021. Urban Water Management Plans. Accessed February 23, 2020. https://water.ca.gov/Programs/Water-Use-And-Efficiency/Urban-Water-Use-Efficiency/Urban-Water-Management-Plans

Geosyntec (Geosyntec Consultants), 2015. Groundwater Monitoring Plan San Luis Rey Valley Basin (9-7) San Diego County, California. California Statewide Groundwater Elevation Monitoring Program. Prepared for County of San Diego, Department of Planning and Development Services.

Howes, Thomas, 1955. "A Brief Study of the Geology and Ground Water Conditions in the Pauma Valley Area San Diego County, California." Master's thesis, California Institute of Technology.

LAFCO (San Diego Local Agency Formation Commission) 2021. Special District Profiles & Maps. Municipal Water Districts. https://www.sdlafco.org/agencies/special-districts

Regional Board (California Regional Water Quality Control Board, San Diego Region), 1994. Water Quality Control Plan for the San Diego Basin (9). Amendments effective on or before ~~May 17, 2016~~September 1, 2021. https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/docs/R9_Basin_Plan.pdf

RWMG (Regional Water Management Group), 2007. 2007 San Diego Integrated Regional Water Management Plan. In collaboration with the Regional Advisory Committee.

RWMG, 2013. 2013 San Diego Integrated Regional Water Management Plan. An Update of the 2007 IRWM Plan. In collaboration with the Regional Advisory Committee.

RWMG, 2018. 2019 San Diego Integrated Regional Water Management Plan. Phase 1 Update of the 2013 IRWM Plan. In collaboration with the Regional Advisory Committee.

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SanGIS, 2026. Planed Land Use to the 2050 Horizon Year for the Series 15 Regional Growth Forecast. Data Warehouse in conjunction with San Diego Association of Governments (SANDAG). Accessed September 4, 2026. https://geo.sandag.org/portal/home/item.html?id=e42d81aee77c40828c873f7b291ef05c

San GIS, 20192025. Existing (20172024) SANDAG land use shapefiles. Data Warehouse in conjunction with San Diego Association of Governments (SANDAG). Accessed September January 1823, 20202026. https://geo.sandag.org/portal/apps/experiencebuilder/experience/?id=fad9e9c038c84f799b5378e4cc3ed068https://www.arcgis.com/home/item.html?id=6fed6288eac2420aab91e337720d69bd

SDCDEH (San Diego County Department of Environmental Health), 2020. "Water Well Program." Accessed December 14, 2020. https://www.sandiegocounty.gov/content/sdc/deh/lwqd/lu_water_wells.html

SDIRWM (San Diego Integrated Regional Water Management), 2019. 2019 San Diego Regional Water Management Plan. Prepared by the Regional Water Management Group in collaboration with the Regional Advisory Committee, dated May 2019.

SDIRWM, 2020. "Integrated Regional Water Management Planning for the San Diego Region." https://www.sdirwmp.org/

SDLAFCO (San Diego Local Agency Formation Commissions), 2020. "Mootamai Municipal Water District." Accessed October 26. https://www.sdlafco.org/home/showdocument?id=2400

SDMMP (San Diego Management and Monitoring Program), 2020. "Plaisted Creek Ecological Reserve." Accessed September 21. https://sdmmp.com/view_preserve.php?preserveid=3141

SDPARKS (San Diego County Parks and Recreation), 2020. "Wilderness Gardens." Accessed September 21, 2020. https://www.sdparks.org/content/sdparks/en/park-pages/WildernessGardens.html

SLRIWA (San Luis Rey Indian Water Authority), 20202026. "San Luis Rey Indian Water Authority." Accessed October 1September 5, 202006. https://www.slriwa.org/

Superior Court of CA (Superior Court of the State of California, County of San Diego), 1953. Stipulated Judgment No. 162650. Strub et al. v. Palomar Mutual Water Company et al.

SWRCB (California State Water Resources Control Board), 2002. Decision 1645: Decision Determining the Legal Classification of Groundwater in the Pauma and Pala Basins of the San Luis Rey River. In the Matter of Applications 30038, 30083, 30160, 30165, 30175, 30178, 30260, 30355, and 30374.

US Congress, 1988. San Luis Rey Indian Water Rights Settlement Act. Public Law 100-675-Nov. 17, 1988.

USFS (United States Forest Service), 2020. "Cleveland National Forest." Accessed September 21, 2020. https://www.fs.usda.gov/main/cleveland/about-forest

Water Authority (San Diego County Water Authority), 2026a. San Diego County Water Authority Fact Sheet. Dated May 2026. https://www.sdcwa.org/wp-content/uploads/2020/11/overview-fs.pdf.

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Water Authority, 2026b. 2025 Urban Water Management Plan. Dated June 2026. https://www.sdcwa.org/wp-content/uploads/2026/07/Urban-Water-Management-Plan-Adopted.pdf

Water Authority, 2008. Comprehensive Annual Financial Report Fiscal Year Ended June 30, 2008.

Weinberg and Jacoby (Ken Weinberg Water Resources Consulting LLC and Bill Jacoby Water Resources Consulting), 2016a. San Diego Regional Agricultural Water Management Plan Part I. Prepared for San Diego County Farm Bureau. Dated January.

Weinberg and Jacoby, 2016b. San Diego Regional Agricultural Water Management Plan Part II. Prepared for San Diego County Farm Bureau. Dated January.

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3.0 Basin Setting (§354.12)

The Basin Setting section describes the physical components of the USLR Valley Groundwater Subbasin and provides a hydrogeologic conceptual model[11] for the understanding of groundwater conditions in the subbasin and development of groundwater budgets. The hydrogeologic conceptual model presented here is based on previous reports, publicly available data, and information provided by the GSA and Subbasin stakeholders. The conceptual model will continue to be updated as new information becomes available.

3.1 General Setting (§354.14(d))

The USLR Valley Groundwater Subbasin (DWR subbasin 9-007.01) includes the Pauma and Pala Subbasins and encompasses approximately 19,200 acres in San Diego County. The valley areas are separated by narrow, steep-walled canyons and underlain by unconsolidated alluvial fill that serve as storage for groundwater. Elevation ranges from approximately 250 ft above mean sea level (amsl) in valley areas to over 5,700 ft amsl in the surrounding watershed area. The majority of land in the groundwater subbasin is used for agriculture, consisting primarily of citrus, avocados, and sub-tropical fruits.

3.1.1 Geography

The USLR Valley Groundwater Subbasin, located approximately 20 miles east of the Pacific Ocean, is bounded to the north by Mount Olympus, Tourmaline Queen Mountain, Chief Mountain, Heriot Mountain, and Agua Tibia Mountain. Boucher Hill, Palomar Mountain, and Rodriguez Mountain bound the subbasin to the east while Weaver Mountain, Pala Mountain, and Lancaster Mountain bound the south and southwest subbasin areas (Figure 3-1). Northwest of Pala Subbasin lie the Santa Margarita Mountains. These mountains continue north along the western side of the Elsinore-Temecula trough, a pronounced topographic and structural depression caused by movement along the Elsinore fault zone. The end of the USLR Valley Groundwater Subbasin (i.e., downstream end of Pala Subbasin) is defined by the Monserate Narrows, located between Monserate Mountain to the north and Lancaster Mountain to the south.

The main surface drainage feature in the area is the San Luis Rey River. The San Luis Rey River flows in a northwesterly direction through Pauma Subbasin and into Pala Subbasin, where it turns to the southwest and flows through the Monserate Narrows and into downgradient Bonsall Subbasin.

Vegetation in the Plan Area includes chaparral, coastal sage scrub, and oak woodland (Recon, 1996).

3.1.2 Climate

The general climate of the area is Mediterranean, with warm, dry summers and mild winters, although temperatures do occasionally fall below freezing. Most precipitation falls between the months of November and April with infrequent rain the rest of the year (particularly in summer months). Precipitation is also two to three times greater in the surrounding hills and mountain areas than in the

[11] A hydrogeologic conceptual model provides an understanding of the general physical characteristics related to regional hydrology, land use, geology and geologic structure, water quality, and principal aquifers/aquitards (DWR, 2016).

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valley areas (Ellis and Lee, 1919). Cyclic hydrologic patterns are common, including wet periods of above-average rainfall and dry periods (drought) with below-average rainfall. Therefore, year-to-year rainfall can be highly variable. Historical annual rainfall at the National Oceanic and Atmospheric Administration (NOAA) precipitation station at Henshaw Dam is shown on Figure 3-2, along with the cumulative departure from mean annual precipitation. This gage has the most complete and extensive precipitation record available in the vicinity of the USLR Valley Groundwater Subbasin.

Average annual precipitation for the period from 1943 through ~~2020~~ 2025 is approximately 24.3 inches. Since this station is located at a higher elevation than the majority of the groundwater subbasin, precipitation in the valley areas is expected to be less (actual recharge from precipitation was estimated from isohyetal contours of precipitation – more accurately representing rainfall in the valley areas – during the development of water budgets in Section 3.3.5). Nevertheless, the cumulative departure from precipitation provides a good illustration of precipitation patterns through time. On this figure, an increasing slope in the cumulative departure indicates a period of above average precipitation (i.e., wet hydrologic period) while a declining trend or slope indicates a period of below average precipitation (i.e., dry hydrologic period).

WY type (i.e., wet, above normal, below normal, dry, or critical) was determined from recorded precipitation at Henshaw Dam using the categories presented in Table 3-1 below. These classifications are based on the thresholds outlined in DWR Water Year Type Dataset Development Report (2021). WY type is also reflected in Figure 3-2.

Table 3-1. Percent Exceedance Ranges and Precipitation Thresholds for Water Year Type

Water Year Type	Percent Exceedance[1] Range [%]	Threshold Between Year Type [in/yr]	Number of Years in Historical Record (WY 1943-2024)
Wet	0% - 30%	28.24	24
Above Normal	>30% - 50%	21.14	17
Below Normal	>50% - 70%	17.55	17
Dry	>70% - 85%	15.14	12
Critical	>85% - 100%	-	13

[1] Percent exceedance refers to the percentage of precipitation values that are greater than a given threshold for the entire period of record. For example, for a year classified as wet hydrology type, that year's precipitation falls in the upper 30% of precipitation values observed at Henshaw Dam. For the Henshaw period of record (1943 through 2025), the highest 30% of annual precipitation records is represented by values greater than 28.24 inches.

3.2 Geology (§354.14(a),(b),(c),(d))

3.2.1 Regional Geologic and Structural Setting

The USLR Valley Groundwater Subbasin lies within the Peninsular Ranges Physiographic Province of Southern California, which is characterized by mountainous ridges and hills interspersed by intermountain valleys and basins. The Peninsular Ranges have been subject to a range of tectonic forces, including

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faulting, tilting, regional uplift, and subsequent erosion. The regional uplift the area has experienced caused the San Luis Rey River to incise a canyon through what is now the Pauma and Pala Valleys – deeper than its current elevation (Ellis and Lee, 1919; Howes, 1955). Later lowering of the area led to the filling of the river cut valleys with fluvial and alluvial material. Additional uplift caused the river to erode back through these deposits to a degree, to its current elevation. At the same time, alluvial fans developed along the Subbasin boundaries, particularly along the northern/eastern side of Pauma Valley. The downcutting and backfilling of the alluvial basins was also influenced by fluctuations in sea level, which fell approximately 300 to 400 ft below its present level near the end of the Pleistocene (DWR, 1965).

The main structural feature in the Plan Area is the Elsinore fault zone, which runs northeast of the Valley (Figure 3-3). The Elsinore fault zone represents the westernmost onshore branch of the San Andreas fault system and extends over 200 km from the southern Los Angeles Basin into Mexico (where it becomes known as the Laguna Salada fault). Three distinct segments of the Elsinore fault are thought to exist in the Plan Area: a strike slip segment northwestortheast of Pala Valley, by Agua Tibia Mountain; a transitional strike-slip segment causing regional transpression north of Frey Creek, and a predominantly thrust faulted segment in Pauma Valley (Howes, 1955; Vaughan, 1987). There is also the nearby Tecolote fault, which forms the boundary between the San Marcos gabbro underlying Pala Mountain and the Bonsall tonalite to the southwest (refer to Section 3.2.2 for discussion of local rock formations), extends to the north under the alluvium-filled valley, and eventually merges with the Elsinore fault zone in the vicinity of Sycamore Canyon.

Repeated and prolonged uplift along the Elsinore fault, primarily during the Pleistocene, has created higher elevations to the northeast and lower elevations in the valley area to the southwest (Howes, 1955). The majority of uplift has occurred in Pauma Valley (Vaughan, 1987). Here, a restraining bend in the Elsinore fault, known as the Palomar bend, causes thrust faulting with a strike-slip component (Howes, 1955; Vaughan, 1987; Vaughan et al., 1999). Uplift of Agua Tibia Mountain largely occurred during the middle Pleistocene as the result of transpressive stresses associated with movement along the Elsinore fault, particularly from this restraining bend (Vaughan et al., 1999).

Other structural evidence of faulting along the Elsinore fault zone includes hourglass-shaped valleys on the sides of the surrounding mountains, steepened stream terrace gradients, deformed and tilted rock formations, extensive fracturing and localized brecciation/gouge zones, and offset alluvial fans (Howes, 1955; Vaughan, 1987). Estimates of right-lateral offset along the fault range from 0 to 40 km with a slip rate of approximately 4.9 +/- 2.0 mm/yr (Vaughan, 1987). Fracturing associated with the Elsinore fault zone is also thought to be a conduit for groundwater flow (Howes, 1955; Vaughan, 1987). Other structural features implied by confused rock associations in the basement complex indicate the existence of structural forces before the development of the groundwater Subbasin. These features are not known to significantly affect groundwater conditions in the groundwater Subbasin (DWR, 1965).

No major earthquakes have occurred along the Elsinore Fault in the USLR Valley Groundwater SubbBasin since the establishment of the Pala Mission in 1816. Historical earthquake magnitudes along the Elsinore fault and geologic evidence of recent and significant tectonic movement suggest the fault is prone to larger (i.e., magnitude 7.0 and greater), infrequent earthquake events rather than smaller, frequent ones (Vaughan, 1987). Large earthquakes are thought to occur every 550 to 600 years (Vaughan et al., 1999).

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3.2.2 Local Geology

The Pala and Pauma Valleys are underlain by valley fill consisting of flood plain and channel alluvial deposits, alluvial fan material, and localized lake deposits, with possible minor amounts of eolian (i.e., windblown) material. Of these, the stream and flood plain deposits tend to be more productive for groundwater due to the well sorted nature of the sediments and dominant presence of sands and gravels (Howes, 1955). Valley fill is surrounded by and underlain by Paleozoic and Triassic metasediments, Jurassic volcanics, and Cretaceous igneous rocks of the Southern California batholith. Tertiary and Quaternary extrusives (e.g., dikes) occur locally throughout the basement complex. A geologic map of the Plan Area is provided as Figure 3-3. Geologic cross-sections were also created using surficial geology, information on well driller's logs (provided as Appendix 3a), and information from previous studies (Figures 3-4 through 3-7). The main geologic units found in the USLR Valley Groundwater Subbasin are discussed in more detail in the following sections.

3.2.2.1 Bedrock

The main crystalline rocks that represent the bedrock, or basement complex, of the San Luis Rey Valley Groundwater Subbasin include the Julian schist, San Marcos gabbro, Bonsall tonalite, and Woodson Mountain granodiorite. Rocks making up the basement complex provide only limited amounts of groundwater through fractures and joints – particularly where weathered bedrock is present. ~~They therefore appear to have limited influence on groundwater in the basin proper (DWR, 1965).~~ For the purposes of this GSP, ~~since the bedrock is considered to be generally non-water bearing and therefore not a part of the groundwater basin,~~ these crystalline units have been lumped together in the geologic map and cross-sections of the USLR Valley Groundwater Subbasin (Figures 3-3 through 3-7). They are also generally referred to as "bedrock" for the hydrogeologic conceptual model of the area. However, brief descriptions of each unit are provided below.

The Julian schist[12] (Triassic age), which is relatively resistant to erosion, forms many of the hills and ridges surrounding the Pauma Subbasin. Larsen (1948) hypothesized the schist originated from Triassic sedimentary rocks that were likely metamorphosed prior to emplacement of the batholith in the early Upper Cretaceous.

The San Marcos gabbro[13] (Cretaceous age) is less resistant that some of the other surrounding igneous and metamorphic rocks and may have a crumbly appearance in outcrops. In areas where the rock is more competent, like northwest of the Agua Tibia ranch house, large boulders are quarried as "black granite" (Howes, 1955).

[12] Schist is a medium-grade metamorphic rock formed from the altering of mudstone or shale through heat and/or pressure. It has medium to large, flat, sheet-like grains in a preferred orientation (nearby grains are roughly parallel).

[13] Gabbro is a phaneritic (coarse-grained), mafic (dark-colored) intrusive igneous rock formed from the slow cooling of magnesium-rich and iron-rich magma inside the earth.

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The Bonsall tonalite[14] (Cretaceous age) is the most common rock type in the vicinity of the Subbasin. It is thought that the tonalite was injected into the older San Marcos gabbro before the gabbro completely solidified – leading to a large number of grabbroic inclusions within the tonalite (Howes, 1955).

Woodson Mountain granodiorite[15] (Cretaceous in age) is highly resistant to erosion and often appears as huge boulders in exposures, such as those found on Woodson Mountain for which it is named.

Pegmatite[16] *dikes*[17] (Upper Cretaceous in age) are common in the bedrock surrounding USLR Valley Groundwater SubbBasin, particularly the San Marcos gabbro and Bonsall tonalite, and stand out in relief due to their resistance to erosion. Near Pala, these pegmatites have been mined for semi-precious stones like kunzite and tourmaline.

Residuum and colluvium deposits represent the weathered surface of local bedrock, occurring primarily on the flanks of valleys tributary to the main San Luis Rey River valley. They typically do not represent a major source of groundwater but may be important sources for groundwater recharge (DWR, 1965).

3.2.2.2 Alluvial Fill

There are four main classifications for the alluvial fill in the USLR Valley Groundwater SubbBasin:

- Older alluvium (Pleistocene age),
- Lakebed (lacustrine) deposits (Pleistocene age),
- Alluvial fan deposits (Pleistocene age), and
- River channel deposits / younger alluvium (Holocene age).

Surrounding outcrops of Woodson Mountain granodiorite, Bonsall tonalite, San Marcos gabbro, Julian schist, and pegmatite dikes represent the primary source material for valley fill. Alluvial sediments in valleys are generally thickest under the San Luis Rey River. In Pauma Valley, sediments may be up to 600 ft thick in localized areas of the northeast portion of the subbasin (Layne, 2010). However, these locations with greater sediment depth typically coincide with alluvial fan deposits, which tend to be less productive. Alluvial fill is shallower in the Pala Subbasin than thicknesses found in Pauma, with a maximum depth of approximately 240 ft (Moreland, 1974). The majority of pumped groundwater in this subbasin comes from younger alluvium.

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[14] Tonalite is an igneous, plutonic (intrusive) rock, of felsic (lighter colored and silica-rich) composition, with phaneritic texture.

[15] Granodiorite is a phaneritic-textured intrusive igneous rock similar to granite, but containing more plagioclase (sodium or calcium) feldspar than orthoclase (potassium) feldspar.

[16] Pegmatite is an igneous rock, formed by slow crystallization at high temperature and pressure at depth, and exhibiting large interlocking crystals usually greater in size than 1 inch.

[17] A dike is a sheet of rock that is formed in a fracture of a pre-existing rock body. Magmatic dikes form when magma flows into a crack then solidifies as a sheet intrusion, either cutting across layers of rock or through a contiguous mass of rock.

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3.2.2.2.1 Older Alluvium

Older alluvium consists of well sorted layers of gravel, sand, silt, and clay up to 160 ft thick (Moreland, 1974). While this unit is generally only associated with the Pauma Subbasin (DWR, 1965; Mooreland, 1974), the cemented nature of alluvial materials from well logs within Pala Subbasin and recent geologic mapping (Bedrossian et al., 2012) indicate that older alluvial materials may also be present in the Pala Subbasin. As such, this unit has been represented in the geologic cross-sections in Pala (Figures 3-4 and 3-5).

3.2.2.2.2 Lakebed Deposits

Many of the wells in the Pauma Subbasin have records of an organic-rich, black clay or mud layer ranging in thickness from 4 to 10 ft, typically found about 90 ft bgs (DWR, 1965; Howes, 1955). It is believed that this layer represents lakebed deposits from paleo Lake Pauma, which existed during the Pleistocene due to the temporary damming of the San Luis Rey River by the Agua Tibia alluvial fan during a period of rapid uplift. The lake has been estimated to be approximately 4 miles long and 1 to 1.5 miles wide with a maximum depth of approximately 147 feet (Howes, 1955). Eventually, overflow of dammed water eroded the Agua Tibia fan material, draining the lake and establishing the current stream channel for the San Luis Rey River. Well-stratified, fine-grained deposits in portions of the Pala Subbasin indicate that local (smaller) damming events may have also occurred in this area (DWR, 1965).

3.2.2.2.3 Alluvial Fan Deposits

The main alluvial fan deposits in the Plan Area are located in the Pauma Subbasin and include the Agua Tibia, Pauma Creek, and Rincon fans. They are composed of heterogeneous and poorly sorted materials from source rocks to the north and east, and the encroachment of these fan materials into the Subbasin has pushed the San Luis Rey River against the valley wall to the southwest (Howes, 1955).

In the Pauma Subbasin, alluvial fan deposits can be as much as 370 ft thick (Moreland, 1974). They are generally poorly sorted in nature, consisting primarily of rock fragments ranging in size from clay to boulders more than 5 ft in diameter. They generally have lower groundwater yields than the other alluvial materials. However, they have been found to be in hydraulic continuity with the San Luis Rey River underlying sediments and provide an important source of recharge (DWR, 1965).

3.2.2.2.4 Younger Alluvium

Recent alluvium consists primarily of sand, gravel, and silt with only minor occurrences of clay. River-channel deposits range from 0 to 130 ft thick in Pauma Subbasin (Moreland, 1974). Fill of the USLR valley is connected to the lower valley through canyon fill in the Monserate Narrows.

3.2.3 Soil Characteristics

Soil type and distribution affects infiltration, surface runoff, interflow, groundwater storage, and deep groundwater losses. Maps of soil coverage in the Plan Area are available through the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) (USDA NRCS, 2020). Their Soil Survey Geographic Database (SSURGO) contains information about soil as collected by the National Cooperative Soil Survey over the course of a century. There are four basic hydrologic soil groups

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under the SSURGO classification system (Group A through D), which are based on soil texture and properties. SSURGO describes each type as the following:

- Group A soils have a high infiltration rate (low runoff potential) when thoroughly wet. They consist mainly of deep, well drained to excessively drained sands or gravelly sands and have a high rate of water transmission. Examples include sand, loamy sand, or sandy loam types of soils.
- Group B soils have a moderate infiltration rate when thoroughly wet. They consist mainly of moderately deep or deep, moderately drained soils that have moderately fine texture to moderately coarse texture and have a moderate rate of water transmission. This includes the silt loam and loam soils.
- Group C soils have a slow infiltration rate when thoroughly wet. They consist mainly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. They have a slow rate of water transmission. The predominant soil in this group is a sandy clay loam.
- Group D soils have a very slow infiltration rate (high runoff potential) when thoroughly wet. They consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. Therefore, they have a very slow rate of water transmission. This includes clay loam, silty clay loam, sandy clay, silty clay or clay type soils. Bedrock is also included in this group due to its very low infiltration rate.

In the USLR Valley Groundwater Subbasin, Group A soils typically represent the main streambed and alluvial fan deposits. This accounts for the majority of the groundwater subbasin area (Figure 3-8). Group -B soils are also found along the flanks of alluvial fans in the subbasin with limited occurrences of Group C soils. Group C and D soils are typically located at the edges of the subbasin near bedrock outcrops.

3.3 Hydrology (§354.14(a),(b),(d); §354.16; §354.18)

3.3.1 Groundwater Basin Boundaries

Under SGMA, basin boundaries define the geographic area included in each groundwater basin or subbasin. The USLR Valley Groundwater Subbasin (DWR Basin 9-007.01) includes both Pauma and Pala Subbasins. The groundwater subbasin itself underlies a relatively narrow, alluvial-filled valley and is surrounded by crystalline bedrock forming relatively steep mountains. The latest version of Bulletin 118, published by DWR (2020a), provides official descriptions and evaluation of groundwater basins in California, including official groundwater basin boundaries. The most recent groundwater basin boundaries (2020a) are shown on Figure 3-1. In addition, Assembly Bill 1944 defines the boundary between the Upper and Lower San Luis Rey Valley Groundwater Subbasins as:

> *"the east line of Range 3 West, San Bernardino Meridian. The portion of the basin to the west of the dividing line shall be the Lower San Luis Rey Valley Groundwater Subbasin and the portion of the basin to the east of the dividing line shall be the Upper San Luis Rey Valley Groundwater Subbasin."*

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The bottom of the groundwater basin has been estimated based on available information from well logs in the subbasin (and the creation of cross-sections shown on Figures 3-4 through 3-7) as well as previous investigations (Moreland, 1974; LGS, 2009; Layne, 2010). Bedrock is shallowest along the western side of the subbasin and generally slopes to the east-northeast (LGS, 2009).

During the course of developing this GSP, it has been found that the current basin boundaries do not adequately represent the true extent of the groundwater subbasin based on geologic contacts and topographic changes indicating the presence of crystalline bedrock. A process for redefining or refining groundwater basin or subbasin boundaries has been provided to local agencies through SGMA. At the time, ~~However,~~ the next basin boundary modification period was~~is~~ not expected before 2022. A modification period has not been available since the development of this GSP and there is no updated information on DWR's website on when another modification period might open. This GSP has been prepared using the currently-defined subbasin boundaries but sets the foundation for future modifications that would allow the groundwater subbasin boundaries to coincide with the geologic conditions present in the subbasin – particularly along the edges. Proposed modifications and an explanation of how these modifications will create a more realistic representation of actual conditions are discussed below. It is important to note that the hydrogeologic conceptual model presented in this GSP still applies to the USLR Valley Groundwater Subbasin as it is currently defined by DWR.

3.3.1.1 Potential Boundary Revisions

Requests for basin boundary modifications may be submitted to DWR periodically for either scientific or jurisdictional reasons. Scientific modifications are based on geologic or hydrologic conditions, while jurisdictional modifications change boundaries to promote sustainable groundwater management. In the case of the USLR Valley Groundwater Subbasin, future basin modifications are supported by scientific information in the form of geologic and topographic data.

As discussed in previous sections, the USLR Valley Groundwater Subbasin is underlain by and surrounded by crystalline bedrock. Since these geologic units are typically considered to have non- (or very low-) water-bearing capacity, they represent the base and edges of the groundwater subbasin. Bedrock contacts have been used in previous iterations of Bulletin 118 to define groundwater basin boundaries. However, it appears that current boundaries may have been based on larger-scale geologic mapping that did not provide as much detail as some other sources currently available. This has led to areas of connected alluvial material being excluded from current basin boundaries while including portions of surrounding hard rock in other areas. These discrepancies are apparent in the surficial geologic map provided as Figure 3-3. Ideally, basin boundaries should generally coincide with the contact between alluvial materials (e.g., Younger Alluvium, alluvial fan deposits, or Older Alluvium) and bedrock.

Proposed groundwater basin boundaries for future revisions are shown on Figure 3-9 for Pauma Subbasin and Figure 3-10 for Pala Subbasin. The proposed boundaries were based on available geologic mapping supplemented by topographic information and aerial imagery. Since bedrock is generally much more resistant to weathering and erosion than sedimentary (i.e., alluvial) material, it stands out in greater topographic relief. Therefore, even when geologic mapping may not provide the level of detail necessary to define basin boundaries in certain locations, topographic information may be used as an indicator of the presence of bedrock. Bedrock is also often visible from publicly available aerial imagery and these maps were used to confirm proposed boundaries in certain areas.

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As shown on Figures 3-9 and 3-10, the proposed basin boundaries coincide well with mapped alluvial/bedrock contacts and a sharp increase in topographic relief. A notable exception that warrants additional discussion is the far eastern portion of Pauma Subbasin. Here, a lobe of alluvial material currently included in DWR-defined basin boundaries has been removed from the proposed Pauma Subbasin extent. Based on a review of geologic mapping and available information, this area appears to represent an uplifted and flattened bedrock area overlain by shallow coverages of alluvium and colluvium/residuum. At the surface, it has been mapped as alluvium. However, based on the geologic coverage, review of driller's logs, topographic expression, and presence of visible bedrock outcrops, the alluvial material covering this area is likely thin. In addition, it is not believed that this area is connected to the main groundwater subbasin and ~~its~~ the principal aquifer system~~(s)~~. Topography and stream drainages indicate that groundwater and surface water flow in this area is to the south-southwest rather than parallel to topography (i.e., north and northwest, as suggested by current basin boundaries and the implied "connection" along Plaisted Creek). Any groundwater outflow from this alluvial lobe would likely surface as rising groundwater at the southern bedrock boundary and travel down the unnamed creek as surface flow over bedrock to the San Luis Rey River or be lost to evapotranspiration.

3.3.2 Groundwater Occurrence and Aquifer Systems

DWR defines an aquifer as a "three-dimensional body of porous and permeable sediment or sedimentary rock that contains sufficient saturated material to yield significant quantities of groundwater to wells and springs, as further defined or characterized in Bulletin 118" (2018). The majority of groundwater in the USLR Valley Groundwater Subbasin is produced from the porous flood plain and alluvial material representing valley fill and represented by the principal aquifer in the subbasin. The Pauma and Pala Subbasins are hydraulically connected, with groundwater from the upgradient Pauma Subbasin flowing into Pala Subbasin.

In Pauma Subbasin, the presence of a fine-grained clay and silt layer representing lakebed deposits from paleo Lake Pauma (see Section 3.2.2.2.2) can create a shallow and locally perched aquifer. However, most of the wells in the Pauma Subbasin are drilled through this perched layer to the underlying principal aquifer and very little information is available regarding shallow water level conditions. While locally perched conditions were suspected during the development of the GSP in 2022, no water level data were available to confirm these conditions. In 2023, two new dedicated clustered monitoring wells were installed in the Pauma Valley area of the USLR Valley Groundwater Subbasin, near the San Luis Rey River. The wells were designed to provide information on discrete zones within the alluvial Subbasin, with a shallow well completed above the Pauma Subbasin clay layer and a deeper monitoring well completed from below the clay layer to bedrock. The well construction summary report was provided as an appendix to the WY 2023 Annual Report (USRLGMA, 2024). Monitoring information since installation of the clustered wells has indicated that perched conditions do exist, at least locally, within Pauma Subbasin – as evidenced by an approximately 20-ft groundwater elevation difference. While well construction information is not available for Pauma Valley CSD monitoring wells near the Pauma Valley Treatment Plant[18], higher water level measurements in these wells indicate that they also reflect perched

[18] While construction information is not known, the bottom of these wells were tagged during a monitoring event and they are quite shallow – around 45 to 50 feet deep.

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groundwater conditions. These water level differences, which provide evidence for the perched groundwater conditions, are shown in Figure 3-11.

It is also common for wells within the valley and foothill areas to tap fracture systems in underlying and surrounding crystalline rock (with either part or all of the well the screen completed in bedrock). These fractured systems have a much lower storage capacity than the alluvial sediments and wells completed in hard rock typically experience lower production capacities. In addition, due to the nature of their secondary porosity (i.e., water is held within a connected network of fractures rather than interstitial pore spaces between sediment grains), these fractured aquifer systems can respond quickly to recharge and/or become depleted quickly without significant recharge. In many places, fractured systems are overlain by a zone of weathered bedrock and/or alluvium which may provide an additional source of water to the hard rock system (Howes, 1955). Well yield is also dependent on fracture density, connectivity, spacing, and orientation – all of which can vary greatly, even over short distances. ~~Therefore, surrounding bedrock is not considered to be part of the aquifer system addressed in this GSP.~~

Due to the typically reduced capacity of these bedrock units to transmit reliable or significant quantities of groundwater to wells, bedrock is not considered to be a separate~~n~~ aquifer unit within the Plan Area. However, these units likely contribute some water to the overlying alluvial aquifer system in the form of mountain front recharge and pumping from the bedrock is accounted for in the groundwater flow model and water budgets. In particular, the Elsinore fault is thought to be a conduit for groundwater flow. Groundwater traveling within fractures and fault splays associated with this structure may be intercepted by creeks transecting the fault, causing groundwater to flow into the USLR Valley Groundwater Subb~~B~~asin as surface water or subsurface flow through the alluvial fans (Howes, 1955).

Several springs have been observed in the area, including Rincon spring at the top of the Rincon alluvial fan, springs along the trace of the Tecolote fault, and a former hot water spring on the northern side of the Agua Tibia alluvial fan (no longer flowing) (Howes, 1955). The source of the hot water is believed to be from surface water warmed at depth and transported to the surface along faults and/or fractures. Local faults and fractures are also thought to be the cause of other, non-hot water seeps and springs by impeding the lateral flow of water (causing rising groundwater levels and eventual daylighting of spring water) or transmitting water to daylighting canyons and outcrops.

3.3.2.1 Aquifer Characteristics

Younger alluvium represent~~s~~ particularly productive aquifer units while the alluvial fans tend to be less productive due to their poorly sorted nature and the presence of significant amounts of fine-grained material. In general, the Rincon alluvial fan is more productive than the Pauma Creek and Agua Tibia alluvial fans (Howes, 1955). Wells constructed in the productive alluvial materials of the principal aquifer in Pauma and Pala Subbasin can produce several hundred gallons per minute (gpm) (Stetson, 1984). Moreland (1974) estimated the specific capacity of alluvium and river channel deposits to range from 13 to 115 gpm/ft, with a hydraulic conductivity of approximately 750 gpd/ft^2, or about 100 ft/d.

Productivity generally decreases with decreasing thickness of unconsolidated material. Alluvial sediments in valleys are generally thickest under the San Luis Rey River. In Pauma Valley, sediments may be up to 600 ft thick in localized areas of the northeast portion of the subbasin (Layne, 2010). However, these locations with greater sediment depth typically coincide with alluvial fan deposits, which tend to be less

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productive. Alluvial aquifer systemsThe principal aquifer of the USLR Valley Subbasin areis typically unconfined in nature, though localized semi-confined and confined conditions may exist where substantial lacustrine deposits are present (i.e., areas underlying fine-grained lakebed deposits from paleo Lake Pauma) (Howes, 1955; Moreland, 1974). In these locations, a perched aquifer is also present.

Wells completed in fractured rock aquifers may only produce a few tens of gallons per minute (Layne, 2010), but groundwater production can be variable. Higher quantities of groundwater produced from these fractured systems depend on the well being located in an extensive network of open fractures (i.e., not mineralized) capable of supplying adequate amounts of water (Geoconsultants, 2009).

3.3.2.2 Aquifer Uses

The principal aquifers in the Pauma and Pala Subbasins are is used for domestic, agricultural, commercial, and municipal water supply purposes. The majority of urban areas are supplied water by water agencies but there are some private wells that provide water for domestic use. Residential water uses include household consumption, irrigation of landscape and/or agricultural crops, watering horses or other livestock, and pumping water to fill swimming pools or ponds. Commercial uses include store front and retail trade strip malls, low-rise office buildings, libraries, post offices, and fire and police stations. Industrial uses include extractive industry (mining), light industrial, and warehousing/public storage. The majority of private pumping is used for agricultural irrigation. Estimated groundwater pumping is discussed in Section 3.3.3.2 –(Groundwater Discharge) and Section 3.3.5 –(Water Budget Information).

3.3.3 Groundwater Recharge and Discharge

Identifying sources and locations of groundwater recharge and discharge is an essential component of the hydrogeologic conceptual model as well as for the development of water budgets for the USLR Valley Groundwater Subbasin. In general, sources of inflow to the Pauma and Pala Subbasins include ungaged and gaged runoff from the surrounding watershed areas, underflow inflow from neighboring mountain blocks, precipitation, and applied water. This translates to recharge from mountain front runoff, the direct infiltration of precipitation, percolation from streamflow, return flow from applied water (from both pumped groundwater and imported water), and the infiltration of treated wastewater. Sources of outflow/discharge chiefly consist of groundwater pumping, surface water flow out of the groundwater subbasin and into downgradient Bonsall Subbasin (including the contribution from rising groundwater), and evapotranspiration. These main physical sources are discussed briefly in the following sections.

The conceptual understanding of groundwater recharge and discharge terms were developed further during the construction of an integrated surface waterwatershed and groundwater model of the USLR Valley Groundwater Subbasin, which was calibrated to observed surface flow and groundwater elevations and used to evaluate water budgets for the subbasin. Assumptions and methods for quantifying individual groundwater recharge and discharge terms and simulating them in the model are discussed in Section 3.3.5, below.

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3.3.3.1 Groundwater Recharge

3.3.3.1.1 Recharge from Mountain Front Runoff

While crystalline bedrock is typically assumed to have a negligible contribution to groundwater flow, the numerous faults and fractures present in the low-permeability bedrock surrounding the USLR Valley Groundwater Subbasin allow the mountain block to represent a significant source of recharge. The Elsinore fault zone, in particular, is thought to be a conduit for groundwater flow to the subbasin. Recharge from mountain front runoff includes both recharge from ungaged surface runoff and subsurface inflow, and is assumed to occur along the contact between upgradient outcrops of bedrock and downgradient alluvial materials. Recharge from mountain front runoff includes contributions from recharge and runoff from natural precipitation and the application of water at land surface in surrounding foothill and mountain area.

3.3.3.1.2 Areal Recharge from Precipitation

Areal recharge refers to the process by which a fraction of the precipitation that falls on the ground within the Subbasin infiltrates downward beyond the root zone where evapotranspiration (ET) may occur. This deep percolation is assumed to eventually recharge the groundwater system. Precipitation falling on the ground surface may also run off and converge in tributaries, be consumed via ET, be held in storage in the root zone, or be held in storage in the vadose zone above the groundwater system. A fraction of the precipitation that runs off may also become deep percolation along the tributary drainages and is included in the term areal recharge in this report. The amount of precipitation that eventually becomes areal recharge is determined by many factors, including the amount, intensity, and timing of precipitation; soil properties such as the storage capacity and depth of soils; topography; the amount of ET by vegetation; the permeability of the aquifer; and land use changes that affect the infiltration capacity of the land surface.

3.3.3.1.3 Streambed Percolation

Streamflow provides a considerable amount of recharge to the USLR Valley Groundwater Subbasin by conveying water from surrounding mountainous areas (where the greatest concentration of precipitation falls) to the groundwater Subbasin, allowing the water to become recharge through streambed infiltration. In general, the amount of recharge from streambed percolation depends on the conductance of the streambed materials, streambed geometry, water levels in the surrounding groundwater system, and amount of streamflow. Streamflow is affected by precipitation, runoff, evapotranspiration, surface water diversions, releases and operations associated with upstream operation of Henshaw Dam, streambed infiltration, and groundwater pumping. Surface flow is intermittent and seasonal throughout much of the Subbasin, and streams commonly go dry for several months each year, particularly in Pauma Subbasin and upper Pala Subbasin. However, there is currently no active, permanent streamflow gage within the Subbasin to provide continuous data suitable for direct measurement of streamflow depletion caused by groundwater pumping.

Ellis and Lee (1919) estimated that approximately ten percent of all precipitation becomes runoff and contributes to streamflow in the San Luis Rey River. For this GSP, a surface waterwatershed model was developed to calculate surface runoff based on soil type/coverage and associated parameters, land use, slope (topography), and applied water in the form of irrigation and/or precipitation. Calculated surface

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runoff was then used as input for the groundwater model which calculates streambed percolation based on streamflow, streambed parameters (i.e., hydraulic conductivity), stream stage, and groundwater elevations underlying the stream channels.

While the San Luis Rey River is the main surface water feature in the subbasin, the majority of flow is captured by Henshaw Dam (owned and operated by Vista Irrigation District (VID)), forming Lake Henshaw. Lake Henshaw is also augmented in dry years with groundwater from Warner Valley. Spills over the dam have only occurred a couple of times since the construction of the dam, and only during extremely wet weather events (Stetson, 1984). Releases from the dam are primarily diverted into the Escondido Canal, where it is transported approximately 14 miles to Lake Wohlford. The water is then treated at the Escondido-Vista Treatment Plant and delivered to VID and City of Escondido service areas. Surface water deliveries are also made from the Escondido Canal to the Rincon Reservation. These deliveries were historically made to a retired penstock on the Rincon Reservation and occasionally released in Hellhole Canyon. Currently, surface water is released near the Escondido diversion dam and flows down the canyon to the reservation.

Surface water that is not able to be captured at the Escondido Canal diversion structure, which has a diversion capacity of 50 cfs, continues downstream into Pauma Valley. These flows typically occur during storm events when flow quantities and water quality (i.e., abundance of suspended sediments in flow) are above diversion abilities or suitability, or when storage is limited in Lake Wohlford. Several entities within the USLR Valley Groundwater Subbasin hold active surface water diversion rights, which are available to view on the California Water Accounting, Tracking, and Reporting System (CalWATRS)[19] (formerly Electronic Water Rights Information Management System (eWRIMS))[20].

3.3.3.1.4 Return Flow from Applied Water

Water applied at the surface can become runoff (if applied in excess of infiltration capacity or irrigation requirements) or can be consumed by evapotranspiration (ET). In addition, it can become groundwater recharge through deep percolation. Return flow refers to the amount of water that returns to the aquifer after application of water to the land surface in the form of irrigation, leaks in water lines, or septic seepage. This includes the use of groundwater, surface water, and imported water.

The use of imported water in the Subbasin has increased since imported water deliveries began in 1947 with the completion of the first San Diego Aqueduct (Recon, 1996). Within the USLR Valley Groundwater Subbasin, YMWD receives imported water through Metropolitan Water District of Southern California (Metropolitan) and the San Diego County Water Authority (Water Authority). YMWD is served off the First Aqueduct, Pipeline No. 1, near Couser Canyon Road in Valley Center just north of Lilac Tunnel (see Figure 3-1) and receives treated water from Lake Skinner (see Plan Area, Section 2.1.2.3, for additional information). During the period from WY 1991 through 2020, YMWD imported water deliveries averaged

[19] https://calwatrs.waterboards.ca.gov/portal/s/
[20] Diversion information available at: https://www.waterboards.ca.gov/waterrights/water_issues/programs/ewrims/

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approximately 2,89 00 acre-ft/yr. Over the last five years (i.e., WY 2016 2021 through 20202025), average deliveries have been closer to 4,700 400 acre-ft/yr.

As mentioned in the previous section, surface water diversion rights are held by several entities in the USLR Valley Groundwater Subbasin. These surface water diversions are typically used to augment irrigation supply. In addition, surface water deliveries from the Henshaw Dam are made to the Rincon Indian Reservation, which has retained vested water rights in this surface water.

Return flow also includes water from septic system seepage. The majority of residential lots are on septic systems and a substantial portion of domestic water is used indoors. This water is then recharged back into the groundwater system via the septic system. Regional Water Board modeling in 1987 indicated that 90 to 99 percent of leachate from septic systems reaches the water table as return flow (County, 2010).

3.3.3.1.5 Recycled Water Spreading

Sewage disposal in the Plan Area is primarily accomplished through septic tanks. One sewage treatment plant is operated by Pauma Valley CSD within Pauma Subbasin, which has discharged wastewater to percolation ponds since 1963 (Moreland, 1974; PVCSD, 2015). The percolation of treated effluent from the Pauma Valley Treatment Plant is covered under CA Regional Water Quality Control Board Order No. R9-2006-0049 and averages approximately 75,000 gpd (84 acre-ft/yr) (NBS/Lowry, Inc., 1991; LAFCO, 2013). Additional recycled water spreading takes place in Pala Subbasin (servicing a portion of the Pala Rreservation), and at the Pauma Casino Pauma, and near Harrah's Resort.

3.3.3.2 Groundwater Discharge

3.3.3.2.1 Groundwater Pumping

Groundwater pumping represents the primary source of discharge from the USLR Valley Groundwater Subbasin. Pumping records were requested from Subbasin stakeholders as part of the GSP effort and were received from many of the water purveyors in the Subbasin and several large agricultural entities. The remaining unreported groundwater pumping, including that from tribal-owned land, was estimated to be water use not met by reported pumping, based on land use and crop type/coverage through time obtained from the County Department of Planning and Land Use (County, 2010) or other estimates of water use from previous studies. This estimation is discussed in further detail in Section 3.3.5 (Water Budget Information). These initial estimates of groundwater pumping were refined during model calibration since the model calibration process provides an indication of the appropriateness of water budget terms based on the ability of model to match observed water level elevations.

Preliminary eEstimates of groundwater pumping presented in this version of the GSP provide a general estimate of sustainable yield for the Ssubbasin. Since additional information is anticipated to be collected throughout the subbasin following GSP implementation, pumping and therefore sustainable yield estimates can continue to be refined to provide the best estimate based on available information (see Section 3.3.5.8 for additional discussion). Based on current information, groundwater pumping in the entire USLR Valley Groundwater Subbasin – including Pauma and Pala Subbasins – over the period from WY 199 12 through 2020 2025 was estimated to average approximately 134,000 acre-ft/yr, including 8,000 acre-ft/yr in reported pumping (primarily in Pauma Subbasin) and 65,000 acre-ft/yr in unreported pumping. These estimates were refined through model calibration since the model calibration process

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~~provides an indication of the appropriateness of water budget terms based on the ability of model to match observed water level elevations.~~

3.3.3.2.2 Rising Water Discharge to Surface Flow and Subsurface Outflow

A stream gains or loses water depending on the relative head (water elevation) in the stream and in the underlying aquifer. When the head in the stream is higher than the head in the aquifer, the stream loses water to the aquifer; when the head in the stream is lower than the head in the aquifer, the stream gains water from the aquifer. In natural systems, the amount of rising water fluctuates depending on groundwater elevations relative to stream stage.

Rising water occurs as groundwater gradients push groundwater to the surface at topographic lows or geologic contacts. Groundwater becomes surface water outflow when it reaches the land surface. In the USLR Valley Groundwater Subbasin, the main area of rising water is at and before the Monserate Narrows, at the end of Pala Subbasin. Here, shallower bedrock elevations force groundwater to the surface where it becomes streamflow. Two United States Geological Survey (USGS) streamflow gaging stations are located at the bottom of Pala Subbasin (11040000 and 11039800), in the Monserate Narrows area, which provide information about surface flow leaving the USLR Valley Groundwater Subbasin. Shallow basement rock and the encroachment of the Agua Tibia Fan on the San Luis Rey River also forces groundwater to the surface near Frey Creek, at the downgradient boundary of Pauma Subbasin. Rising water conditions at this location were historically observed year-round, even during drought events (DWR, 1965).

Groundwater underflow outflow to Bonsall Subbasin also occurs in the river sediments running through the Monserate Narrows. Underflow outflow was estimated by Ellis and Lee (1919) to be approximately 340 acre-ft/yr using Darcy's equation. Moreland (1974) estimated underflow outflow from Pala Subbasin at Monserate Narrows to be approximately 250 to 480 acre-ft/yr.

3.3.3.2.3 Evapotranspiration

ET includes the consumption of surface and groundwater through evaporation and transpiration by plants. In general, groundwater ET decreases with decreasing groundwater elevation and is the highest in areas where groundwater level elevations approach or exceed the ground surface. In areas of shallow groundwater, brush and trees along the river (phreatophytes) can derive water directly from the subsurface. Moreland (1974) estimated ET from riparian vegetation to be approximately 1 to 1.4 acre-ft/acre when water table is 10-30 ft bgs and 2 acre-ft/acre when the water table is less than 10 ft bgs. Muckel and Blaney (1945) estimated the consumptive use of native vegetation in the San Luis Rey Valley Groundwater Basin to range from 1.3 to 4.6 ft.

3.3.4 Current and Historical Groundwater Conditions

3.3.4.1 Groundwater Elevations

Groundwater recharge in the USLR Valley Groundwater Subbasin can be highly variable year-to-year, depending on the amount of rainfall the area experiences. During dry periods (below average rainfall), groundwater pumping can cause temporary declines in groundwater levels which tend to recover during wet periods (Stetson, 1984). This causes groundwater elevations in the Plan Area to fluctuate seasonally and annually in response to groundwater stresses (such as pumping) and recharge from precipitation

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events. The highest groundwater levels are typically observed in March before regional pumping increases and are lowest in late fall (November) before seasonal rainfall/recharge events (Geosyntec, 2015). In addition, the aquifer responds fairly quickly to groundwater stresses and replenishment due to higher hydraulic conductivity (Born, Barrett & Associates, 1985). Therefore, the rapid recovery of groundwater levels has been observed during recharge events (DWR, 1965).

Contours of groundwater elevation were developed based on observed water level data[21]. Data were received from Subbasin stakeholders or obtained through State databases, such as the California Statewide Groundwater Elevation Monitoring (CASGEM) Program database. Information received from various entities was reviewed to identify any anomalies. Some datasets were not able to be used due to uncertainty (e.g., obvious transducer drift, etc.). As discussed in the Plan Area section (Section 2.2.1.1), DWR developed the CASGEM Monitoring Program in 2009 to establish a permanent, locally managed program of routine groundwater monitoring to track seasonal and long-term groundwater elevation trends in all of California's alluvial groundwater basins. Within the San Luis Rey Valley Groundwater Basin, the County of San Diego represents the sole Monitoring Entity, with some water districts participating as contributing agencies (including YMWD). CASGEM wells within the USLR Valley Groundwater Subbasin included YMWD 21a (southeastern, upper portion of Pauma Subbasin), YMWD PV-W2 (lower portion of Pauma Subbasin), Wilderness Gardens WG-1 (upper portion of Pala Subbasin), and State Well 10S02W06F002S (lower portion of Pala Subbasin). All of these wells focus on the upper principal alluvial aquifer. Groundwater contours for Fall 1991 (representing the start of the period that was used to develop historical water budgets (WY 1992) – see Section 3.3.5.5) and Fall 2025 (representing current water levels) are shown on Figures 3-11 12 and 3-1213.

The groundwater elevation contours represent lines of equal elevation on the groundwater surface. Groundwater flow occurs perpendicular (i.e., at 90°) to the elevation contours. Both contour figures show similar patterns for groundwater flow. In the upgradient portion of the subbasin (southeastern area of Pauma Subbasin), groundwater generally flows to the west and southwest down the alluvial fans towards the axis of the valley. Groundwater flow then starts to bend to the north through Pauma Subbasin and into Pala Subbasin, following the direction of surface water flow. In Pala Subbasin, groundwater generally flows west – again, following the direction of flow in the San Luis Rey River and the general topography in the subbasin. As also indicated by the figures, there are few available water level data in Pala Subbasin to constrain water level contours. The need for additional potential water level and water quality monitoring in this subbasin is discussed in the monitoring network section of this GSP (Section 5.0).

Depth to groundwater contours are shown on Figure 3-13 14 These contours were developed by subtracting the contoured groundwater elevations from the ground surface elevation.

Hydrographs showing water level measurements through time were also assembled from available information. Selected hydrographs in Pauma and Pala Subbasins are shown on Figures 3-14 15 and 3-1516, respectively. Hydrographs were selected primarily based on data record (many of the wells only had a handful of measurements and did not provide a good indication of water level change through time)

[21] Note: well screen information is unavailable for many some of the wells with observed water levels. This represents a data gap for which information will be requested through the well inventory management program (see Section 6.2.2).

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and in order to provide a good representation of water levels throughout the subbasin. As shown on the figures, many of the wells – particularly in Pauma Subbasin where records are more extensive – indicate declining groundwater levels in earlier time periods, such as the late 1980s through the early 1990s. According to the cumulative departure from mean annual precipitation, this time period generally coincided with wet and average hydrologic conditions (Figure 3-2). Therefore, these water levels likely indicate the increase in agricultural production in the area at a time when imported water deliveries to the subbasin were still relatively small (approximately 1,400 acre-ft/yr from 1990 to 2000). While Less data are available in the Pala Subbasin, the Barona Tribal Authority reported historical low groundwater levels at certain wells in the late 1990s and early 2000s (County, 2010). Declines in water levels were also observed in the Subbasin were also observed in the 1940s and 1950s (Howes, 1955). Declines in groundwater levels are also typically more pronounced in the alluvial fan areas of the subbasin and tend to be more consistent along the axis of the valleys.

Starting in the early 2000s, water level elevations generally begin to respond more to the hydrologic cycles observed in the cumulative departure graph (i.e., groundwater elevations stabilize under average hydrologic conditions, increase under wet hydrologic conditions, and decrease when hydrologic conditions are dry). In the last five to ten years in particular, groundwater levels in many parts of the subbasin show recovery. This coincides with average to wet hydrologic conditions and the increased use of imported water (averaging approximately 34,800 600 acre-ft/yr over the last 10 years).

Therefore, following a period of decline averaging approximately 1 to 4 ft/yr over the last 30 years, groundwater levels in the USLR Valley Groundwater Subbasin flattened out and have recovered significantly appear to have become fairly balanced over the last 10 years or so. In addition, many wells showThe recent recovery is likely due to a stabilization in land use and the increasing use of supplemental water through imported water deliveries.

3.3.4.2 Groundwater Storage

Groundwater storage is computed as the volume of groundwater in a given basin from the basement of the aquifer (i.e., bedrock surface) to a given reference point. This reference point could be ground surface (representing total maximum amount of groundwater storage assuming the basin could be filled to saturation) or a defined groundwater elevation (e.g., spring high, fall low, or specified target groundwater elevation). Previous estimates of groundwater storage in the USLR Valley Groundwater Subbasin are summarized in Table 3-1 2 below.

For the current analysisDuring development of the GSP, groundwater storage was computed from the top of bedrock surface (i.e., bottom of the principal alluvial aquifer) to the top of the current water table in 1991 and 2020, using initial specific yield and specific storage values from the USGS salt balance model developed for the subbasin (Moreland, 1974). These storage coefficients range from 0.09 to 0.12. Historical water level contours for 1991 and current water level contours for 2020 are provided as Figures 3-11 and 3-12, respectively. As shown on the figures, wWater level control points for these elevation surfaces, especially the 1991 snapshot, are fairly scarce and generally located near in the center portions of the subbasin. Therefore, uncertainty tends to increase around the margins of the subbasin where control is more limited. Calibration of the groundwater model provides a little more confidence in these areas as aquifer parameters are refined to produce water levels that match observed measurements

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throughout the subbasin for all times included in the model calibration period. Model assessment of changes in groundwater in storage are discussed in Section 3.3.5.4.

Based on contoured groundwater elevations and storage parameters from the USGS model, groundwater storage in the USLR Valley Groundwater Subbasin in 1991 ~~is~~ was estimated to be approximately 184,000 acre-ft while ~~current~~ groundwater in storage in 2020 was~~s~~ approximately 124,000 acre-ft. These estimates are generally in line with previous estimates of storage for the subbasin (see table below).

Table 3-2~~1~~. Previous Estimates of Groundwater Storage for the Upper San Luis Rey Valley Groundwater Subbasin

Source	Pauma Subbasin	Pala Subbasin [acre-ft]	Total Upper San Luis Rey Valley
Stetson (1984)	107,000 – 140,000	41,000 – 53,000	148,000 – 193,000
Layne (2010)	42,880 – 125,561	-	-
~~GSP~~ PVGSA (~~2021~~2022)	-	-	124,000 – 184,000

3.3.4.3 Groundwater Quality

Most common water quality contaminants in San Diego County include elevated nitrate, naturally occurring radionuclides, total dissolved solids (TDS), and bacteria. Most common sources of anthropogenic contamination include leaking underground fuel tanks, sewer and septic systems, agricultural applications, and facilities with excess animal waste. Within the USLR Valley Groundwater Subbasin, the main constituents of concern are TDS, nitrate, and perchlorate.

Groundwater quality in the USLR Valley Groundwater Subbasin is typically calcium-sodium bicarbonate (Stetson, 1984). The general water chemistry is likely influenced by water moving along the Elsinore fault zone, which is thought to contribute large quantities of gypsum to the groundwater system (Vaughan, 1987). Quality is also strongly influenced by surface water in the San Luis Rey River and return flows from imported water and groundwater applied to the surface for irrigation (Stetson, 1984).

Surface water of the San Luis Rey River is generally good but of variable quality. Surface water brings natural salts from upstream areas into the Subbasin area where it can infiltrate into the subsurface (Stetson, 1984). TDS in surface water between Lake Henshaw and the Monserate Narrows typically ranges from 200 to just over 400 mg/L, with increases generally observed during dry periods (Stetson, 1984). TDS concentrations also tend to increase downstream (DWR, 1965). The water quality of surface water released from Lake Henshaw also depends on the amount of time the water was stored behind the dam due to effects from evapotranspiration. In addition, wet precipitation events provide a large influx of high-quality water, diluting groundwater in storage that is higher in TDS (DWR, 1965). There is a concern that reduced natural recharge from upgradient diversions may lead to a slow increase in TDS over time (Stetson, 1984).

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Applied water at the surface can leach chemicals and minerals in the unsaturated vadose zone and transport them to the underlying aquifer system. There is a tendency in groundwater basins towards the general degradation of groundwater quality through time due to irrigation and septic return flows, use of imported water, and evapotranspiration (DWR, 1965). This is an important concern for the USLR Valley Groundwater Subbasin, since groundwater quality (particularly TDS concentrations) can affect agricultural yields.

The Porter-Cologne Water Quality Control Act (California Water Code, Division 7, Chapter 2) requires that beneficial uses and water quality objectives be established for both surface and groundwaters of the State. The establishment of beneficial uses and water quality objectives for surface water is also mandated by the federal Clean Water Act (33 USC). The California Water Code defines water quality objectives as:

> *"The limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area".*

According to the Basin Plan (Regional Board, 1994), beneficial use is defined as

> *"the uses of water necessary for the survival or wellbeing of man, plants, and wildlife. These uses of water serve to promote the tangible and intangible economic, social, and environmental goals of mankind".*

In the Plan Area, beneficial use includes municipal and domestic supply, agricultural supply, industrial service supply, water recreation, and the support of freshwater and wildlife habitat (including habitat for rare, threatened or endangered species). The Basin Plan's water quality objectives are numerical limits designed to protect the beneficial uses designated for the water body (surface or groundwater). TDS and nitrate groundwater objectives for the USLR Valley Groundwater Subbasin are summarized below (Regional Board, 1994):

Table 3-3~~2~~. Groundwater Quality Objectives

Hydrologic Subarea	TDS [mg/L]	Nitrate (NO_3) [mg/L]
Pauma Subbasin	800	45*
Pala Subbasin	900	45*

Notes:
[1] Concentrations not to be exceeded more than 10% of the time during any one year period.
[2] The Basin Plan allows for measurable degradation of groundwater in this basin to permit continued agricultural land use. Point sources, however, would be controlled to achieve effluent quality corresponding to the tabulated numerical values. In future years demineralization may be used to treat groundwater to the desired quality prior to use.
* A nitrate (as NO_3) concentration of 45 mg/L equates to a nitrate as N concentration of 10 mg/L. Use of nitrate as N is the current reporting metric for nitrate, though the Basin Plan documents objectives set around nitrate as NO_3.

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~~Ambient g~~Groundwater quality in the Subbasin was evaluated using water quality data from online databases, including the Safe Drinking Water Information System's (SDWIS's) Public Drinking Water Watch (PDWW), the Water Board's Groundwater Ambient Monitoring and Assessment (GAMA) Program, and the State Board's California Laboratory Intake Portal (CLIP), and supplemental GSP sampling. Supplemental GSP water quality sampling results and lab reports are provided in Appendix 3b. Water quality conditions and trends for each constituent of concern are discussed in the following subsections. ~~by taking median concentration of average water quality in wells with at least three water quality readings from 2015 through 2020. Well locations with available datasets during this period are shown on Figure 3-16. The median was chosen as a representative value of overall basin water quality because medians can be reliably calculated for datasets with mixed censored and non-censored data (detects and non-detects), allow for the use of an entire water quality dataset while minimizing the skewing effect of potential data outliers, and do not rely on parametric statistical methods that assume normal data distribution to remove potential outliers. As shown on Figure 3-16, no wells in the Pala Subbasin met the criteria of having at least three water quality readings in the last six years. Therefore, ambient concentrations in this area were not able to be determined.~~

3.3.4.3.1 Total Dissolved Solids

TDS is a measure of salinity which accounts for all dissolved solids in water (as milligrams per liter [mg/L]) including organic and suspended solids and is commonly analyzed to determine general suitability for human consumption. A TDS concentration of 500 mg/L is the secondary standard for drinking water established by the U.S. EPA and State Water Resources Control Board. A TDS of greater than 1,000 mg/L is generally considered to be brackish water and not suitable as a potable supply without treatment or blending. As shown above, the groundwater quality objectives for TDS in the Pauma and Pala Subbasins are 800 and 900 mg/L, respectively.

Natural sources of TDS include interaction of groundwater with the soil, rock, and organic matter which compose an aquifer system. Salts are also concentrated through the removal of water through ET. Human activities such as irrigation and agricultural practices which include application of synthetic fertilizers and manure are a common source of TDS. Also, effluent from wastewater treatment facilities and septic systems and other industrial processes, as well as the use of imported water which tends to be higher in TDS than many groundwaters, can contribute to elevated TDS concentrations in water.

TDS concentrations in the USLR Valley Groundwater Subbasin ~~were evaluated based on available water quality data and recent groundwater quality sampling as part of the initial GSP monitoring network to establish a baseline for groundwater conditions (see Section 3.3.4.3.3)~~are variable. In general, TDS tends to increase downgradient, indicating gradual accumulation of salts with distance from recharge sources. Historical TDS concentrations are shown on Figure 3-17 while average TDS concentrations ~~from the Spring 2021 water quality sampling event~~during the last five years (WY 2021 through 2025) are shown on Figure 3-18. Historically, TDS in the subbasin ranges from 19.6 mg/L to 1,~~950~~400 mg/L (Figure 3-17). Current TDS samples, representing the period from WY 2021 through 2025, indicate concentrations ranging from ~~120~~ 190 mg/L to 1,~~400~~100 mg/L (Figure 3-18).

It is important to note that continuous water quality records within the subbasin are ~~very~~ limited. Recent data (within the last 10 to 15 years) is really only available in the Pauma Subbasin. The majority of historical data points shown on Figure 3-17 (from the California Division of Drinking Water's (DDW's) water quality

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databases) – particularly those in Pala Subbasin and areas overlying reservation lands – represent older records which may not reflect current conditions. Groundwater sampling during GSP development and implementation, which provide the most recent water quality data, took place primarily in the Pauma Subbasin and upper portion of Pala Subbasin based on access to wells (refer to Sections ~~3.3.4.3.3~~5.2.1.1 and 5.2.3 for additional discussion).

3.3.4.3.2 Nitrate

Nitrate is commonly associated with the industrial process of manufacturing synthetic fertilizers and with agricultural activities, septic systems, confined animal facilities, and wastewater treatment facilities. However, nitrate in water can also be naturally occurring. Nitrate in drinking water is a health concern to both humans and animals, and the State has established an MCL of 10 mg/L for nitrate as nitrogen (N). The State's Public Health Goal (PHG) for nitrate as N~~O~~$_3$ is ~~45~~ 10 mg/L (SWRCB, 2020), which is roughly equivalent to the San Diego Basin Plan objective for nitrate as NO_3 of 45 mg/L.

Nitrate concentrations vary substantially within the USLR Valley Groundwater Subbasin and are understood to reflect a combination of legacy (pre-2015) nitrate stored in the unsaturated zone, changing groundwater levels, agricultural land use, septic loading, and groundwater flow conditions. Figures 3-19 and 3-20 show the distribution of nitrate (as N) in the USLR Valley Groundwater Subbasin historically and based on ~~the Spring 2021 water quality sampling event~~current (WY 2021-2025) conditions, respectively. Historically and currently, nitrate (as N) in the subbasin has range~~s~~d from ~~0.02 mg/L~~non-detect to ~~29.4~~62 mg/L (Figure~~s~~ 3-19 and 3-20). ~~Current samples indicate nitrate (as N) concentrations ranging from 1.6 mg/L to 32 mg/L (Figure 20).~~ However, as with the TDS samples, nitrate data is very limited historically while current water quality sampling was limited primarily to Pauma Subbasin due to well access and reporting restrictions.

The highest nitrate concentrations occur in the upper portion of the Pauma Subbasin, generally above Sycamore Canyon. This area has been identified as the Upper Pauma Nitrate/Perchlorate-Affected Area based on historical (pre-2015) and recent nitrate and perchlorate data showing elevated concentrations in this localized portion of the Subbasin. Public supply wells in this area have historically required blending, operational changes, or other management actions to address elevated nitrate. Some public supply wells in this area have also recently been disconnected from potable supply networks or leased for agricultural use, and YMWD has begun evaluating the feasibility of a nitrate treatment facility for wells in the area.

The Upper Pauma Nitrate/Perchlorate-Affected Area is used to provide a technically appropriate framework for distinguishing known localized groundwater-quality impairment from basin-wide degradation or migration of affected groundwater into currently less-affected areas. The affected area is not a separate SGMA management area. It is a water quality evaluation and SMC accounting area used to support RMS-specific thresholds (Section 4.4), sentinel monitoring (Section 5.2.3), and adaptive management (see Section 6.3 for discussion of new projects and management actions related to groundwater quality, particularly within this affected area).

Within the affected area shown on Figures 3-19 and 3-20, nitrate concentrations are elevated relative to the rest of the Subbasin and typically exceed the drinking water MCL of 10 mg/L as N. Review of available nitrate and groundwater level data indicates that increasing nitrate trends in several wells in this area are correlated with rising groundwater levels (Figure 3-21). This relationship suggests that at least a portion

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of the observed nitrate increase may reflect remobilization of nitrate stored in the vadose zone from historical and ongoing agricultural and septic sources as the water table rises. Under this conceptual model, rising groundwater levels can intersect or mobilize nitrate-bearing pore water that accumulated in the unsaturated zone during prior periods of agricultural land use and lower groundwater elevations.

3.3.4.3.3 ~~Initial Monitoring Network – Water Quality Sampling~~Perchlorate

Perchlorate in groundwater is typically associated with aerospace and military operations, specifically the manufacturing, testing, and disposal of rocket propellants, explosives, and fireworks, but can also be associated with the use of particular fertilizers in agricultural areas. Figures 3-22 and 3-23 show the distribution of perchlorate in the USLR Valley Groundwater Subbasin historically and based on current (WY 2021-2025) conditions, respectively.

Perchlorate exists within certain areas of the Subbasin, particularly within the Upper Pauma Nitrate/Perchlorate-Affected Area, where measured concentrations have exceeded the MCL of 6 micrograms per liter (µg/L). The co-occurrence of elevated nitrate and perchlorate in the Upper Pauma Nitrate/Perchlorate-Affected Area is consistent with a common or related agricultural source. Perchlorate has been associated in other basins with historical use of imported natural nitrate fertilizers derived from Chilean nitrate deposits, and such fertilizers may also contribute nitrate to the subsurface. Based on the available information, the elevated nitrate and perchlorate in the upper Pauma area is likely associated, at least in part, with historical fertilizer use and subsequent storage and transport of nitrate- and perchlorate-bearing water in the vadose zone and alluvial groundwater system.

Historically and currently, perchlorate in the subbasin has ranged from non-detect to 23 µg/L (Figures 3-19 and 3-20). However, even more so than other water quality data, historical and current perchlorate data is limited almost exclusively to Pauma Subbasin due to well access and reporting restrictions. Unlike nitrate, available perchlorate data in the Upper Pauma Nitrate/Perchlorate-Affected Area do not show a clear relationship with groundwater levels. Instead, perchlorate concentrations appear to be generally stable or decreasing. These trends are consistent with cessation or substantial reduction of historical perchlorate loading and possible natural attenuation processes. Because perchlorate is highly soluble and mobile in groundwater, continued monitoring is warranted to confirm that perchlorate-affected groundwater is not materially worsening or expanding downgradient or laterally beyond the known affected area.~~As part of the GSP effort, an initial monitoring network was established to provide a good foundation for characterizing current groundwater conditions and which could be used for future, on-going monitoring after GSP implementation. The wells selected to be monitored during the GSP development process are shown on Figure 3-21. These wells were selected based on available data, geographic and vertical distribution, and willingness of the well owner to participate in the GSP monitoring effort. Where good well coverage was available, selected monitoring locations were determined based primarily on available data (wells with greater historical data coverage were prioritized over wells with less or no available information) in order to take advantage of the historical data record.~~

~~Groundwater quality samples were taken semiannually during the GSP development to provide a representation of current ambient groundwater conditions in the basin in spring and fall. After implementation of the GSP, select wells from the monitoring network will also provide representative data to evaluate GSP sustainability indicators, including groundwater levels, groundwater storage, water quality, and depletions in interconnected surface water, in accordance with the specific sustainability~~

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goals established by the GSA (Section 4.0). Future monitoring of these sustainability indicators, as well as additional discussion and recommendations for the monitoring network, is provided in the monitoring network section of the GSP (Section 5.0).

The first groundwater quality sampling event took place on March 24, 25, and 29, 2021. Depth to groundwater measurements were taken in all the monitoring wells using a water level meter with a manufacturer's reported accuracy of 0.01 foot. At the time of purging and sampling, each of the wells except MW19 and MW30 had been pumping for a period of at least several hours.

The selected monitoring wells sampled consist of existing operable wells with dedicated pumps. During purging, water was poured into a flow-through cell and calibrated water quality meter (YSI ProDSS) capable of measuring pH, dissolved oxygen, conductivity, salinity, total dissolved solids, temperature, turbidity, and oxidation/reduction potential. The water quality meter probe and associated flow-through cell interior were rinsed but not decontaminated between wells due to samples being collected directly from the well sample ports. Water quality measurements were recorded approximately every 5 minutes as the wells were pumping. Generally, the wells were sampled after approximately 15 minutes of pumping. Samples were collected directly into appropriate laboratory supplied containers.

Well MW30 could not be sampled from the well head so a water sample representing this location was collected from the nearby water tank that receives water from MW30 among others. As such this sample represents a composite of several wells, including a well completed in bedrock. The sample was collected from a valve on the discharge pipe from the storage tank.

Each sample was labeled and placed in an ice-packed cooler for transport under chain-of-custody to the laboratory for analysis. The groundwater sampling data sheets were reviewed by a state of California-certified Professional Hydrogeologist and are provided in Appendix 3b while sampling results are summarized in attached Table 3-13.

A similar sampling event occurred in Fall 2021, on October 12, 13, and 14. Results from this sampling event are also included in Appendix 3b and Table 3-13.

3.3.4.4 Interconnected Surface Water Systems

Surface water and streams in the Subbasin are shown in Figure 3-24. Given the depth to groundwater in much of the Subbasin, particularly within the Pauma Subbasin, percolation from streamflow is thought to be largely in free fall conditions; that is, the streams are not in direct hydraulic connection with the underlying water table and aquifer system so that surface recharge must percolate through the unsaturated zone before becoming accessible to groundwater pumping. This is especially true for tributaries to the San Luis Rey River (e.g., stream channels crossing alluvial fans). While there are areas within the Subbasin where groundwater has been known to enter the San Luis Rey River (such as in the downgradient Pala Subbasin area where there is standing water), not enough stream flow or groundwater level information near stream channels is available to definitively delineate gaining or losing stream reaches – that is, where streams are interconnected or disconnected from underlying groundwater. This has been identified as a data gap area and additional data collection following GSP implementation will help to develop a better understanding of interconnected surface watersISW in the Subbasin.

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For the purposes of GSP development, the Nature Conservancy has suggested using a depth to groundwater threshold of 50 ft to identify stream reaches that could potentially be interconnected with groundwater. Areas where estimated groundwater is within 50 ft of ground surface are also denoted on Figure 3-2224. However, available groundwater hydrographs in the Subbasin near the river suggest that seasonal fluctuations are typically around 20 to 30 ft in these wells, which may be a better threshold indicator of interconnectivity. In addition, estimates of groundwater elevations and corresponding depth to groundwater are based on limited observations. Therefore, the interconnectivity of surface water and groundwater systems will need to be evaluated as additional information becomes available through increased monitoring and data collection.

3.3.4.4.1 Location and Timing of ISW Depletion

The USLR watershed and groundwater flow models were used to estimate the portion of streamflow depletion[22] attributable to groundwater pumping by comparing net stream gains for six segments along the San Luis Rey River over baseline model conditions (representing the calibration period from 1991 through September 2025) with a no-groundwater-pumping scenario for the same time period, in lieu of surface water and groundwater monitoring data detailing the interconnectivity of surface water with the underlying groundwater system. This model-based comparison provides a quantitative basis for evaluating the location, quantity, and timing of streamflow depletion caused by groundwater pumping. For this evaluation, the San Luis Rey River was divided into six reaches: three reaches in the Pauma Subbasin and three reaches in the Pala Subbasin. The reach-based analysis provides a more detailed understanding of where modeled depletion occurs along the river and supports identification of priority areas for future monitoring and refinement of SMCs. The six reaches evaluated for this analysis include:

- **Pauma Reach 1:** from the upgradient boundary of the USLR Valley Groundwater Subbasin to just before the confluence with Yuima and Potrero Creeks.
- **Pauma Reach 2:** from the confluence with Yuima and Potrero Creeks to just before the confluence with Pauma Creek.
- **Pauma Reach 3:** from the confluence with Pauma Creek to just before the confluence with Frey Creek (generally representing the boundary between the Pauma and Pala Subbasins).
- **Pala Reach 1:** from the confluence with Frey Creek to just before the confluence with Marion Creek.
- **Pala Reach 2**: from the confluence with Marion Creek to just before the confluence with Pala Creek.
- **Pala Reach 3:** from the confluence with Pala Creek to the downgradient boundary of the USLR Valley Groundwater Subbasin at the Monserate Narrows.

[22] Depletion of ISW due to groundwater pumping can occur through reduction of inflow to ISW from groundwater or an increase in outflow from ISW to groundwater. While modeled depletion occurs in the USLR Valley Groundwater Subbasin due to groundwater pumping, it should only be considered undesirable if it significantly and unreasonably impacts beneficial use of surface water (DWR, 2024b).

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The net stream gain for the Pauma and Pala Subbasin reaches is shown in Figures 3-25 and 3-26, respectively. This represents the amount of water entering the stream from the aquifer (baseflow), minus the streamflow entering the aquifer system through streambed percolation. On these plots, positive values indicate a gaining stream (i.e., the contribution of water from the groundwater system is greater than the lost streamflow through percolation), while negative values indicate a losing stream (i.e., streambed percolation is greater than inflow from the surrounding aquifer system). Annual depletion of ISW for the Pauma and Pala Subbasin reaches, which represents the difference between the without pumping and with pumping scenarios, is shown in Figures 3-27 and 3-28, respectively.

The model results indicate that from the top of the Subbasin down, the San Luis Rey River passes through three regimes. All of the Pauma reaches as well as Pala Reach 1 are losing under real-world conditions (i.e., with pumping) and no-pumping conditions. This confirms the conceptual model that this stretch of the San Luis Rey River is naturally losing – as evidence by ephemeral streamflow and lower groundwater elevations relative to the streambed elevation. Here, pumping deepens an existing loss rather than reversing a gain. Pala Reach 2 represents a transition reach. Without groundwater pumping, this reach is a gaining reach. With groundwater pumping, this reach is primarily a losing reach. Pala Reach 3 at the end of the groundwater Subbasin is a persistently gaining reach, both with and without pumping. These conditions are reflected physically through shallow groundwater, standing water, and increased riparian vegetation.

The results also indicate that groundwater pumping results in simulated depletion of surface water in both the Pauma and Pala Subbasins, even in the continually losing reach. This depletion, however, is not distributed evenly along the river. In the Pauma Subbasin, modeled depletion is concentrated primarily in Pauma Reach 2, which accounts for the largest modeled depletion of the six reaches, averaging approximately 3,200 acre-ft/yr during the calibration period. Pauma Reach 3 also contributes to the modeled depletion, averaging approximately 1,000 acre-ft/yr, while Pauma Reach 1 contributes a smaller portion, averaging approximately 400 acre-ft/yr. The cumulative modeled depletion at the downstream end of the Pauma Subbasin averages approximately 4,600 acre-ft/yr during the calibration period.

In the Pala Subbasin, modeled depletion is concentrated primarily in Pala Reach 2 and Pala Reach 3. Pala Reach 2 averages approximately 2,600 acre-ft/yr of modeled depletion while Pala Reach 3 averages approximately 1,700 acre-ft/yr. Pala Reach 1 is more variable and generally contributes a smaller portion of total modeled depletion. The Pala reaches collectively average approximately 5,000 acre-ft/yr of modeled depletion, and total modeled depletion at the downstream end of the Pala Subbasin averages approximately 9,600 acre-ft/yr during the calibration period. Pala reach depletion compared to pumping in the Pala Subbasin and associated reach zones indicates that all of this depletion cannot be caused by Pala pumping alone.

The timing of modeled depletion varies by hydrologic condition. Average annual depletion is highest during wet years and generally lower during dry and critical years, as shown in Figure 3-29. This pattern indicates that modeled depletion is not controlled solely by annual groundwater pumping. Rather, it appears to be influenced by the availability of surface flow, streambed leakage, antecedent groundwater conditions, the spatial distribution of pumping, and lagged groundwater/surface water response. During wetter years, more surface water is available in the river system and the model simulates greater potential for stream-aquifer exchange and pumping-induced depletion. Depletion is lower in critical years because there is no surface water to deplete. The same relationship is true with seasonal depletion: pumping peaks

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in July and is lowest in December, while pumping-induced ISW depletion peaks in March and is lowest in October or November. This is because, particularly in the disconnected or losing reaches, depletion requires water in the stream. Therefore, management strategies keyed to particular water year types are unlikely to be effective for the connected reaches.

The model results also indicate that annual depletion does not have a reliable direct relationship with reach zone or total annual Subbasin pumping. Furthermore, a plot of cumulative USLR Valley Groundwater Subbasin pumping and cumulative annual surface water depletion suggests that depletion may lag behind pumping and may persist over multi-year periods (Figure 3-30). This lagged response is an important consideration for the ISW SMC framework because a single-year depletion value may reflect prior pumping and antecedent conditions rather than current-year management alone.

3.3.4.5 Groundwater Dependent Ecosystems

Henshaw Dam was constructed in 1922 by VID to provide water for domestic and agricultural uses. Water is released from the dam into the natural stream channel and then diverted approximately 10 miles downstream into the Escondido Canal, which is located upgradient of the USLR Valley Groundwater Subbasin. Prior to construction of the dam, the San Luis Rey River in the vicinity of Henshaw Dam was perennial, with minimum flows above 1.4 cfs (Case Study Report #76). Continuous flow was also observed in the San Luis Rey River at Pala from 1903 through 1915 (Ellis and Lee, 1919).

The California Department of Fish and Game reported that riparian vegetation adjacent to the river may have historically supported large populations of wildlife, but no records of fish and wildlife existing in the river prior to dam construction were found in the Department of Fish and Game files (Case Study Report #76). Sensitive species identified by the Nature Conservancy and California Department of Fish and Wildlife as potentially being present within the USLR Valley Groundwater Subbasin are summarized in the following table. However, not enough information is currently known to verify their presence in the subbasin or assess their reliance on potential GDEs and/or ~~interconnected surface waters~~ISW. Therefore, impacts of groundwater management in the subbasin on wildlife habitat may need to be revisited as additional information becomes available. Discussion to this effect will be included in ~~the 5-year report~~periodic reporting as needed.

Table 3-~~43~~. Sensitive Wildlife Species Potentially Present within the Subbasin

Scientific Name	Common Name	Legal Protected Status	
		Federal	State
Actinemys marmorata	Western Pond Turtle		Special Concern
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern
Anniella pulchra	California Legless Lizard		Special Concern
Arizona elegans occidentalis	California Glossy Snake		Special Concern
Buteo swainsoni	Swainson's Hawk		Endangered

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Scientific Name	Common Name	Legal Protected Status	
		Federal	State
Coccyzus americanus occidentalis	Western Yellow-Billed Cuckoo	Candidate - Threatened	Endangered
Empidonax traillii extimus	Southwestern Willow Flycatcher	Endangered	Endangered
Gelochelidon nilotica vanrossemi	Gull-Billed Tern	Bird of Conservation Concern	Special Concern
Gila orcuttii	Arroyo Chub		Special Concern
Icteria virens	Yellow-Breasted Chat		Special Concern
Oncorhynchus mykiss	Southern California Steelhead	Endangered	
Pelecanus erythrorhynchos	American White Pelican		Special Concern
Phrynosoma blainvilli	Coast Horned Lizard		Special Concern
Rana draytonii	California Red-Legged Frog	Threatened	Special Concern
Setophaga petechia brewsteri	A Yellow Warbler	Bird of Conservation Concern	Special Concern
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern
Thamnophis hammondii	Two-striped Gartersnake		Special Concern
Thamnophis sirtalis ssp. 1	South Coast Gartersnake		Special Concern
Vireo bellii pusillus	Least Bell's Vireo	Endangered	Endangered

Since construction of the dam, flows between the dam and Escondido Canal are likely insufficient to support fishery habitat (Case Study Report #76). As mentioned in the Plan Area section, the USLRRCD has several conservation easements for Arroyo Toads in the USLR Valley Groundwater Subbasin, but these habitat areas are primarily dependent on seasonal surface water and the vernal pools created after storm events and do not appear to be maintained by shallow groundwater. The ~~PVGSA~~ USLRGMA is unaware of any managed wetlands within the subbasin.

Helix Environmental conducted a desktop study to assess the possibility of groundwater dependent ecosystems (GDEs) in the USLR Valley Groundwater Subbasin. Sources of information included recent and historical aerial imagery, National Wetlands Inventory (NWI) mapping, San Diego Association of Governments (SANDAG) regional vegetation mapping, topographic mapping, and other pertinent biological resources data. A summary of their investigation is provided as Appendix 3c.

Based on this analysis, areas of potentially groundwater dependent vegetation were identified but have not been verified through field investigation. As shown on Figures 3-~~23~~ 31 and 3-~~24~~ 32 for Pauma and Pala Subbasins, respectively, the potential groundwater dependent vegetation communities are typically located along the San Luis Rey River and tributary drainages, though many drainages were considered to

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be too incised or located in too steep of topography to support groundwater dependent vegetation. The vegetation communities include:

- Southern Riparian Forest
- Southern Coast Live Oak Riparian Forest
- Southern Arroyo Willow Riparian Forest
- Southern Cottonwood-Willow Riparian Forest
- Southern Riparian Woodland
- Southern Sycamore-Alder Riparian Woodland
- Southern Riparian Scrub
- Mule Fat Scrub
- Southern Willow Scrub
- Freshwater Riparian
- Non-Native Riparian

These vegetation areas identified as being potentially dependent on groundwater are not necessarily GDEs. Instead, the vegetation areas shown on Figures 3-~~23~~ 31 and 3-~~24~~ 32 may be relying on ambient soil moisture (not considered part of the interconnected groundwater system) and seasonal rainfall/surface flow. Also, as mentioned in the hydrogeologic conceptual model, water traveling within bedrock fractures and fault splays (not part of the USLR Valley Groundwater Subbasin) may be intercepted by transecting creeks, thereby becoming available to riparian vegetation.

Figure 3-~~25~~ 33 shows vegetation areas located within areas estimated by the groundwater model (see Section 3.3.5.1) to have groundwater within 30 ft of land surface. This depth is recommended by the Nature Conservancy as a threshold by which to identify areas where potential GDEs are accessing groundwater. Guidance from a USGS technical report (Maddock et al., 2012) applicable to the southwest considers 20 ft below ground surface to be the typical extinction depth for most deep-rooted riparian vegetation. That is, most roots of riparian vegetation would not be able to access groundwater resources if groundwater levels were deeper than this threshold. This 20-ft threshold is therefore also indicated on Figure 3-~~25~~33. However, as noted previously, these areas (and their groundwater dependency) need to be evaluated by field investigation and through the collection of additional data. Therefore, they are being retained here as potential GDEs until further information is available through the management actions to address data gap areas (see Section 6.0).

3.3.4.6 Seawater Intrusion

As discussed in the Plan Area section (Section 2.4.1), seawater intrusion is typically observed in groundwater basins in closer proximity to the coast (e.g., downstream reaches of the Lower San Luis Rey Valley Groundwater Subbasin[23]), where lowering of groundwater levels from pumping can reverse the

[23] The neighboring Lower San Luis Rey Valley Groundwater Subbasin has had historical issues with seawater intrusion (prior to the 1960s), between two to six miles inland from the Pacific Coast. Imported water deliveries

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groundwater flow gradient and allow ocean water to flow inland to lower groundwater elevations. Given the distance of the USLR Valley Groundwater Subbasin from the coast, the possibility of seawater intrusion from the ocean is not considered a threat.

3.3.4.7 Land Subsidence Conditions

Land subsidence due to groundwater withdrawal is a long-term, gradual phenomenon that can have lasting effects, even after cessation of pumping. Subsidence from groundwater pumping has been well documented historically in other locations of California and the United States (e.g., Johnson et al., 1968; Meade, 1968; Ireland et al., 1984; and Poland and Ireland, 1988) and is typically associated with:

- Aquifers having a high percentage of fine-grained interbedded materials, which are normally consolidated.
- High rates of sustained pumping which cause long-term (e.g., decades) declines on groundwater levels ranging from 100 to 200 ft.

Typically, subsidence occurs as the result of the compaction of fine-grained confining beds (e.g., clays) due to dewatering of the sediment pores from excessive pumping or groundwater withdrawal. This causes the clay to compress, or compact, resulting in the lowering of the overlying land surface. The amount of compaction an aquifer may experience is a function of the compressibility of sediments within the range of change in applied stress (i.e., change in water level) as well as the magnitude of the change in stress, which is characterized by Terzaghi's Theory of Consolidation. Compaction is also dependent on the thickness of interbedded clay layers and the length of time declines in water levels have been experienced or observed.

Thick, interbedded layers of clay necessary for land subsidence have not been observed in the USLR Valley Groundwater Subbasin. The only significant accumulation of fine-grained sediments are those from paleo Lake Pauma, which have a maximum thickness of about 10 ft and are not continuous throughout the entire Subbasin. Substantial long-term declines in groundwater elevations have also not been observed, nor have there been any accounts of historical land subsidence or features associated with subsidence (e.g., ground fissuring). Therefore, subsidence potential in the USLR Valley Groundwater Subbasin is considered to be a very low risk.

3.3.5 Water Budget Information (§354.18)

A water budget is an accounting of all water that flows into and out of a specified area (i.e., recharge and discharge), including any resulting water storage change. This may be expressed through the Equation of

have since allowed groundwater levels to recover enough to maintain groundwater gradients and limit seawater intrusion (SDIRWM, 2020). Current salinity values are still measuring high in the Lower San Luis Rey Valley Groundwater Subbasin, possibly from a combination of salt loading from storm water and irrigation flows and historical seawater intrusion effects (City of Oceanside et al., 2008). Maintaining control of saline water intrusion is requirement in the Oceanside Narrows through use of minimum threshold groundwater elevations designed to maintain a seaward groundwater gradient in the Mission Basin.

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Hydrologic Equilibrium, which is essentially a statement of the Conservation of Mass relating inflow, outflow, and change in groundwater storage:

Inflow = Outflow +/- Change in Groundwater Storage

The geohydrologic conceptual model presented above indicates that the Pauma and Pala Subbasins are hydrologically connected and were essentially formed through the same geologic processes. Therefore, water budgets were established for both subbasins using a calibrated model of the USLR Valley Groundwater Subbasin.

3.3.5.1 Upper San Luis Rey Groundwater Model ~~(USLRGM)~~

During development of this GSP, the USLR Groundwater Model ~~(USLRGM)~~ was developed and calibrated for the unconsolidated sediments of Pauma and Pala Subbasins (Figure 3-34). It consists of an integrated ~~surface water~~watershed and ~~three-layer~~ groundwater model. The 2022 version of the groundwater model included three model layers for the alluvial material and ~~that~~ was calibrated to observed surface water flow and groundwater elevations for the period from 1991 through 2020 ~~(Figure 3-26)~~. The model was then updated and recalibrated for the 2027 GSP Amendment for the period from 1991 through September 2025. During the model update, an additional model layer was also added representing the underlying bedrock to improve the simulation of pumping in the USLR Valley Groundwater Subbasin.

The watershed modeling component uses the modeling code Hydrologic Simulation Program – Fortran (HSPF). HSPF is a successor to the FORTRAN version of the Stanford Watershed Model (SWM). The SWM evolved over the period from approximately 1956 through 1966. Work in 1974 resulted in the widely available codes developed for and with support of the EPA. HSPF is a comprehensive and physically based watershed model that can simulate water cycle components with a time step of less than one day. The watershed model is calibrated to observed streamflow at available USGS gaging station locations.

The groundwater modeling component was constructed using MODFLOW, a block-centered, modular finite difference groundwater flow code. Widely used and highly versatile, it was developed by the USGS (McDonald and Harbaugh, 1988) for the purpose of modeling both saturated and unsaturated groundwater flow. Specifically, the Newton formulation of the MODFLOW-2005 computer code, known as MODFLOW-NWT, was used for the ~~USLRGM~~USLR Groundwater Model. The Newton-Raphson solver included in the MODFLOW-NWT code is well suited for solving problems involving drying and rewetting nonlinearities of the unconfined groundwater flow equation (Niswonger et al., 2011). The input data for the groundwater model was based on a monthly basis (i.e., monthly stress periods) from January 1991 through ~~December~~ September ~~2020~~2025. The monthly stress periods provide the ability to model the seasonal aspects of fluxes such as areal recharge, return flow, pumping, mountain front runoff, and streambed percolation. The groundwater model is calibrated to observed groundwater elevations throughout the subbasin. Boundary conditions used to simulate inflow and outflow terms in the groundwater model are shown on Figure 3-~~27~~35.

Model calibration is performed to improve the accuracy of the model in simulating observed groundwater levels. The method used to calibrate the ~~USLRGM~~ USLR Groundwater Model was the industry standard "history matching" technique in which hydrogeologic parameters are manually varied until the best fit is achieved for transient conditions. These parameters included horizontal and vertical hydraulic conductivities, specific yield, model general head boundaries, and streambed conductance. The 2022

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version of the USLRGM Groundwater Model was calibrated for the period January 1991 through December 2020, while the calibration period for the 2027 version of the model was extended through September 2025. Model-simulated water levels generally provide a good match with measured water levels and follow observed trends.

Additional information and discussion regarding the initial development of the surface waterwatershed and groundwater components of the USLRGM Groundwater Model is provided in the modeling documentation as Appendix 3d. Information about the model update and recalibration for the 2027 GSP Amendment is provided as Appendix 3e. While this model provides a solid approach for evaluating groundwater budgets and individual recharge and discharge terms, it also represents a tool that can be used for future basin management, such as providing projections of groundwater impacts and the evaluation of proposed projects to meet groundwater sustainability goals. However, the model represents a simplified approximation of complex hydrogeologic systems and was designed with certain built-in assumptions. The accuracy of the predictions made by the integrated model is highly dependent on the simplifying assumptions used. In addition, the modeling results are not absolutes, but are indications that will need to be confirmed by actual operations, monitoring and refinement through an adaptive management process.

A reliable watershed or groundwater model depends upon accurate and abundant sources of measured data and a satisfactory calibration and/or validation period. Often, in absence of complete or accurate records, model input represents estimated and/or averaged values. Future use of an extended data set and calibration period should continue to improve the accuracy and reliability of the model.

3.3.5.2 Groundwater Inflows

Water budget terms were based on the hydrogeologic conceptual model presented above for groundwater recharge and discharge. The general modeling approaches taken to estimate each groundwater inflow term through time based on measured data and/or the development of scientific assumptions are summarized below.

3.3.5.2.1 Recharge from Mountain Front Runoff

Recharge from mountain front runoff was estimated by the surface waterwatershed model based on precipitation (see next section), potential ET, soil type/coverage, land use, topography/slope, and other hydrologic properties. A discussion of the data used for the watershed model is included in Appendices 3d and 3e. Interception of recharge through surface water diversions and pumping outside of the groundwater Subbasin (but within the watershed area) was also considered. Recharge calculated by the watershed model becomes input to the groundwater model by simulating recharge along the active groundwater model cells at the base of the mountains. Annual recharge from mountain front runoff is shown on Figure 3-2836.

3.3.5.2.2 Areal Recharge from Precipitation

Areal recharge from precipitation was also estimated by the surface waterwatershed model based on precipitation, potential ET, soil type/coverage, land use, topography/slope, and other hydrologic properties.

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Precipitation data were obtained from multiple precipitation stations within or outside the model boundary, including Henshaw Dam Station, Palomar Mountain Observatory Station, and Vista Station. Each station has varying periods and frequencies of recorded precipitation data. In addition, gridded estimates of monthly and annual precipitation were obtained in the form of PRISM maps. PRISM (Parameter-elevation Regression on Independent Slopes Model) was developed by the National Resources Conservation Service (NRCS) National Water and Climate Center (NWCC) and the PRISM Climate Group at Oregon State University. Gridded data represents the long-term (30-year) annual precipitation from 1981 through 2010.

Precipitation throughout the USLR Valley Groundwater Subbasin was then established based on observed rainfall at the nearby precipitation gaging stations, isohyetal contours of gridded historical average annual precipitation, and the establishment of precipitation adjustment factors to distribute/scale observed daily precipitation across the modeled area appropriately. Recharge from areal precipitation calculated by the watershed model becomes input to the groundwater model by simulating recharge to the uppermost model layer across the active groundwater area. Annual recharge from areal precipitation is shown on Figure 3-2937.

3.3.5.2.3 Streambed Percolation

Historical daily streamflow data were obtained from two USGS gages (downloaded from the National Water Information System webpage) for varying periods of record (see Appendix 3d). The daily readings from these two gages (Station 11036700 San Luis Rey River Near Pauma Valley, and Station 11039800 San Luis Rey River Near Pala) were used to help calibrate the USLR Watershed Model. Henshaw Dam release data (minus diversions into the Escondido Canal) were also used as surface inflow for the watershed model, and surface diversion data from several surface water diversion locations were used in the watershed model to estimate streamflow. The model also takes into account runoff generated from precipitation events and the excess application of water at the surface, and tributary inflow.

Model output from the watershed model was then used as input for the groundwater model. Streambed percolation was estimated by the groundwater model using the Streamflow Routing Package. The Streamflow Routing Package routes tributary inflows through modeled stream networks and simulates streambed percolation based on streamflow, streambed conductance (refined during model calibration), and model-simulated groundwater levels. Annual recharge from streambed percolation is shown on Figure 3-3038.

3.3.5.2.4 Return Flow from Applied Water

Return flow from applied water was estimated using return flow percentages from a recent study within the Temecula-Murrieta Groundwater Basin (Stetson, 2016), as summarized below.

Table 3-54. Return Flow Percentages

Water Use Type	Return Flow (% of Water Use)
Commercial/Industrial/Public Facilities	13%
Residential (High Density)	9%

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Water Use Type	Return Flow (% of Water Use)
Residential (Low Density)	11%
Agriculture/Parks/Golf Course	18%

Return flows are categorized by application (e.g., agricultural, municipal, or residential) and calculated based on estimated water use (including pumped groundwater and imported water). For residential return flows, indoor/outdoor water use percentages and septic return flows were refined based on values provided in Appendix D of the Stetson report (2016).

Return flows include water returned to the aquifer from imported water use in the Subbasin. As mentioned previously, imported water use has increased through time. Annual imported water amounts are shown on Figure 3-3139. Return flow from total water use (pumped, imported, or surface water supply) was then simulated in the groundwater model by applying estimated recharge volumes to the uppermost model layer. Annual recharge from return flow is shown on Figure 3-3240.

3.3.5.2.5 Recycled Water Spreading

As described in Section 3.3.3.1.5, recycled water spreading occurs at the Pala wastewater treatment plant in Pala Subbasin and at the Pauma Valley Treatment Plant and Pauma Casino in Pauma Subbasin. Historical spreading records were available for operations at Pauma Valley Treatment Plant and were used for spreading activities at this site. Recharge from recycled water spreading at the two other facilities was assumed based on estimated pumping (or water usage), a 40% indoor water use percentage, 60% sewage connection (for Pala area), and 5% treatment loss. Annual estimated recharge from recycled water spreading is shown on Figure 3-3341.

3.3.5.3 Groundwater Outflows

The general modeling approaches taken to estimate each groundwater outflow term through time based on measured data and/or the development of scientific assumptions are summarized below.

3.3.5.3.1 Groundwater Pumping

Groundwater pumping was based on historical pumping records, where available. Estimates of unrecorded pumping for those areas not served by a water service entity were primarily based on land use and published associated water use (including the demand estimates provided in Table 3-6 of the County's General Plan Update Groundwater Study; County, 2010) and other estimates of water use from previous studies. Since agricultural irrigation represents such a large portion of groundwater pumping in the Subbasin, estimates of agricultural water use were based on crop type using available crop mapping data. Multi-year coverage was available from DWR at https://data.cnra.ca.gov/dataset/statewide-crop-mapping, as well as from SANDAG. Crop-specific agricultural demand estimates from the County's Table 3-6 were then applied to the areas identified by the crop mapping. Pumping estimations were also made for tribal areas, including casino usage, based on available reports (Geo-Logic Associates, 2009; Pala Band of Mission Indians, 2019; Stetson, 1984; Tierra Environmental Services, 2007). Estimated pumping

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rates were simulated in the groundwater model using the Well Package and assigned to the locations of known or estimated pumping. Annual estimated groundwater pumping from the calibrated model is shown on Figure 3-3442.

3.3.5.3.2 Underflow Outflow

Underflow outflow to downgradient Bonsall Subbasin was calculated by the groundwater model based on calibrated aquifer parameters, observed downstream groundwater elevations, and model-simulated groundwater elevations. Annual estimated underflow outflow is shown on Figure 3-3543. As shown, underflow outflow to Bonsall has been fairly constant. Underflow outflow under projected (future) conditions is also not anticipated to change considerably (see Section 3.3.5.7).

3.3.5.3.3 Evapotranspiration

Evapotranspiration represents another value that is calculated by the groundwater model. The model uses the ET Package based on model-simulated groundwater elevations, and extinction depths and consumptive use estimates from previous studies (e.g., Muckel and Blaney, 1945; Moreland, 1974). Annual estimated underflow outflow is shown on Figure 3-3644. ET volumes calculated by the model for the groundwater budgets represent the groundwater that is consumed by riparian vegetation and vegetation in areas of shallow groundwater. Interception of precipitation by other native vegetation relying on soil moisture from the unsaturated, or vadose, zone rather than groundwater is accounted for in the surface waterwatershed model. Therefore, the groundwater consumed by native vegetation is represented by this ET term.

3.3.5.4 Change in Groundwater Storage

Change in groundwater storage is calculated as the sum of the inflow terms minus the sum of the outflow terms. Average annual change in groundwater storage for historical, current, and projected water budgets are presented in the following sections. The cumulative change in groundwater storage over the updated calibration period (WY 19912 through 20202025) is provided as Figure 3-3745. The cumulative departure from mean annual precipitation at the Lake Henshaw Station is also shown on the figure. As shown on the figure, the change in groundwater storage largely responds to changes in hydrologic conditions (i.e., wet and dry periods cause rises and declines in groundwater storage, respectively).

3.3.5.5 Historical Water Budget

The historical water budget for the USLR Valley Groundwater Subbasin was evaluated over the model calibration period from January October 1991 through December September 20202025 (WY 1992 through 2025). This 3034-year period represents average hydrologic conditions (with an average precipitation of 24.8 5 inches per year compared to a long-term average of 24.3 inches per year from 1943 through 20202025) and includes both dry and wet hydrologic periods. In addition, it represents the period of time for which information – such as water level and pumping data – becomes more readily available. Average annual inflow and outflow for the USLR Valley Groundwater Subbasin from the historical period (WY 19912 through 20205) are summarized in the following tables representing the groundwater and surface water budgets. Groundwater and surface water budgets are also shown in and on Figures 3-3846 and 3-47, respectively. Annual groundwater and surface water terms are provided in attached Table 3-14Appendix 3e.

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Table 3-65. Upper San Luis ReyUSLR Valley Groundwater SubbBasin – Historical Groundwater Budget (WY 19911992-20202025)

	Term	Annual Average Average Annual [acre-ft/yr]
Inflow	Recharge from Mountain Front Runoff	7,0512,976
	Areal Recharge from Precipitation	3,790184
	Streambed Percolation	6,0078,297
	Return Flow from Applied Water	2,689610
	Recycled Water Spreading	228243
	Total Inflow	**19,76517,309**
Outflow	Groundwater Pumping*	14,2632,969
	Subsurface Outflow	4,780316
	Evapotranspiration (ET)	2,2691,942
	Total Outflow	**21,31319,227**
	Change in Groundwater Storage	**-1,548918**

* Pumping is inclusive of the entire Subbasin, including pumping on tribal-owned lands.

Table 3-74. USLR Valley Groundwater Subbasin – Historical Surface Water Budget (WY 1992-2025)

	Term	Average Annual [acre-ft/yr]
Inflow	Tributary Inflow	15,147
	Runoff	9,702
	Rising Groundwater	4,888
	Total Inflow	**29,737**
Outflow	Streambed Percolation	13,184
	Stream Outflow	16,552
	Total Outflow	**29,736**

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As shown in the tTable 3-6 above, annual change in groundwater storage during the period from WY 19912 through 2020 2025 was estimated to be -1,548 918 acre-ft/yr. This storage decline is generally reflected in observed water levels in the Subbasin, especially Pauma Subbasin, which show general groundwater declines from the 1990s until the last 10 to 15 years or so.

3.3.5.6 Current Water Budget

Individual water budget terms for the evaluation of the current water budget for the USLR Valley Groundwater Subbasin were determined using the same approaches described above for the historical water budget, but over the last five years (i.e., WY 201621 through 202005). Hydrology (i.e., precipitation) during this period is slightly higher thanalso about the same as the long-term average precipitation observed at Henshaw Dam: 25.724.2 inches versus 24.3 inches. This above average rainfall contributes additionale groundwater recharge through mountain front runoff, areal recharge from precipitation, and streambed percolation are therefore comparable to the historical averages. HoweverIn addition, groundwater pumping and return flows are typicallyis lower reduced since additional more of the recent irrigation demand would be met with natural recharge rather than having to rely on pumped groundwater oris met through imported water suppliesdeliveries.

Average annual inflow and outflow for the USLR Valley Groundwater Subbasin from the current period (WY 2021 through 2025) are summarized in the following tables representing the groundwater and surface water budgets. Groundwater and surface water budgets are also shown in Figures 3-48 and 3-49, respectively. Annual groundwater and surface water terms are provided in attached Appendix 3e.Average annual inflow and outflow for the USLR Valley Groundwater Subbasin from the current period (2016 through 2020) are summarized in the following table and on Figure 3-39. Annual terms are provided in attached Table 3-14.

Table 3-86. Upper San Luis ReyUSLR Valley Groundwater SubbBasin – Current Groundwater Budget (WY 201621-20202025)

	Term	Annual Average [acre-ft/yr]
Inflow	Recharge from Mountain Front Runoff	9,2623,289
	Areal Recharge from Precipitation	4,9423,194
	Streambed Percolation	10,6629,573
	Return Flow from Applied Water	2,320125
	Recycled Water Spreading	295321
	Total Inflow	**27,48118,502**
Outflow	Groundwater Pumping*	12,23510,861
	Subsurface Outflow	5,0084,361
	Evapotranspiration (ET)	2,1261,757

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	Term	Annual Average [acre-ft/yr]
	Total Outflow	~~19,369~~16,979
	Change in Groundwater Storage	~~8,111~~1,522

* Pumping is inclusive of the entire Subbasin, including pumping on tribal-owned lands.

Table 3-~~9~~4. USLR Valley Groundwater Subbasin – Current Surface Water Budget (WY 2021-2025)

	Term	Average Annual [acre-ft/yr]
Inflow	Tributary Inflow	16,351
	Runoff	9,771
	Rising Groundwater	4,110
	Total Inflow	**30,231**
Outflow	Streambed Percolation	13,683
	Stream Outflow	16,547
	Total Outflow	**30,230**

The groundwater budget presented above (Table 3-8) supports the water levels observed throughout much of the Subbasin – indicating recovery in water levels and groundwater storage over the last ~~five to~~ ten years or so. A combination of ~~above~~ average precipitation, with several wet years, and increased use of imported water has allowed groundwater storage to recover by ~~over~~ nearly 8,000 acre-ft~~/yr~~ ~~for~~over the last five years.

3.3.5.7 Projected Water Budget

The historical and current water budgets presented above are based on land use conditions and annual groundwater pumping under the historical conditions for the period in question (WY 199~~1~~2 through 202~~0~~5 for historical and WY 20~~16~~21 through ~~2020~~ 2025 for current). The projected water budget needs to account for water demands based on long-term water supply planning by Subbasin stakeholders. As discussed in the Plan Area section (Section 2.3), land use in the USLR Valley Groundwater Subbasin is not anticipated to change much. Land and water use will remain predominantly agricultural and projected residential increases are expected to have negligible effect on overall water demand. Therefore, the projected water budget was evaluated using the average pumping and associated return flows from the past five years (WY 20~~16~~21 through ~~2020~~2025) and average hydrologic conditions using historical precipitation from WY ~~1991~~ 1992 through ~~2020~~2025, repeated approximately 1.5 times, to provide a 50-year projection~~repeated twice to provide a 60-year projection~~.

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Projected average annual inflow and outflow for the USLR Valley Groundwater ~~Subbasin (using repeating hydrologic conditions from 1991 through 2020)~~ are summarized in the following tables for the groundwater budgets and surface water budgets, respectively, and on Figures 3-~~40~~50 and 3-51. Annual terms are provided in attached ~~Table 3-15~~Appendix 3e.

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Table 3-107. Upper San Luis ReyUSLR Valley Groundwater SubbBasin – Projected Groundwater Budget (2022-2081WY 2026-2075)

	Term	Annual Average [acre-ft/yr]
Inflow	Recharge from Mountain Front Runoff	3,2977,051
	Areal Recharge from Precipitation	3,0283,790
	Streambed Percolation	8,5156,914
	Return Flow from Applied Water	2,2872,483
	Recycled Water Spreading	321295
	Total Inflow	**17,45020,532**
Outflow	Groundwater Pumping*	11,13113,659
	Subsurface Outflow	4,3784,858
	Evapotranspiration (ET)	1,9112,123
	Total Outflow	**17,42120,641**
	Change in Groundwater Storage	**27-109**

* Pumping is inclusive of the entire Subbasin, including pumping on tribal-owned lands.

Table 3-118. USLR Valley Groundwater Subbasin – Projected Surface Water Budget (WY 2026-2075)

	Term	Average Annual [acre-ft/yr]
Inflow	Tributary Inflow	16,191
	Runoff	9,845
	Rising Groundwater	4,830
	Total Inflow	**30,866**
Outflow	Streambed Percolation	13,345
	Stream Outflow	17.521
	Total Outflow	**30,866**

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A continuation of current water use practices in the Subbasin for the next 60 50 years, assuming approximately average hydrologic conditions, is anticipated to continue to be sustainable, with essentially no change in groundwater storage (a slight increase cause additional groundwater storage declines of approximately 3100 acre-ft/yr). This indicates that current pumping conditions are approximately equal to the sustainable yield of the Subbasin. Additional groundwater management actions, such as water conservation or imported water use (see Section 46.0) may be able to mitigate the slight projected depletion of groundwater storageincrease the amount of water available for additional groundwater pumping. However, as mentioned previously, the projected water budget presented above assumes the continuation of current Subbasin conditions, including pumping volumes, water use, application rates, return flows, etc. If water use (especially pumping volumes) increases in the Subbasin, then additional projects and/or management actions will be needed to help address decreases in groundwater elevations, depletions in groundwater storage, and potential effects on interconnected surface waterISW flow.

3.3.5.8 Estimate of Sustainable Yield

Sustainable yield is defined by SGMA (Water Code, section 10721(w)) as the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result. In the USLR Valley Groundwater Subbasin, the chronic lowering of groundwater levels and significant and/or unreasonable reduction of groundwater storage would represent the primary undesirable results. Other undesirable results include significant and unreasonable degraded groundwater quality, and depletions of interconnected surface waterISW, and land subsidence that have significant and unreasonable adverse impacts on beneficial uses of the surface water. Given local conditions in the subbasin, and as discussed previously, seawater intrusion and land subsidence areis not anticipated to contribute to potential undesirable results in the subbasin.

Previous estimates of sustainable, or safe, yield are summarized below.

Table 3-128. Previous Estimates of Sustainable Yield for the Upper San Luis ReyUSLR Valley Groundwater Subbasin

Source	Pauma Subbasin	Pala Subbasin [acre-ft/yr]	Total Upper San Luis Rey Valley
Ellis and Lee (1919)	-	-	7,640
Moreland (1974)	4,530	2,545	7,075

Given local conditions and the potential undesirable results discussed above, sustainable yield for the USLR Valley Groundwater Subbasin was considered to be the amount of groundwater pumping achievable with no change in groundwater storage. Through evaluation of the subbasin water budgets, an increase in groundwater storage indicates that additional sustainable yield is available (e.g., pumping is well within sustainable rates). If, however, the pumping results in a negative change in storage, groundwater pumping is in excess of the sustainable yield. The determination of sustainable yield can therefore be expressed as:

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Sustainable Yield = Pumping +/- Change in Storage

Groundwater pumping in the subbasin was estimated based on water demand (see description of groundwater pumping estimates in Section 3.3.5.3.1, above), reported pumping (obtained from Subbasin stakeholders), and records of supplemental imported water use (which offsets the need for additional groundwater pumping). Total average groundwater pumping for the period from WY 1991 1992 through 2020 2025 was estimated to be approximately 14,313,000 acre-ft/yr. The change in groundwater storage from WY 19912 to 2020 2025 is approximately -1,500 900 acre-ft/yr. This general decrease in groundwater storage is supported by groundwater level declines observed in the subbasin, particularly for the period from the 1990s through the early 2000s (see Section 3.3.4.1).

Preliminary eEstimates of sustainable yield for the current investigation are provided below. These values should continue to be refined as additional information is collected following GSP implementation.

Table 3-139. Estimates of Sustainable Yield for the Upper San Luis ReyUSLR Valley Groundwater Subbasin

Period	Groundwater Pumping	Change in Storage [acre-ft/yr]	Sustainable Yield
Historical Period (WY 1991 1992 – 20202025)	14,30013,000	-1,900 1,500	11,10012,700
Current Period (WY 2016 2021 – 20202025)	12,20010,900	1,5008,100	12,40020,300
Projected Period (WY 2022 2026 – 20812075)	11,10013,700	-1000	13,60011,100

As shown above, historical sustainable yield in the USLR Valley Groundwater Subbasin is estimated to be approximately 12,711,100 acre-ft/yr. This is larger than previous estimates of sustainable yield by Ellis and Lee (1919) and Moreland (1974), which were on the order of 7,000 to 8,000 acre-ft/yr, but much of the difference may be explained by difference in estimation approach. The sustainable yield estimate developed by Ellis and Lee looked at the volume of groundwater that could be extracted over a 3-year period assuming no or negligible recharge (i.e., extreme drought period), be adequately replenished the following year, and be completely replenished prior to the next drought. This methodology is somewhat unclear, but the area used for the analysis of the "San Luis Rey Valley (Upper)" appears to only encompass approximately 4,400 acres. The active model area developed for this the GSP investigation area is just over 13,000 acres. The Moreland (1974) investigation provides a water budget table for both Pauma and Pala Subbasins. Sustainable yield was then estimated following the equation presented above, whereby the yield may be expressed as the pumping plus or minus the change in groundwater storage. However, the change in storage presented by Moreland was not calculated or verified independently of his pumping/water budget term estimations as was done for the preliminary GSP estimate. That is, the change in storage presented by Moreland was calculated as the sum of the estimated inflows minus the sum of the outflows and did not consider observed change(s) in groundwater elevations. The change in storage (and, in turn, sustainable yield estimate) is therefore directly related to the assumptions he made for each individual groundwater budget term and the various uncertainties associated with them.

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The historical sustainable yield value provided here represents an estimate of pumping that will result in no long-term depletion of groundwater storage for representative, long-term average hydrologic conditions. However, sustainable yield is not a constant value. Due to changes in annual precipitation – and therefore natural recharge – sustainable yield can be assumed to fluctuate annually. This will result in a fluctuation of groundwater storage corresponding to wet and dry hydrologic cycles, but it is assumed that the sustainable yield pumping will result in generally stable groundwater storage that will not trend towards depletion over the long-term. In addition, sustainable yield varies depending on cultural conditions in the subbasin, such as changes in land use within the subbasin and irrigation practices, water supply sources (native vs. supplemental), and water management programs (increased use of recycled water or surface water, etc.). This is apparent in estimates of sustainable yield using current groundwater budgets. Under the conditions experienced over the last five years, sustainable yield is estimated to be closer to ~~20~~12,~~300~~ 400 acre-ft/yr.

Future changes in these conditions should be considered through periodic future updates of sustainable yield estimates. An opportunity to refine sustainable yield estimates for the USLR Valley Groundwater Subbasin is provided through future SGMA-required reporting. These reports will incorporate additional metered flows, providing a better indication of actual groundwater pumping, and supplemental water levels established by the proposed monitoring network (Section 5.0).

In addition, since the change in groundwater storage also relates to the amount of groundwater inflows and outflows experienced in the Subbasin, sustainable yield may be increased through supplemental recharge, such as the use of imported water from outside the ~~subbasin~~ Subbasin to supplement water supply. This additional water, which was not extracted from groundwater reserves within the subbasin, provides return flows (i.e., groundwater recharge) that have been shown to be beneficial in maintaining and even leading to the recovery of groundwater levels. Previous estimates of sustainable yield summarized in ~~the table~~Table 3-12 above represent older estimates with lower or no imported water contributions. The increased use of imported water through time, especially in recent years, contributes to an increased estimated sustainable yield for the USLR Valley Groundwater Subbasin over previous estimates as well as a higher sustainable yield under current water use conditions. If current water use and land use continues into the future, sustainable yield is estimated to be approximately ~~13,6~~11,100 acre-ft/yr. However, ~~maintaining~~ this level of sustainable yield requires the continued use of supplemental imported water supplies in the subbasin. Reduction of return flows from imported water without a similar reduction in groundwater pumping will eventually cause groundwater levels, and therefore groundwater storage, in the subbasin to fall. Additional discussion of factors that could influence future sustainable yield is provided in the following sections.

3.3.5.8.1 Impact of Climate Change

An estimate of predicted climate change is provided through the SGMA Climate Change Technical Advisory Group (CCTAG) guidance document (DWR, 2018)[24]. The CCTAG reviewed an ensemble of climate simulations to develop change factors for precipitation and evapotranspiration. The climate change

[24] DWR also collaborated with Lawrence Berkeley National Laboratory in 2020 to update the 2070 extreme scenario utilizing an improved climate period analysis method to better capture projected changes in temperature and precipitation (DWR, 2020b). The extreme warming scenario was used for this analysis to provide a more extreme bookend of potential impacts.

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factors were downscaled to the Variable Infiltration Capacity (VIC) land surface model grid by the CCTAG. Each VIC grid cell contains a change factor which varies by month and location.

Using VIC cells encompassing the USLR Valley Groundwater Subbasin, the average precipitation climate change factor shows a reduction in precipitation under 2030 climate change conditions of approximately 1 percent. Under 2070 conditions (dry and extreme warming, DEW), precipitation is projected to be reduced by 3 28 percent. Generally, decreases in precipitation are seen in each month except for September, where an increases in precipitation are anticipated in summer months. However, these months have little precipitation, so these increases does not correspond to a large increasesdifference in rainfall amountvolume. Decreases during October through December account for the primary reduction in overall precipitation. ET is anticipated to increase approximately 4 percent per 2030 climate change guidance and 10 19 percent per 2070 climate change guidance. The ET change factors show greater uniformity than precipitation factors, which are more variable.

An estimation of climate change impacts on the projected sustainable yield of the USLR Subbasin was made by adjusting model-estimated groundwater recharge and discharge terms influenced by natural processes (i.e., areal recharge from precipitation, recharge from mountain front runoff, streambed percolation, and ET) based on the anticipated changes to precipitation and ET discussed above. While actual reduction in precipitation and increases in ET will not have a directly linear impact on groundwater recharge and discharge, this evaluation presents an initial estimate of effects from these changes. A summary of the potential effects of climate change on projected sustainable yield in the subbasin is provided below.

Table 3-1410. Projected Sustainable Yield and Impact of Potential Climate Change

Hydrologic Condition	Groundwater Inflow	Groundwater Outflow	Change in Storage	Sustainable Yield
	[acre-ft/yr]			
Historical Hydrology	20,5017,300	20,619,200	-100-1,900	13,60011,100
2030 Climate Change	17,40020,400	17,50020,700	-100-300	11,00013,400
2070 Climate Change (DEW)	13,30020,000	17,80020,900	-4,500-900	6,70012,800

As shown in the table above, sustainable yield is anticipated to be reduced by approximately 200-100 acre-ft/yr under 2030 climate change conditions and 800 4,400 acre-ft/yr under 2070 conditions. However, the assumed outflow for the climate change scenarios is likely high since they assume a continuation of current pumping and land use conditions, regardless of changes in hydrology. In reality, the changes in climate assumed by the climate scenarios, and the 2070 DEW model in particular, would likely result in changes in actual basin operations within the USLR Valley Groundwater Subbasin, including increased use of imported water and land fallowing. The change in groundwater storage under the climate change scenarios is therefore conservative and would be less with reactionary change in groundwater pumping. However, if climate change does create challenging conditions in the future for beneficial users, Therefore, if future conditions follow predicted climate change modeling, implementing management actions and projects for sustainability (as discussed in Section 6.0) may become increasingly important in the future, and will be triggered if confirmed water level MT exceedances occur due to reduced recharge

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and continued pumping. This would likely includes augmenting Subbasin groundwater supply with additional sources of water, such as imported water. Proposed projects and management actions to diversify water supply, efficiently use existing sources of water, and increase available recharge are discussed in Section 6.0.

While running a model scenario with the adjusted natural recharge and discharge terms would result in a more comprehensive analysis of potential impacts from climate change (by calculating the change in additional groundwater budget terms such as underflow outflow), there is significant uncertainty associated with future and model conditions. These include but are not limited to: DWR modeled climate change assumptions, future land use and water use in the subbasin, and groundwater conditions and parameters from the USLR Groundwater ModelGM which was calibrated using a limited dataset (spatially and temporally). Incorporating additional information on pumping, groundwater level conditions, and surface flow in the USLR Valley Groundwater Subbasin as it becomes available through future data collection efforts will allow estimates of sustainable yield to be refined. In addition, this increased understanding will improve model reliability. Additional modeling scenarios may be run as needed to evaluate future or projected conditions, including assessing impacts from climate change and proposed management actions or projects.

3.3.5.8.2 Imported Water Reliability

As discussed in Section 2.1.2.3, YMWD receives imported water from the Water Authority. The Water Authority states that its *"supply portfolio includes high-priority, independent Colorado River supplies negotiated through the landmark 2003 Quantification Settlement Agreement, or QSA. These highly reliable supplies are the cornerstone of the San Diego region's long-term water supply diversification strategy. In addition, the Water Authority purchases Colorado River water from the Metropolitan Water District of Southern California"* (Metropolitan) (Water Authority website[25]). The Water Authority receives approximately 280,000 acre-feet annually from these efforts, comprising around 87% of the Water's Authority's total water supply (Water Authority, 2026). However, the Water Authority has progressively been reducing reliance on SWP water.Source: Table 5-6 in DWR, 2020b

TAF = thousand acre-ft

During the most recent drought from 2012 through 2016, delivery of Table A allocations ranged from 5 to 65 percent, with an average 5-year delivery of 37 percent (DWR, 2022a). In their Notice to State Water Project Contractors dated January 20, 2022, DWR recently increased the 2022 SWP Table A Allocation from 0 to 15 percent. According to the notice, "the Table A Allocation increase is made consistent with the long-term water supply contracts, legal requirements, and public policy. In determining available SWP supplies, DWR has considered several factors including existing storage in SWP conservation reservoirs, estimates of future runoff under very dry conditions, SWP operational and regulatory constraints such as,

[25] https://www.sdcwa.org/your-water/imported-water-supplies/

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~~Endangered Species Act and California Endangered Species Act requirements, and the 2022 demands of SWP Contractors. DWR may revise this and any subsequent allocations if warranted by the year's developing hydrologic and water supply conditions." YMWD will continue to work with the Water Authority provide imported water supplies as a part of the water portfolio for USLR subbasin.~~Historical imported water supplies to YMWD have demonstrated a high degree of reliability. Differences in annual imported water use have primarily reflected variations in demand and local groundwater availability rather than limitations on the availability of imported supply. SDCWA's adopted 2025 UWMP further concludes that its existing and planned portfolio is sufficient to meet regional demands through 2050 under normal, single-dry, and multiple-dry-year conditions. More importantly, its multiple-dry-year analysis actually assumes constrained Metropolitan supplies and still finds substantial regional supply adequacy. Therefore, it is defensible for the USLR projected baseline to assume that YMWD can receive its projected imported-water demand through at least the SDCWA planning horizon.

3.3.5.9 Quantification of Overdraft

A groundwater basin is generally regarded as being in overdraft when pumping exceeds natural and artificial groundwater recharge. As presented above, the preliminary estimate of sustainable yield for the USLR Valley Groundwater Subbasin is approximately ~~12~~11,~~700~~ 100 acre-ft/yr. This value indicates that historical pumping rates of ~~14~~13,~~300~~ 000 acre-ft/yr were in excess of sustainable yield by approximately 1,~~500~~ 900 acre-ft/yr. This additional pumping resulted in observed water level and groundwater storage declines. Current pumping, however, is estimated to be below the estimated historical sustainable yield of ~~12~~11,~~700~~ 100 acre-ft/yr. Lower pumping rates, in conjunction with average to wet hydrological conditions, has contributed to increases in groundwater levels seen in many parts of the Subbasin within the last ~~five to~~ ten years. It is important to note that these pumping and sustainable yield numbers ~~still need~~will continue to be verified through additional data collection and model refinement. Additional pumping data can be used to verify pumping estimates and associated assumptions and allow for the refinement and recalibration of the groundwater model that will, in turn, improve confidence in sustainable yield estimates.

Pauma and Pala Subbasins were considered to be at or near hydrologic balance in the 1984 study by Stetson. Following this study, groundwater elevations – particularly in Pauma Subbasin – showed declines from the 1990s through the early 2000s. Over the last ~~ten~~ fifteen years or so, water levels have recently stabilized and ~~have started to~~ show recovery over the last 10 years. This seems to be due in large part to the use of imported water to augment groundwater supplies, allowing for a reduction in groundwater pumping. Since land use in the subbasin is not anticipated to change very much in the future, water demand will also likely remain at or near current levels. Future unanticipated changes in water demand and/or imported water supplies could result in the Subbasin falling out of sustainable management.

3.4 Management Areas (§354.20)

Management areas can be used in a groundwater basin to control and/or mitigate the development of undesirable effects. The Upper Pauma Nitrate/Perchlorate-Affected Area described in Sections 3.3.4.3.2 and 3.3.4.3.3 is not established as a separate SGMA management area under 23 CCR § 354.20. Rather, it is a technical evaluation and SMC accounting area used to distinguish known localized groundwater

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quality impairment from basin-wide degradation (see Section 4.4 for additional discussion). No separate management areas are anticipated to be required for the current management and operation of the USLR Valley Groundwater Subbasin.

3.5 References (§354.4(b))

AB 1944 (Assembly Bill No. 1944), 2018. Chapter 255. An act to amend Section 10721 of, and to add Section 10722.5 to, the Water Code, relating to groundwater. Approved by the Governor September 5, 2018. Filed with Secretary of State September 5, 2018.

Bedrossian, T.L., P. Roffers, C.A. Hayhurst, J.T. Lancaster, and W.R. Short, 2012. California Geological Survey Special Report 217: Geologic Compilation of Quaternary Surficial Deposits in Southern California (Revised). Dated December 2012.

Born, Barrett & Associates, 1985. Groundwater Impact Analysis of the Proposed Pala Sand and Gravel Extraction Project of J.B. Unlimited. Prepared for J.B. Unlimited, dated October 1985.

Case Study Report #76: Lake Henshaw, San Luis Rey River. Provided by County of San Diego.

City of Oceanside, City of Vista, and County of San Diego, 2008. San Luis Rey River Watershed Urban Runoff Management Program. Prepared for California Regional Water Quality Control Board San Diego Region 9. https://www.ci.oceanside.ca.us/civicax/filebank/blobdload.aspx?blobid=26177

County (County of San Diego) Department of Planning and Land Use, 2010. County of San Diego Department of Planning and Land Use General Plan Update Groundwater Study. Dated April 2010. Available at: https://www.sandiegocounty.gov/content/dam/sdc/pds/gpupdate/docs/BOS_Aug2011/EIR/Appn_D_GW.pdf.

DWR (California Department of Water Resources), 1965. Water Quality Report on Pauma, Pala, and Bonsall Ground Water Basins. A Report to San Diego Regional Water Quality Control Board (No. 9), dated December 1965.

DWR, 2016. Best Management Practices for the Sustainable Management of Groundwater: Hydrogeologic Conceptual Model. Dated December 2016.

DWR, 2018. Bulletin 118, 9-007.01 San Luis Rey Valley – Upper San Luis Rey Valley Basin Boundaries Description.

DWR, 2018. Sustainable Groundwater Management Program Resource Guide: DWR-Provided Climate Change Data and Guidance for Use During Groundwater Sustainability Plan Development. Dated July 2018.

DWR, 2020a. CA Bulletin 118 Groundwater Basins. Updated December 20, 2020. Available at: https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118.

DWR, 2020b. Updated to the 2070 Extreme Climate Change Scenarios Dataset. Available at: https://data.cnra.ca.gov/dataset/extreme-climate-change-scenarios-for-water-supply-planning/resource/f2e1c61a-4946-4863-825f-e6d516b433ed and

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https://data.cnra.ca.gov/dataset/sgma-climate-change-resources.The Final State Water Project Delivery Capability Report 2019. Dated August 26, 2020. Available at: https://water.ca.gov/Library/Modeling-and-Analysis/Central-Valley-models-and-tools/CalSim-II/DCR2019.

DWR, 2021. Sustainable Groundwater Management Act Water Year Type Dataset Development Report. Available at: https://water.ca.gov/programs/groundwater-management/data-and-tools#:~:text=DWR%20is%20providing%20the%20Sustainable,utilize%20data%20of%20comparable%20quality.

DWR, 2022a. State Water Project Historical Table A Allocations – Water Years 1996 – 2022. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/State-Water-Project/Management/SWP-Water-Contractors/Files/1996-2022-Allocation-Progression-012022a.pdf.

DWR, 2022b. Notice to State Water Project Contractors: 2022 State Water Project Table A Allocation Increase from 0 to 15 Percent. No. 22-01, dated January 20, 2022. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/State-Water-Project/Management/SWP-Water-Contractors/Files/22-01-2022-Allocation-Increase--15-Percent-012022.pdf.DWR, 2024a. Depletions of Interconnected Surface Water, and Introduction. DWR Sustainable Groundwater Management Office. Draft, dated February 2024. Available at: https://s3.amazonaws.com/og-production-open-data-cnra-892364687672/resources/218e3361-c142-400f-a97f-5dfa79cd4997/depletionsofisw_paper1_intro_draft.pdf?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAJJIENTAPKHZMIPXQ%2F20260606%2Fus-east-1%2Fs3%2Faws4_request&X-Amz-Date=20260606T184924Z&X-Amz-Expires=86400&X-Amz-SignedHeaders=host&X-Amz-Signature=b4769a9daec81c0ff59d59e8543bb7804c263efa532d3182bc7a8a943c94af79.

DWR, 2024b. Techniques for Estimating Interconnected Surface Water Depletions Caused by Groundwater Use. DWR Sustainable Groundwater Management Office. Draft, dated September 2024. Available at: https://s3.amazonaws.com/og-production-open-data-cnra-892364687672/resources/9c76066b-b20b-4241-9199-4578bdb5a720/depletionsofisw_paper2_techniques_draft.pdf?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAJJIENTAPKHZMIPXQ%2F20260606%2Fus-east-1%2Fs3%2Faws4_request&X-Amz-Date=20260606T185106Z&X-Amz-Expires=86400&X-Amz-SignedHeaders=host&X-Amz-Signature=19a665c4af76681b73792942ff894c13a21672cf29f727538a31a7852fdc04ba.

DWR, 2024c. Examples for Estimating Interconnected Surface Water Depletions Caused by Groundwater Use. DWR Sustainable Groundwater Management Office. Draft, dated September 2024. Available at: https://s3.amazonaws.com/og-production-open-data-cnra-892364687672/resources/9edd0f9c-317f-42ba-85ff-15f49aa5ff43/depletionsofisw_paper3_examples_draft.pdf?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAJJIENTAPKHZMIPXQ%2F20260606%2Fus-east-

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1%2Fs3%2Faws4_request&X-Amz-Date=20260606T185245Z&X-Amz-Expires=86400&X-Amz-SignedHeaders=host&X-Amz-Signature=cbe3cdcc4243da0635c830d50cb7c24eade0e9afb1a992c439ff56d0988ed9c6.

Ellis, A.J., and C.H. Lee, 1919. Geology and Ground Waters of the Western Part of San Diego County, California. United States Geological Survey Water Supply Paper 446, prepared in cooperation with the Department of Engineering of the State of California and the City of San Diego.

Geoconsultants (Geoconsultants, Inc.), 2009. Geological and Geophysical Survey for Water Well Locations – Yuima Municipal Water District Properties, San Diego County, California. Prepared for Yuima Municipal Water District, dated November 30, 2009.

Geo-Logic Associates, 2009. Evaluation of Current Utilization of Groundwater Resources in the Pala Groundwater Basin, San Diego County, California. Dated October 9, 2009.

Geosyntec (Geosyntec Consultants), 2015. Groundwater Monitoring Plan – San Luis Rey Valley Basin (9-7) San Diego, California – California Statewide Groundwater Elevation Monitoring Program. Prepared for the County of San Diego, Department of Planning and Development Services, dated October 2015.

Helix (Helix Environmental Planning), 2021. Groundwater Dependent Vegetation Assessment for the Groundwater Sustainability Plan for the Upper San Luis Rey Valley Groundwater Sub-Basin. Prepared for Geoscience Support Services, Inc., dated May 21, 2021.

Howes, T.B., 1955. A Brief Study of the Geology and Ground Water Conditions in the Pauma Valley Area, San Diego County, California. California Institute of Technology Thesis, Master of Science, Division of Geological Sciences. Dated May 31, 1955.

Ireland, R.L., J.F. Poland, and F.S. Riley, 1984. Land Subsidence in the San Joaquin Valley, California, as of 1980. U.S. Geological Survey Professional Paper 437-I. Available here: https://pubs.er.usgs.gov/publication/pp437I.

Jennings, C.W., R.G. Strand, and T.H. Rogers, 1977. Geologic map of California: California Division of Mines and Geology, scale 1:750,000. Available at: https://mrdata.usgs.gov/geology/state/state.php?state=CA.

Johnson, A.I., R.P. Moston, and D. A. Morris, 1968. Physical and Hydrologic Properties of Water-Bearing Deposits in Subsiding Areas in Central California. U.S. Geological Survey Professional Paper 497-A. Available at: https://pubs.er.usgs.gov/publication/pp497A.

Kennedy, M.P., 2006. Preliminary Geologic Map of the Boucher Hill 7.5' Quadrangle, San Diego County, California: A digital database (revised 2014). California Department of Conservation, California Geological Survey. Version 1.2. https://ngmdb.usgs.gov/Prodesc/proddesc_106522.htm.

LAFCO (San Diego Local Agency Formation Commission), 2013. Pauma Valley Community Services District. Fact Sheet, updated September 16, 2013. Available at: https://www.sdlafco.org/home/showpublisheddocument/2488/636914599002700000.

Formatted: Font: 10 pt, Bold

Layne (Layne Christensen Company), 2010. Yuima Municipal Water District Geophysical Survey Reinterpretation. Prepared for Yuima Municipal Water District, dated December 2010.

LGS (Layne GeoSciences), 2009. Pauma Groundwater Basin Geophysical Surveys – Pauma Valley, California. Prepared for Yuima Municipal Water District, dated May 5, 2009.

Maddock, T., K.J. Baird, R.T. Hanson, W. Schmid, and H. Ajami. RIP-ET: A Riparian Evapotranspiration Package for MODFLOW-2005. Chapter 39 of Section A, Groundwater, Book 6, Modeling Techniques. USGS Techniques and Methods 6-A39. Available at: https://pubs.usgs.gov/tm/tm6a39/pdf/tm6a39.pdf.

McDonald, M.G., and A.W. Harbaugh, 1988. A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model: U.S. Geological Survey Techniques of Water-Resources Investigations Book 6, Chapter A1, 586 p.

Meade, R.H., 1968. Compaction of Sediments Underlying Areas of Land Subsidence in California. U.S. Geological Survey Professional Paper 497-D. Available here: https://pubs.er.usgs.gov/publication/pp497D.

Moreland, J.A., 1974. Hydrologic- and Salt-Balance Investigations Utilizing Digital Models, Lower San Luis Rey River Area, San Diego, California. U.S. Geological Survey Water-Resources Investigations 24-74. Prepared in cooperation with the Joint Administration Committee of the Santa Margarita and San Luis Rey Watershed Planning Agencies, dated October 1974. Available at: https://pubs.usgs.gov/wri/1974/0024/report.pdf.

Muckel, D.C., and H.F. Blaney, 1945. Utilization of the Waters of Lower San Luis Rey Valley, San Diego County, California. U.S. Department of Agriculture, Division of Irrigation. Dated April 1945. Available at: https://babel.hathitrust.org/cgi/pt?id=uc1.31822007881618&view=1up&seq=3.

NBS/Lowry, Inc., 1991. Report of Waste Discharge for the Pauma Valley Sewage Treatment Plant. Submitted by Pauma Valley Community Services District, dated June 21, 1991.

Niswonger, R.G., S. Panday, and M. Ibaraki, 2011. MODFLOW-NWT, a Newton Formulation of MODFLOW-2005: U.S. Geological Survey Techniques and Methods 6-A37.

Pala Band of Mission Indians, 2019. Grant Application: Pala Tribe Water Management Tool to Build Drought Resiliency through Infrastructure Enhancement. Submitted to U.S. Department of the Interior Bureau of Reclamation Policy and Administration. WaterSMART Drought Response Program: Drought Resiliency Projects for Fiscal Year 2019 Funding Opportunity Announcement No. BOR-DO-19-F003. Dated March 25, 2019.

Poland, J.F. and R.L. Ireland, 1988. Land Subsidence in Santa Clara Valley, California, as of 1982. U.S. Geological Survey Professional Paper 497-F. Available here: https://pubs.usgs.gov/pp/0497f/report.pdf.

PVCSD (Pauma Valley Community Services District), 2015. Sewer System Management Plan (SSMP).

Recon (Regional Environmental Consultants), 1996. San Luis Rey River – Water Quality Management Plan. Prepared for County of San Diego Department of Parks and Recreation, dated February 26, 1996.

Formatted: Font: 10 pt, Bold

Regional Board (California Regional Water Quality Control Board, San Diego Region), 1994. Water Quality Control Plan for the San Diego Basin (9). Amendments effective on or before May 17, 2016. Available at: https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/docs/R9_Basin_Plan.pdf

RWMG, 2018. 2019 San Diego Integrated Regional Water Management Plan. Phase 1 Update of the 2013 IRWM Plan. In collaboration with the Regional Advisory Committee.

USDA NRCS (US Department of Agriculture, Natural Resources Conservation District), 2020. Soil Survey Geographic (SSURGO) database for San Diego County, California. Available at: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx.

USLRGMA (Upper San Luis Rey Groundwater Management Authority), 2024. Upper San Luis Rey Valley Groundwater Sustainability Plan Annual Report – Water Year 2023 (October 2022 through September 2023). Prepared by Geoscience Support Services, Inc., dated March 2024.

Stetson (Stetson Engineers), 1984. Final Report on Surface and Ground-Water Resources of the Upper San Luis Rey River System Relative to the La Jolla, Rincon, San Pasqual, Pauma and Pala Indian Reservations. Dated November 1984.

Stetson, 2016. Water Use Factors and Return Flow Rates Applied to Land Use Coverage within PRMS Model. Prepared for the Santa Margarita River Groundwater Model Working Group, dated October 18, 2016.

SWRCB (California State Water Resources Control Board), 2002. Decision 1645: Decision Determining the Legal Classification of Groundwater in the Pauma and Pala Basins of the San Luis Rey River. In the Matter of Applications 30038, 30083, 30160, 30165, 30175, 30178, 30260, 30355, and 30374.

SWRCB, 2020. MCLs, DLRs, PHGs, for Regulated Drinking Water Contaminants. Updated August 21, 2020. Available at: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MCLsandPHGs.html.

Tierra Environmental Services, 2007. Environmental Assessment for the Pala Tribal Wastewater System Rehabilitation Project. Prepared for the U.S. Environmental Protection Agency and Pala Band of Mission Indians, dated October 11, 2007.

Vaughan, P.R., 1987. Alluvial Stratigraphy and Neotectonics along the Elsinore Fault at Agua Tibia Mountain, California. University of Colorado Thesis, Master of Science, Department of Geological Sciences.

Vaughan, P.R., K.M. Thorup, and T.K. Rockwell, 1999. Paleoseismology of the Elsinore Fault at Agua Tibia Mountain, Southern California. Bulletin of the Seismological Society of America, 89, 6, pp 1447 – 1457, December 1999.

Water Authority, 2026. 2025 Urban Water Management Plan. Dated June 2026. https://www.sdcwa.org/wp-content/uploads/2026/07/Urban-Water-Management-Plan-Adopted.pdf.

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4.0 Sustainable Management Criteria (§354.22)

Sustainable groundwater management is defined as the *"…management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results…"* (Water Code Section 10721 (v)). SGMA has identified six sustainability indicators which refer to effects caused by groundwater conditions occurring throughout a basin that, when significant and unreasonable, cause undesirable results (Water Code Section 10721(x)). These are:

- Reduction of Groundwater in StorageChronic Lowering of Groundwater Levels
- Reduction of Groundwater in Storage
- Seawater Intrusion
- Degraded Water Quality
- Depletion of Interconnected Surface Water (ISW)
- Land Subsidence (not considered applicable in the USLR Valley Groundwater Subbasin)

Seawater Intrusion

- Depletion of Interconnected Surface Water (not considered applicable in the USLR Valley Groundwater Subbasin)

Basin sustainability, and the effectiveness of the proposed projects and management actions and programs (Section 6.0) will be judged by the ability to eliminate or avoid undesirable results and conditions represented by the six sustainability indicators, as specifically applicable to the USLR Groundwater Subbasin. For these sustainability indicators, a GSP must develop quantitative sustainabilitysustainable management criteria (SMCs) that allow a GSA to define, measure, and track sustainable management. These criteria include the following:

- Undesirable Result (UR) – significant and unreasonable conditions for any of the sixeach sustainability indicators.
- Minimum Threshold (MT) – numeric value used to define the point at which significant and unreasonable undesirable results occur for each sustainability indicator.
- Measurable Objective (MO) – specific, quantifiable goal to track the performance of sustainable management.
- Interim Milestone (IM) – target value representing measurable groundwater conditions, in increments of five years, set by the GSA as part of the GSPto track progress toward the MO.

The development of these sustainable management criteriaSMCs relies upon information about the USLR Subbasin developed in the hydrogeologic conceptual model presented in Section 3.0, the description of current and historical groundwater conditions, and the water budget. As discussed in Section 3.0, the USLR Valley Groundwater Subbasin is generally operating sustainably under current water demand and water supply conditions. With the exception of several small areas, water quality in the Subbasin is very generally good and there has been no reported subsidence. The sustainable management criteriaSMCs are used to establish thresholds and objectives to ensure the USLR Valley Groundwater Subbasin does not experience undesirable results in the future.

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4.1.1 Representative Monitoring Sites

The sustainability criteriaSMCs form the framework to define sustainable management particular to the Subbasin and delineate between sustainable and unsustainable groundwater conditions based on current and proposed use. Representative monitoring sites (RMSs) are the specific wells, monitoring locations, or other measurement points used to evaluate groundwater conditions relative to the SMCs established for each applicable sustainability indicator. RMSs are selected to represent conditions in relevant areas of the Subbasin and provide the data needed to determine whether MTs, MOs, and IMs are being met. Because conditions and available data vary by sustainability indicator, the RMS networks include different monitoring locations for groundwater levels, groundwater quality, land subsidence, and ISW. Data collected at RMSs are evaluated during annual reporting and periodic evaluations to assess whether groundwater management is avoiding undesirable results and whether refinements to the monitoring network or SMCs are warranted. This routine evaluation of data from the RMSs In addition, these criteria allow for real-time and consistent tracking of groundwater conditions at representative monitoring sites (RMSs) to show progress towards sustainability, provides an early identification of potential problems as they might arise, and allows for timely appropriate decisions to be made regarding additional or modified projects and management actions and projects.

The selected representative monitoring sites are the well set represented by the pumpers that have responded to the call to participate in the GSP. These wells are also part of the preliminary monitoring network, for which historical water level and/or water quality trends are known. Figure 4-1 shows the location of monitoring wells, primarily in the Pauma portion of the USLR with several monitoring wells located in the eastern portion of the Pala Basin. Representative monitoring sites are a subset of the wells in the preliminary monitoring program. These wells were chosen to provide a sufficient distribution throughout the subbasin, have known well construction details, are operational/pumping wells that may be impacted by undesirable results, and have screened intervals representative of alluvial material. Wells were also excluded from representative monitoring sites if there was an issue with historical data and the ability to use it to define sustainability management criteria (e.g., drift in transducer data so that recorded measurements do not represent reality) or the pump setting was below the inferred bedrock surface. The two available monitoring locations in the Pala Portion of the USLR Subbasin (MW-29 and MW-30) did not meet criteria for the selection of representative monitoring sites but will be used to monitor water levels as part of the GSP monitoring program. Table 4-2 summarizes the available well information for the selected monitoring wells.

The current selection of representative monitoring sites (or Key Wells) was used to define undesirable results and other sustainable management criteria for the basin. At the moment, these sites are largely represented by municipal and agricultural supply wells since selection was limited to available information collected or supplied during the GSP development process. It is acknowledged that current sustainability criteria may not be protective of all domestic wells in the basin for which information is largely unavailable. Therefore, additional data will need to be collected following implementation of the GSP to understand where these wells are located, how they operate, and what historical conditions have been in order to determine how beneficial use at these locations can be protected. At the five-year review period, it may be necessary to adjust sustainability management criteria for water levels to accommodate new information about domestic wells and water use to ensure protection of domestic users, including those

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~~in the identified SDAC area and in tribal areas. In addition, RMSs to track sustainability management criteria for GDEs and interconnected surface water reaches may be necessary following verification of groundwater dependency and/or interconnectivity.~~

~~4.2~~4.1 Sustainability Goal (§354.24)

DWR states that "*SGMA requires local agencies to develop and implement GSPs that achieve sustainable groundwater management by implementing projects and management actions intended to ensure that the basin is operated within its sustainable yield by avoiding undesirable results*" (DWR, 2016). As discussed in Section 3.3.5, the sustainable yield is a crucial and fundamental element of GSP development, including for the establishment of ~~sustainable management criteria~~SMCs. The importance of the USLR Valley Groundwater Subbasin sustainable yield is magnified by the fact that groundwater is the sole source of water for some users and provides a significant supply to Subbasin ~~pumpers~~water users.

Results of the historical water balance analysis (from WY 199~~1~~2 through ~~2020~~2025) indicate that the sustainable yield for the USLR Subbasin is approximately 1~~1~~2,~~7~~100 acre-ft/yr. The use of imported water (an average of ~~2,8~~3,100 acre-ft/yr since WY 199~~1~~2 and generally increasing through time) has led, in part, to the recovery of groundwater levels after the 2012 through 2016 drought.

~~4.2.1~~4.1.1 Description of Sustainability Goal

The sustainability goal for the USLR Valley Groundwater Subbasin is to manage and preserve its groundwater resource as a sustainable water supply. To the greatest extent possible, the goal is to preserve historic operations of beneficial use in the Subbasin as well as allow for future planned uses as conceived by the GSA and Subbasin stakeholders. The sustainability goal will be accomplished by achieving the following objectives:

- Operate the USLR Valley Groundwater Subbasin groundwater resource within the sustainable yield.
- Implement projects and management actions to reduce USLR Valley Groundwater Subbasin groundwater demands, increase efficient use of current supplies, maximize use of supplemental water supplies, and mitigate undesirable results.
- Actively monitor the USLR Valley Groundwater Subbasin and adaptively manage projects and management actions to ensure the GSP is effective and that undesirable results are avoided.

Sustainable management involves the use and management of groundwater without causing undesirable results, but it does not necessarily include reversing natural undesirable conditions. Moreover, per SGMA §10727.2(b)(4), a GSP may – but is not required – to address undesirable results that occurred before and have not been corrected by the SGMA benchmark date of January 1, 2015. In the USLR Valley Groundwater Subbasin, no undesirable results are currently present nor have been reported historically. Proposed projects and management actions outlined the GSP (Section 6.0) will further ensure that undesirable results do not occur in the S~~s~~ubbasin going forward.

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4.2.24.1.2 Summary of Sustainable Management Criteria

The approach to assessing sustainability indicators and setting the sustainability criteriaSMCs has been based on:

1) Review of available information from the Plan Area, and Hydrogeologic Conceptual ModelBasin Setting sections of the GSP, andincluding Historic and Current and Historical Groundwater Conditions and Water Budget Information sections of the GSP, and
2) Discussions with Subbasin stakeholders at GSA meetings and public workshops, and
3) Feedback from stakeholders since GSP implementation.

The approach began by qualitatively defining undesirable results based on a simple understanding that an undesirable result is something that cannot be allowed to happen due to potentially unmitigable impact on beneficial use and users. Based on the hydrogeologic conceptual model presented in Section 3.0, seawater intrusion and subsidence are not likely to occur in the USLR Subbasin. Therefore, these two indicators will be discussed only briefly below.

The monitoring of groundwater levels is directly tied to management of the volume of groundwater storage, so sustainability goals for managing groundwater levels are considered with groundwater storage goals. Due to the current lack of streamflow gages in the USLR Valley Groundwater Subbasin, near-river The monitoring of groundwater levels also represent the best available indicator can also be tied to the streamflow in the San Luis Rey River where groundwater levels are shallow enough to create groundwater/surface water interactionsfor ISW. Currently, there is only one active stream gage along the San Luis Rey River within the USLR Subbasin, and it has a very limited record. The gage (installed by DWR) records river stage height but not discharge volumes. Modifications to thisan existing gage and/or installation of at least one additional gage will be necessary to validate a correlation between surface water and groundwater to assess interconnection between surface flow and groundwater. The GSA has also included several other projects and management actions to increase understanding of ISW conditions, as discussed in Section 6.0.

Groundwater quality within the subbasin is generally good, with only a few areas with elevated TDS, or nitrate, and perchlorate. However, while perchlorate concentrations in the Subbasin are generally stable or declining, gradual increases in TDS and nitrate concentrations through time can be observed throughout the Subbasin. In order to monitor these changes and help distinguish between known localized impairment and basin-wide degradation, constituent-specific monitoring networks and SMCs have been establishedHowever, the subbasin will be managed, as a whole, to ensure that ambient basin groundwater quality meets the applicable regulations for groundwater quality.

In addition, even though the USLR Valley Groundwater Subbasin is a low risk for pumping-induced subsidence and Interferometric Synthetic Aperture Radar (InSAR) data has not recorded subsidence between 2016 and 2025, SMCs for land subsidence have been established to avoid significant and unreasonable subsidence caused by groundwater extraction that substantially interferes with land use, surface water conveyance, flood control, drainage, roads, utilities, structures, or other critical infrastructure.

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~~As mentioned previously, the USLR Sustainability Goal has the objective to provide a long-term, reliable, and efficient groundwater supply for agricultural, domestic, municipal, and industrial uses. Undesirable results for the applicable sustainability indicators are discussed in the following sections.~~A summary of the ~~sustainability criteria~~SMCs ~~as~~ relevant to USLR Valley Groundwater Subbasin and as guided by the ~~Sustainability~~ sustainability ~~Goal~~ goal is provided in the table below (note: since seawater intrusion ~~and subsidence are~~is not likely to occur in the USLR Subbasin, ~~these two~~this indicator~~s were~~ was not included). Additional discussion is presented in the following sections for the individual sustainability indicators. The ~~sustainability criteria~~SMCs will provide a means to measure basin management toward sustainable Subbasin conditions. Accordingly, sustainability needs to be achieved either by operating within the current sustainable yield of the ~~groundwater~~ Subbasin or by increasing the sustainable yield through the addition of new water supplies through planned projects.

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Table 4-1. USLR Groundwater Subbasin – Summary of Sustainable Management Criteria

Sustainability Indicator	Undesirable Result	Minimum Threshold	Measurable Objective	Interim Milestone
Groundwater Levels	Groundwater levels significantly below the lowest observed or inferred elevation following the 2012-2016 drought in representative wells. May be indicated when two consecutive exceedances occur in each of two consecutive years, in 25% or more of the RMSs.	Set approximately 5 ft below the lowest observed or inferred elevation following the 2012-2016 drought period to account for measurement uncertainty and/or resolution.	Elevation representing approximately three years of groundwater in storage above MTs (approximately 46,000 acre-ft above MT elevations, which generally corresponds to 50 ft above MTs, depending on location in Subbasin).	Since recent water levels are at or above MOs for water level, IMs have been set at the MO for each RMS.
Groundwater in Storage	Groundwater levels used as a proxy.	Groundwater in storage at MTs for groundwater levels.	Groundwater in storage at MOs for groundwater levels.	Groundwater levels used as a proxy.
Groundwater Quality	When groundwater management activities cause or contribute to significant and unreasonable degradation of groundwater quality that impairs, or substantially threatens to impair, the long-term viability of beneficial uses and users in the Subbasin. May be indicated when average annual concentrations at 25% or more of the RMSs exceed MTs for two consecutive annual monitoring events over at least two years, after confirmation sampling and data review (per constituent).	**TDS:** Average annual concentrations above the upper secondary maximum contaminant level (SMCL) of 1,000 mg/L. **Nitrate**: Average annual concentrations of nitrate (as N) above maximum contaminant levels (MCL) or levels associated with preexisting degraded groundwater in the Subbasin (within the Upper Pauma Nitrate/Perchlorate-Affected Area). **Perchlorate**: Average annual concentrations above historical maximum observed values (within the Upper Pauma Nitrate/Perchlorate-Affected Area), above the MCL of 6 µg/L (downgradient well with observable perchlorate), or concentrations above non-detect (directly downgradient of the affected area).	**TDS:** San Diego Basin Plan Water Quality Objectives. **Nitrate:** MCL. **Perchlorate:** MCL for wells within the Affected Area, non-detect for those without.	Recognizing that the GSA has little, if any, control over water quality drivers in the Subbasin, IMs have been set equal to the MOs for the duration of the implementation period.

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Sustainability Indicator	Undesirable Result	Minimum Threshold	Measurable Objective	Interim Milestone
Interconnected Surface Water	When groundwater pumping in the Subbasin causes a significant and unreasonable reduction in surface water flow, surface water persistence, or shallow groundwater conditions that support beneficial uses and users of surface water. May be indicated when groundwater elevations fall below the ISW proxy MTs for two consecutive monitoring events in each of two consecutive water years (reach specific)	Set approximately 5 ft below the lowest observed or inferred elevation following the 2012-2016 drought period to account for measurement uncertainty and/or resolution.	Elevation representing approximately three years of groundwater in storage.	Since recent water levels are at or above proxy MOs for water level, IMs have been set at the MO for each RMS.
Subsidence	Subsidence caused by groundwater extraction that substantially interferes with land use, surface water conveyance, flood control, drainage, roads, utilities, structures, or other critical infrastructure. May be indicated when confirmed exceedances of the MT occur at two or more RMSs or when a confirmed exceedance at a single RMS causes or is reasonably expected to cause significant and unreasonable impacts to major infrastructure, drainage, flood-control features, or other beneficial uses of the land surface.	0.1 ft of vertical displacement in one year, or 0.2 ft of vertical displacement over five years, based on annual InSAR data.	Zero vertical displacement	Zero vertical displacement
Seawater Intrusion	Not applicable	Not applicable	Not applicable	The absence of seawater intrusion will be verified during periodic evaluations.

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~~Table 4-1. Upper San Luis Rey Groundwater Subbasin – Summary of Sustainable Management Criteria~~

~~Sustainability Indicator~~	~~Undesirable Result~~	~~Minimum Threshold~~	~~Measurable Objective~~	~~Interim Milestone~~
~~Groundwater Levels~~	~~Groundwater levels at the elevation of current pump settings in representative wells (wells with known construction details and historical water level elevations)~~	~~Set at wells by operators as lowest operational level[1]~~	~~Elevation representing 3-years of groundwater in storage (approximately 50 ft above MT elevations)[1]~~	~~IMs for wells with water levels below the MOs will be determined at 5-year reporting after consistent data collection, refinement of groundwater model, and updated analysis of basin storage to evaluate, if appropriate, the quantity of water needed to reach MO elevations~~
~~Groundwater in Storage~~	~~Groundwater in storage when water levels are at the elevation of current pump settings~~	~~Groundwater in storage at MTs for groundwater levels~~	~~3-years of groundwater in storage (approximately 54,000 acre-ft)~~	~~To be determined at 5-year reporting period based on refinement of groundwater model and analysis of basin storage from expanded data collection~~
~~Interconnected Surface Water/ Groundwater~~	~~Groundwater levels fall below the lowest groundwater level since 2015 in identified areas with potentially dependent vegetation~~	~~Lowest groundwater level since 2015 in identified areas with potentially dependent vegetation~~	~~Maintain seasonal groundwater levels since 2015 in identified areas with potentially dependent vegetation~~	~~Based on model-simulated hydrographs, none may be needed. This will need to be confirmed through additional monitoring~~
~~Groundwater Quality~~	~~TDS and Nitrate above Basin Objectives (800 mg/L for TDS, 45 mg/L for Nitrate as NO_3)~~	~~Basin Objectives~~	~~TDS and Nitrate as NO_3 at current ambient concentrations (assumed to be the median of available basin wide concentrations: 607 mg/L for TDS, 25.8 mg/L for Nitrate as NO_3)~~	~~Current TDS and Nitrate concentrations are at the measurable objectives~~
~~Subsidence~~	~~Not applicable~~	~~Not applicable~~	~~Not applicable~~	~~Evidence of or potential for land subsidence will be reevaluated in the 5-year report~~
~~Seawater Intrusion~~	~~Not applicable~~	~~Not applicable~~	~~Not applicable~~	~~The absence of seawater intrusion will be verified in the 5-year report~~

~~4.3 Undesirable Results (§354.26)~~

~~The approach to assessing sustainability indicators and setting the sustainability criteria has been based on:~~

~~1) Review of available information from the Plan Area, Hydrogeologic Conceptual Model, and Historic and Current Groundwater Conditions and Water Budget sections of the GSP, and~~

~~2) Discussions with basin stakeholders at GSA meetings and public workshops.~~

~~The approach began by qualitatively defining undesirable results based on a simple understanding that an undesirable result is something that cannot be allowed to happen due to potentially unmitigable impact on beneficial use and users. Based on the hydrogeologic conceptual model presented in~~

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~~Section 3.0, seawater intrusion and subsidence are not likely to occur in the USLR Subbasin. Therefore, these two indicators will be discussed only briefly below.~~

~~The monitoring of groundwater levels is directly tied to management of the volume of groundwater storage, so sustainability goals for managing groundwater levels are considered with groundwater storage goals. The monitoring of groundwater levels can also be tied to the streamflow in the San Luis Rey River where groundwater levels are shallow enough to create groundwater/surface water interactions. Currently, there is only one active stream gage along the San Luis Rey River within the USLR Subbasin, and it has a very limited record. The gage (installed by DWR) records river stage height but not discharge volumes. Modifications to this gage and installation of at least one additional gage will be necessary to validate a correlation between surface water and groundwater to assess interconnection between surface flow and groundwater.~~

~~Groundwater quality within the subbasin is generally good, with only a few areas with elevated TDS or nitrate. However, the subbasin will be managed, as a whole, to ensure that ambient basin groundwater quality meets the applicable regulations for groundwater quality.~~

~~As mentioned previously, the USLR Sustainability Goal has the objective to provide a long-term, reliable, and efficient groundwater supply for agricultural, domestic, municipal, and industrial uses. Undesirable results for the applicable sustainability indicators are discussed in the following sections.~~

4.44.2 Chronic Lowering of Groundwater Levels (§354.26(a),(b),(c))

Chronic lowering of groundwater levels can indicate significant and unreasonable depletion of supply, causing undesirable results to domestic, agricultural, or municipal groundwater users if continued over the planning and implementation horizon. As a clarification, drought-related groundwater level declines are not considered chronic if groundwater recharge and discharge are managed such that groundwater levels recover during non-drought periods. Declining groundwater levels directly relate to other potential undesirable effects as well (e.g., groundwater storage and ~~interconnected surface water~~ISW). These effects are described in subsequent sections. Effects on well users are described here.

As stated in Section 3.0, USLR Subbasin groundwater levels fluctuate seasonally due to the availability of rainfall for aquifer recharge. ~~2020~~ 2025 groundwater elevations ranged from ~~2,7~~1,600 ft amsl in the uppermost reaches of the groundwater Subbasin to 250 ft amsl at the downstream end of the USLR Subbasin near the Monserate Narrows (see Figure 3-~~12~~13). Gradients are steep along the flanks of the Valley (approximately 0.~~07~~06 ft/ft) and much flatter along the axis of the valley (approximately 0.01 ft/ft to 0.~~008~~003 ft/ft~~.~~).

Review of the hydrographs provided on Figures 3-~~14~~15 and 3-~~15~~16 indicates that groundwater elevations in Pauma Valley wells have had a generally downward trend from the 1990s, with historically low groundwater elevations during the 2012 to 2016 drought. Groundwater levels have generally increased since 2016~~ but have not recovered everywhere to pre-drought conditions~~. In wells for which longer-term water level data is available, water levels are at or approaching 1990 levels. Sustainability will be achieved when the seasonal range of groundwater changes remains within a range of elevations that will have no long-term negative impacts on Subbasin pumpers and remain within the sustainable yield through balanced recharge and extractions. ~~Hydrographs~~ The few hydrographs available in the Pala Valley (Figure

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3-~~15~~16) indicate that groundwater levels have generally been more consistent, particularly in the downgradient portions of the USLR Valley Groundwater Subbasin.

4.2.1 Representative Monitoring Sites

The selected RMSs for groundwater levels are largely represented by the pumpers that have responded to the call to participate in the GSP. These wells are summarized in Table 4-2 below while Figure 4-1 shows the location of groundwater level monitoring points and RMSs (see Section 5.2.1 for additional information about the water level monitoring network). The majority of these are located in the Pauma portion of the USLR Valley Groundwater Subbasin, with a few monitoring wells located in the Pala Subbasin, on either side of the Pala Reservation. RMSs are a subset of the wells in the groundwater level monitoring network. These wells were chosen to provide a sufficient distribution throughout the subbasin and have known well construction details. Wells screened within the alluvial material were prioritized during the selection of RMSs, but the availability of wells to monitor limited the ability to do this in certain areas of the Subbasin. Wells were also excluded from RMSs if there was an issue with historical data and the ability to use it to define SMCs (e.g., drift in transducer data so that recorded measurements do not represent reality, unexplained trends or shifts in data inconsistent with surrounding measurements).

The current selection of RMSs was used to define undesirable results and other SMCs for groundwater level. At the moment, these sites are largely represented by municipal and agricultural supply wells since selection was limited to available information collected or supplied during the GSP development and implementation process. The updated and recalibrated USLR Groundwater Model was used to verify that proposed MTs did not adversely affect other nearby wells, especially domestic wells, as discussed in the following section. Overall, the analysis of potential well impacts indicated that the MTs presented below will prevent extensive depletion of supply. However, data are still limited in areas of the Subbasin – particularly related to domestic wells and verified well information. The GSA will continue to request information from Subbasin stakeholders, including well location, operational data, and historical or current water level conditions in order to improve the understanding of pumping and water use in the Subbasin and to determine how beneficial use at these locations can be protected. Water level SMCs will be reevaluated at the next periodic evaluation and adjusted as necessary, to accommodate new information about domestic wells and water use to ensure protection of domestic users, including those in the identified SDAC area and in tribal areas.

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Table 4-2. Water Level RMS Summary

GSP Well ID	Subbasin	MT [ft amsl]	MO [ft amsl]	IM [ft amsl]
MW-5	Pauma	757	807	807
MW-9	Pauma	661	711	711
MW-10	Pauma	656	706	706
MW-12	Pauma	622	672	672
MW-13	Pauma	593	643	643
MW-19	Pauma	549	609	609
MW-23	Pauma	577	627	627
MW-25	Pauma	521	570	570
MW-34	Pauma	903	953	953
MW-35	Pauma	670	720	720
MW-37	Pauma	560	610	610
MW-41	Pauma	530	580	580
MW-42	Pala	439	465	465
MW-43	Pala	270	273	273

~~4.4.1~~4.2.2 Undesirable Results (§354.26)

~~Accordingly, t~~The definition of undesirable results for ~~would be~~ the chronic lowering of groundwater levels would be observed groundwater elevation trends~~,~~ indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. In particular, undesirable results ~~with respect to groundwater elevations are those~~may occur at groundwater elevations that ~~will~~ have a negative impact on Subbasin pumpers, such as groundwater elevations falling significantly below the lowest observed or inferred elevation following the 2012-2016 drought in representative wells, which is the historical period during which there were concerns about being able to continue pumping in certain wells and that irrigation schedules and pumping operations had to be modified in response to low water levels~~below a depth where well pumps become non-operational, or the well can no longer produce the volume of water required to meet the demand of the pumper~~.

~~4.4.1.1~~4.2.2.1 Potential Causes of Undesirable Results

Groundwater levels ~~has~~ generally declined since the 1990s and reached historical lows around October 2016 for the period of record. This period coincided with the most severe recent dry period consisting of

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a below normal year in 2012, critical years in 2013 and 2014, and below normal years in 2015 and 2016 (refer to Figure 3-2). Water levels were fairly flat during the drought period and have recovered well since then~~with periods of recovery beginning in 2004 and 2011~~. Review of historical groundwater hydrographs~~contours~~ indicates that groundwater levels in wells ~~have~~ declined to elevations below the top of well screens of some Subbasin pumpers, especially during the 2016 drought, but, for the most part, have not resulted in the inability to run the wells. At times, the seasonal or annual lowering of groundwater levels in the past has necessitated agricultural users to purchase water for irrigation. Nevertheless, without implementation of sustainability goals to maintain Subbasin operation within sustainable limits (i.e., pumping in excess of sustainable yield), undesirable results could occur in the future.

~~4.4.1.2~~4.2.2.2 Potential Effects on Beneficial Uses and Users

Groundwater is a significant source of supply in the Plan Area and supplies wells for agricultural, municipal, industrial, and domestic beneficial uses. Groundwater has been and is being used for a range of beneficial uses, even during drought, and with reasonable operation and maintenance by well owners. Undesirable results in regard to groundwater elevations include the lowering of groundwater levels to a depth where the wells cannot be operated. Significant lowering of groundwater levels can require lowering of pumps and increased energy costs from the additional hydraulic lift. However, the USLR Subbasin is a shallow groundwater basin with generally short well screens and pump settings within the principal alluvial aquifer. Maintaining groundwater levels at the appropriate elevations so as to not result in well production reductions of the required supply, approximately represented by historically low levels during the 2016 drought, will eliminate the need to change pump settings in the future.

4.2.3 Minimum Thresholds (§354.28)

According to GSP Regulations Section 354.28(c), the MT for chronic lowering of groundwater levels must be the groundwater elevation indicating depletion of supply at a given location that may lead to undesirable results. MTs for chronic lowering of groundwater levels are to be supported by information on the rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the Subbasin. In the USLR Subbasin, the MT relative to the chronic lowering of groundwater levels is defined at designated RMSs by historical groundwater levels.

The general approach to defining sustainability criteria (MTs and MOs) for groundwater levels has involved the evaluation of historical and model-calculated groundwater elevations through time relative to hydrologic conditions. As mentioned in Section 4.2.1, the RMSs for evaluating SMCs related to groundwater levels include a collection of wells including municipal, private, and agricultural pumpers. The majority of these wells are in the Pauma Valley portion of the USLR Valley Groundwater Subbasin because availability of monitoring locations and the increased participation of stakeholders in this area. Water level information is limited to that provided during stakeholder data request periods while well information has been collected from available databases, including DWR's Online System for Well Completion Reports (OSWCR) and USGS Water Data for the Nation (WDFN).

Groundwater surface elevations for MTs were selected based on the observed and interpreted historical groundwater elevations during the recent drought from 2012 through 2016, since this condition reflects

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a recent, sustained dry period stress in which groundwater levels approached historical lows and pumping operations were affected, but no verified dry-well reports were received by the GSA. To account for measurement uncertainty and measurement frequency, including the possibility that the lowest water level was missed by manual readings and uncertainty associated with projecting water levels backward using the groundwater flow model when historical levels were unavailable, a buffer of approximately five feet was used below the historical observed minimum elevation. Groundwater levels falling below the selected MTs may represent an undesirable result at the specific well location.

Due to the lack of well information and low resolution of groundwater elevation conditions in general (except around wells with observed measurements – primarily in Pauma Subbasin), the USLR Groundwater Model was used to verify that proposed MTs would not adversely affect other wells in the Subbasin, especially domestic wells. This analysis of potential well impacts, which is included as Appendix 4a, compares simulated groundwater elevations in October 2016, representing low (Fall) groundwater elevations following the 2012 through 2016 drought, to available well construction information (i.e., screened intervals and total depths) for wells throughout the Pauma and Pala Subbasins. This water level roughly coincides with predicted groundwater conditions when water levels in RMS wells would be nearing or crossing selected MTs. Overall, the analysis of potential well impacts indicates that revised MTs based on Fall 2016 conditions will prevent extensive depletion of supply (over 83% of wells have low apparent vulnerability of becoming dry). Of the 265 wells evaluated, approximately 13% were predicted to be potentially dry. However, the majority of these wells have locational uncertainty related to actual well location (72% of these wells are located by centroid of section) and/or model accuracy. Of the private or domestic wells with potential impacts, all but one are located within a public water supplier service area and are able to receive alternative water supply. The one outside service area coverage is located in the along the northeast boundary of Pala Subbasin. The uncertainty in predicted potentially dry wells is further demonstrated by the fact that no verified dry well reports were received by the GSA relative to the 2012 through 2016 dry period. While the USLRGMA recognizes that the absence of reported impacts does not eliminate the potential for impacts to private or undocumented wells, the results are used to identify potential problem areas for the development of adaptive management responses for the potential for groundwater levels to approach the Fall 2016 condition after a future drought period. Review and modification of MTs, or the addition of supplemental RMSs in different areas of the Subbasin, may be required in future periodic updates to ensure beneficial use for all groundwater pumpers, including domestic, SDAC, and tribal users.

MTs for the RMSs are summarized in Table 4-2. The MT elevations are shown in relationship to historical groundwater levels and known well screen intervals for each well on Figures 4-2 and 4-3. Undesirable results for groundwater level may be indicated when two consecutive exceedances (i.e., spring and fall or fall and spring) occur in each of two consecutive years, in 25 percent or more of the RMSs.

~~4.4.2~~4.2.4 Measurable Objectives (§354.30)

MOs for the chronic lowering of groundwater levels are defined as an operating range of groundwater levels allowing reasonable fluctuation with changing hydrologic conditions. The MTs represent the bottom of the operating range and are protective of Subbasin pumpers while the MOs for groundwater levels are also subject to the need of each Subbasin pumper. The MO for the USLR Subbasin is set at a groundwater

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elevation that coincides with approximately three years of operational storage for the Subbasin. The calibrated USLR Groundwater Model was used to calculate these elevations at the identified RMSs, which are summarized in Table 4-2. In general, this corresponds to approximately 50 ft of groundwater elevation over MTs for the majority of RMSs, though this elevation becomes lower downgradient.

Three years of groundwater storage is equivalent to approximately 46,000 acre-ft, which considers current average annual groundwater pumping (from WY 2021 through 2025) of approximately 10,900 acre-ft/yr and imported water use of approximately 4,400 acre-ft/yr (refer to Section 3.3.5.6 for current water budgets). This value is conservative because it allows three years of groundwater reserves to meet water demand, even though much of that demand is currently satisfied through imported water. Therefore, this approach for defining MOs against the lowering of groundwater levels (as well as groundwater storage) also allows protection against periods of prolonged drought or below average precipitation years.

Groundwater levels in all but two of the RMSs are above MOs, based on current (Fall 2025) groundwater conditions. The two wells below MOs, MW-23 and MW-42, are generally located near the Pauma/Pala boundary. Based on projected water budgets and assuming a continuation of water use conditions in the Subbasin, the long-term change in storage is approximately 30 acre-ft/yr (essentially no change). However, in any individual dry year or sequence of wet years, the change in storage can be two to three orders of magnitude higher or lower.

4.2.5 Interim Milestones

SGMA requires GSPs to establish IMs in five-year increments as part of the reasonable path toward achieving the Subbasin sustainability goal within 20 years of Plan implementation. An IM represents a target groundwater condition rather than a threshold defining an undesirable result; MTs continue to define the groundwater conditions used to evaluate the potential occurrence of undesirable results, as discussed in Section 4.2.3 above. IMs for groundwater level have been established at each RMS to provide quantitative five-year benchmarks consistent with SGMA requirements. As of Fall 2025, groundwater elevations at 12 of the 14 RMSs were already above their respective MOs. Therefore, Subbasin conditions are generally at or better than the groundwater level conditions established as the desired long-term target under the GSP, rather than at conditions requiring a gradual progression from the MT toward the MO.

Accordingly, the groundwater level IM for each RMS is established equal to its respective MO for each five-year milestone through the sustainability horizon. Establishing IMs at the MOs is appropriate because there is no technical basis for establishing intermediate target elevations below the MOs when current groundwater conditions already meet the MOs at most RMSs. For the two RMSs currently below their MOs, setting the IM equal to the MO establishes a clear target for attaining the desired groundwater condition rather than allowing a lower interim condition solely to create a staged trajectory. This approach is consistent with the USLRGMA's adaptive management strategy and recognizes the substantial seasonal and interannual variability in groundwater elevations within the Subbasin. Groundwater levels may periodically decline below an MO during dry hydrologic periods without constituting an undesirable result, provided that groundwater levels remain above applicable MTs and basin-wide undesirable result criteria are not met. The IMs therefore provide benchmarks for evaluating whether groundwater conditions are

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being maintained at, or progressing toward, the desired long-term condition while retaining the operational flexibility incorporated into the groundwater level SMC framework.Reduction of Groundwater in Storage

Groundwater in storage is the volume of groundwater in the basin that is available for groundwater production. In the USLR Subbasin, groundwater in storage is water that is within the pore spaces of alluvial aquifer that lies above the bedrock surface and below the phreatic surface (water table). Undesirable results are defined with respect to the Sustainability Goal for the USLR Subbasin which includes an objective to provide reliable storage for water supply resilience during droughts and shortages. As such, the definition of potential undesirable results for storage reduction would be the inability of the groundwater basin to meet water supply demands during drought periods and includes consideration of how much storage has historically been in the basin (i.e., operating storage) and how much stored groundwater reserve is needed to withstand drought. To date, the basin has not reached a point considered to be reflective of undesirable results. While groundwater levels in some basin wells have fallen below the top of screen elevations, basin pumpers have reported that the wells have continued to operate and supply the requisite volume of water to maintain operations.

The USLR is a shallow groundwater basin with limited storage. Therefore, additional deeper storage is not available to sustain pumping during drought periods. Based on historical and current pumping and groundwater trends, managing groundwater levels in the future above the MTs will result in an appropriate amount of groundwater in reserve. If future operations from any of the basin pumpers include increasing pumping volumes or new extractions are planned, the current analysis will require revisiting and additional supplies or reductions elsewhere may be required. Basin management should include recommendations to reduce groundwater production during drought years in order to aid the maintenance of groundwater levels above MTs.

4.4.2.10.1.1.1 Potential Causes of Undesirable Results

As with a chronic lowering of groundwater levels, undesirable results with respect the groundwater in storage can be the result of sustained groundwater extraction in excess of the long-term sustainable yield. In addition, a portion of applied water (contributing to groundwater return flow) currently comes from the direct delivery of imported water. The return flow from this applied, imported surface water contributes to the water budget and meets a portion of the water demand in the basin. If the imported water supply is reduced or disrupted, continued pumping could further reduce groundwater in storage. The planned reserves discussed above do not consider the use of imported water or other sources of groundwater recharge during a three-year drought.

4.4.2.20.1.1.1 Potential Effects on Beneficial Uses and Users

Groundwater is a significant source of supply for basin pumpers, primarily for agriculture. Reduction of groundwater in storage would reduce access to supply with adverse effects on the community, economy, and environmental setting of portions of the USLR which are reliant on groundwater. Groundwater has historically been available during droughts.

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~~4.4.3 Seawater Intrusion~~

~~Given the distance of the downgradient boundary from the ocean, seawater intrusion is not of concern for the USLR Groundwater Subbasin. In addition, while seawater intrusion has historically occurred in the downgradient Lower San Luis Rey Groundwater Subbasin, minimum threshold groundwater elevations designed to maintain a seaward groundwater gradient are currently being implemented in the Mission Subbasin to protect inland areas from further seawater intrusion (see Section 2.4.1). Therefore, seawater intrusion as a sustainability indicator is not applicable to the USLR Groundwater Subbasin and no sustainability management criteria were developed. The absence of seawater intrusion will be verified in the five-year report.~~

~~4.5 Minimum Thresholds (§354.28)~~

~~4.5.1 Chronic Lowering of Groundwater Levels~~

~~According to GSP Regulations Section 354.28(c), the MT for chronic lowering of groundwater levels must be the groundwater elevation indicating depletion of supply at a given location that may lead to undesirable results. MTs for chronic lowering of groundwater levels are to be supported by information on the rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the basin. In the USLR Subbasin, the MT relative to the chronic lowering of groundwater levels is defined at designated Key Wells by historical groundwater water levels and the elevation of the top of the well screens for the known basin pumpers.~~

~~The general approach to defining sustainability criteria (MTs and MOs) for groundwater levels has involved the development of a groundwater elevation surface constructed from monitoring well sites in the basin. As mentioned in Section 4.1.1, the representative monitoring sites for evaluating sustainability criteria related to groundwater levels include a collection of wells including municipal, private, and agricultural pumpers. Well information was limited to that provided during the stakeholder data request period.~~

~~Groundwater surface elevations were selected by individual basin pumpers who have elected to participate in the GSP process. The pumpers who are participating in the GSP process represents groundwater extractions almost exclusively in the Pauma Valley portion of the USLR Groundwater Subbasin. Pumpers provided the minimum depth for each of their wells to operate successfully based on their past experiences during drought conditions. This approach is founded on the idea that undesirable results – whether reported or not – should not be allowed to occur in the future. Therefore, MTs and MOs at reported active wells were developed to avoid reaching the point of an undesirable result in the individual wells. Groundwater levels falling below the selected MTs represent an undesirable result at the specific well location. Due to the lack of well information and low resolution of groundwater elevation conditions in general (except around wells with observed measurements – primarily in Pauma Subbasin), a spatial analysis of MTs and water level impacts on all basin wells and groundwater users in the subbasin was not possible. Review and modification of MTs, or the addition of supplemental representative monitoring sites in different areas of the subbasin, may be required in future 5-year updates to ensure beneficial use for all groundwater pumpers, including domestic, SDAC, and tribal users. Undesirable~~

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~~results are indicated when two consecutive exceedances occur in each of two consecutive years, in 25 percent or more of the Key Wells.~~

~~MTs for the representative monitoring sites are summarized in Table 4-3. These correspond to the minimum operational groundwater levels provided by participating basin pumpers. The MTs are lower than historical lowest groundwater levels and are based upon the minimum level that would continue to allow production from each well. The MT elevations are shown in relationship to historical groundwater levels and known well screen intervals for each well on Figures 4-2 and 4-3. In all cases, the MT elevation is at least five feet above the current pump settings in each of the wells.~~

4.3 Reduction of Groundwater in Storage

Groundwater in storage is the volume of groundwater in the basin that is available for groundwater production. In the USLR Subbasin, groundwater in storage is water that is within the pore spaces of alluvial aquifer that lies above the bedrock surface and below the phreatic surface (water table). The amount of groundwater in storage is evaluated based on groundwater elevations and aquifer parameters. As such, water levels are used as a proxy for the evaluation of the reduction of groundwater in storage. ~~Undesirable results are defined with respect to the Sustainability Goal for the USLR Subbasin which includes an objective to provide reliable storage for water supply resilience during droughts and shortages. As such, the definition of potential undesirable results for storage reduction would be the inability of the groundwater basin to meet water supply demands during drought periods and includes consideration of how much storage has historically been in the basin (i.e., operating storage) and how much stored groundwater reserve is needed to withstand drought. To date, the basin has not reached a point considered to be reflective of undesirable results. While groundwater levels in some basin wells have fallen below the top of screen elevations, basin pumpers have reported that the wells have continued to operate and supply the requisite volume of water to maintain operations.~~

~~The USLR is a shallow groundwater basin with limited storage. Therefore, additional deeper storage is not available to sustain pumping during drought periods. Based on historical and current pumping and groundwater trends, managing groundwater levels in the future above the MTs will result in an appropriate amount of groundwater in reserve. If future operations from any of the basin pumpers include increasing pumping volumes or new extractions are planned, the current analysis will require revisiting and additional supplies or reductions elsewhere may be required. Basin management should include recommendations to reduce groundwater production during drought years in order to aid the maintenance of groundwater levels above MTs.~~

The USLR is a shallow groundwater basin with limited storage. Therefore, additional deeper storage is generally not available to sustain pumping during drought periods, though some wells do produce from fractured rock underlying the Subbasin. This has been accounted for in the updated and recalibrated (2027 version) of the USLR Groundwater Model. Based on historical and current pumping and groundwater trends, managing groundwater levels in the future above the MTs should result in an appropriate amount of groundwater in reserve. If future operations from any of the Subbasin pumpers include increasing pumping volumes or new extractions are planned, the current analysis will require revisiting and additional supplies or reductions elsewhere may be required. Basin management should include

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recommendations to reduce groundwater production during drought years in order to aid the maintenance of groundwater levels, and therefore groundwater storage, above MTs.

4.3.1 Representative Monitoring Sites

Groundwater in storage conditions are evaluated at the same RMS wells used to monitor groundwater levels.

4.3.2 Undesirable Results (§354.26)

Undesirable results are defined with respect to the sustainability goal for the USLR Subbasin which includes an objective to provide reliable storage for water supply resilience during droughts and shortages. As such, the definition of potential undesirable results for storage reduction would be the inability of the groundwater Subbasin to meet water supply demands during drought periods and includes consideration of how much storage has historically been in the Subbasin (i.e., operating storage) and how much stored groundwater reserve is needed to withstand drought. To date, the Subbasin has not reached a point considered to be reflective of undesirable results. While groundwater levels in some basin wells have approached MTs and fallen below the top of screen elevations, Subbasin pumpers have reported that the wells have continued to operate and supply the requisite volume of water to maintain operations.

Undesirable results for the reduction in groundwater in storage are defined by the same exceedance criteria set for the chronic lowering of groundwater levels (Section 4.2.2).

4.3.2.1 Potential Causes of Undesirable Results

As with a chronic lowering of groundwater levels, undesirable results with respect the groundwater in storage can be the result of sustained groundwater extraction in excess of the long-term sustainable yield. In addition, a portion of applied water (contributing to groundwater return flow) currently comes from the direct delivery of imported water. The return flow from this applied, imported surface water contributes to the water budget and meets a portion of the water demand in the Subbasin. If the imported water supply is reduced or disrupted, continued pumping could further reduce groundwater in storage. The planned reserves discussed above do not consider the use of imported water or other sources of groundwater recharge during a three-year drought.

4.3.2.2 Potential Effects on Beneficial Uses and Users

Groundwater is a significant source of supply for Subbasin pumpers, primarily for agriculture. Reduction of groundwater in storage would reduce access to supply with adverse effects on the community, economy, and environmental setting of portions of the USLR Subbasin which are reliant on groundwater. Groundwater has historically been available during droughts.

4.3.3 Minimum Thresholds (§354.28)

SGMA guidance documents do not recommend a specific requirement for groundwater in storage. Considerations offered by the "Draft Best Management Practices for Sustainable Management of

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Groundwater - Sustainable Management Criteria BMP" when establishing the MT for groundwater storage may include, but are not limited to:

- What are the historical trends, water year types, and projected water use in the basin?
- What groundwater reserves are needed to withstand future droughts?
- Have production wells ever gone dry?
- What is the effective storage of the basin? This may include understanding of the:
  - Average, minimum, and maximum depth of municipal, agricultural, and domestic wells.
  - Impacts on pumping costs (i.e., energy cost to lift water).
- What are the adjacent basin's minimum thresholds?

~~Undesirable results would involve insufficient stored water to sustain beneficial uses through drought periods. The storage criterion is directly linked to groundwater levels and is evaluated as a volume on a basin-wide basis. Therefore, the MT for groundwater storage is fulfilled by using the MT for groundwater levels as a proxy.~~

The general approach for defining ~~sustainability criteria~~SMCs for groundwater in storage ~~has~~ involved review of historical cumulative change in storage and expected future storage declines during droughts. Review of historical change in storage indicates that an average decline in groundwater storage of 1,~~520~~920 ~~-~~acre-ft/yr has occurred between WY 199~~21~~ and 202~~50~~. During the 2012 through 2016 period (representing the most recent drought period), declines in groundwater storage averaged ~~6~~5,~~328~~10 acre-ft/yr. Historically, groundwater has been available even when groundwater levels reached historical low elevations. Management of groundwater levels above the groundwater level MTs will result in sufficient groundwater in storage to meet historical demands. Reduction of pumping or limited new production, in addition ~~of supplies~~to the continued use of imported water to balance the water budget will further ensure a reliable water supply for Subbasin pumpers.

Undesirable results would involve insufficient stored water to sustain beneficial uses through drought periods. The storage criterion is directly linked to groundwater levels and is evaluated as a volume on a basin-wide basis. Therefore, the MT for groundwater storage is fulfilled by using the MT for groundwater levels as a proxy. Undesirable results may be indicated when two consecutive exceedances occur in each of two consecutive years, in 25 percent or more of the RMSs.

4.3.4 Measurable Objectives (§354.30)

Since the sustainability indicator for groundwater in storage addresses the ability of the groundwater Subbasin to support existing and planned beneficial uses of groundwater, recent drought conditions were considered when establishing ~~sustainability management criteria~~SMCs for groundwater levels and groundwater storage. Figure 3-2 shows the rainfall record from 1943 through 202~~0~~5 at Lake Henshaw. The chart includes a cumulative departure line which indicates generally hydrologic conditions: a downward trend represents dry conditions while an~~d~~ upward trend represents wet conditions. The average rainfall for the historical water budget base period (WY 199~~1~~2-202~~50~~) is similar ~~slightly higher than~~to the long-term average rainfall (24.53 inches versus 24.33 inches). However, during the most recent extended drought (2012-2016), pumping has continued in the groundwater Subbasin.

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Pauma hydrographs with records during the most recent drought (see Figure 3-145) show a steady decline through the end of 2016. In some of the wells in the upper Pauma Subbasin, these depressed water levels extend out to 2020. However, with increased rainfall of Water YearsWYs 2017, 20189, 2020, and 201923, Subbasin water levels show recovery, approaching or surpassing (albeit not necessarily to the pre-five-yearpre drought levels in wells with longer-term records). A portion of the groundwater level recovery is also attributed to availability of imported water to augment groundwater pumping. Groundwater level data for the Pala Subbasin within the USLR is very limited. Two wells (WG-1/09S01W31L located at the upstream portion of Pala Subbasin and 10S02W06F02 located in the downstream portion of Pala Subbasin) have water level records spanning the 2012-2016 drought (see Figure 3-156). The data show that groundwater levels remained essentially stable, suggesting that pumping in the Pauma Subbasin was less than the decrease in inflow to this portion of the subbasin during the drought.

Planning for Urban Water Management Plans requires an assessment of available water supplies for a normal, single dry, and five-year drought period. For planning purposes, as selected by Subbasin stakeholders, considered herein is a groundwater reserve for a three-year dry period. The approach taken was to determine the groundwater elevation which represents a three-year supply (approximately 4654,000 acre-ft) above the elevation of the MTs at selected wells (see Table 4-32). The MO for storage is also fulfilled by the MO for groundwater levels, which maintains groundwater levels within the operating range to protect operations of municipal, agricultural, and domestic wells in the Subbasin and provide for a minimum three-year supply of groundwater.

The MO elevation for groundwater levels was set at an elevation which conservatively represents the volume of a 3-year reserve between the MO elevation and the MT elevation. The 3-year reserve volume does not consider annual inflow to the Subbasin that will occur even during drought periods, or the availability of imported water, so it is very conservative.

4.3.5 Interim Milestones

Since sustainable management criteria for groundwater levels are being used as a proxy for groundwater storage, the interim milestonesIMs would be those discussed above in Section 4.2.5.

4.64.4 Degradation of Water Quality

Degraded water quality can impair water supply and affect human health and the environment. Impacts to drinking water supply wells can result in increased sampling and monitoring, increased treatment cost, use of bottled water, negative impacts on agriculture, and the loss of wells. The GSA's role under SGMA is to manage groundwater conditions so that GSA actions and groundwater management do not cause significant and unreasonable degradation of groundwater quality or migration of degraded groundwater that impairs beneficial uses and users.

An overview of groundwater quality in the USLR Subbasin is provided in Section 3.3.4.3. The main constituents of concern for degraded groundwater quality are TDS, nitrate, and perchlorate. Current ambient for total dissolved solids (TDS) and nitrate (as NO_3) – two important indicators of groundwater quality – in Pauma Subbasin is approximately 607 mg/L and 25.8 mg/L, respectively. Figures 3-17 and 3-

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18 show historical and current water quality measurements for TDS, ~~while~~ Figures 3-19 and 3-20 show historical and current water quality measurements for ~~N~~nitrate (as N), and Figures 3-22 and 3-23 show historical and current water quality measurements for perchlorate. Given the restricted amount of water quality data available in the Subbasin (both spatially and temporally and particularly in Pala Subbasin), the additional data collection efforts and analyses at the identified RMSs will improve understanding and help better characterize groundwater quality throughout the USLR Valley Groundwater Subbasin. Ongoing annual assessments of water quality through the GSP implementation and incorporation of additional RMSs, as needed and as available to better protect domestic and tribal users and provide coverage in remaining data gap areas, will help evaluate conditions and identify potential trends towards undesirable results.

The SMC framework is based primarily on applicable drinking water regulations and San Diego Basin Plan water quality objectives. However, the framework also recognizes that portions of the Subbasin contain existing or legacy (pre-2015) water quality impairment. In these areas, continued exceedance of a drinking water benchmark in an already affected well is not, by itself, interpreted as a potential new SGMA undesirable result. Instead, already affected wells are evaluated using site-specific degradation thresholds and sentinel monitoring to determine whether conditions are materially worsening or whether affected groundwater is migrating into areas where water quality is currently less affected. Specifically, an area of increased nitrate and perchlorate concentrations representing preexisting conditions was identified in the Pauma Subbasin, referred to as the Upper Pauma Nitrate/Perchlorate-Affected Area (refer to Section 3.3.4.3.2). This affected area is not established as a separate SGMA management area under 23 CCR § 354.20. Rather, it is a technical evaluation and SMC accounting area used to distinguish known localized groundwater quality impairment from basin-wide degradation.

Groundwater quality in the Subbasin is influenced by historical and ongoing land uses, imported water quality, septic system loading, agricultural practices, evapoconcentration, and reduced natural recharge associated with surface water diversions outside the direct control of the GSA. The water quality SMCs are therefore intended to identify and respond to significant and unreasonable degradation associated with groundwater conditions managed under the GSP. They are not intended to establish a regulatory cleanup program, supersede the authority of the State Water Resources Control Board's (Water Board's) Division of Drinking Water (DDW), San Diego County (County) Environmental Health, or other regulatory agencies, or require the GSA to remediate water quality impacts caused by historical land use, ongoing permitted activities, septic systems, imported water quality, or other sources outside the GSA's authorities.~~There were insufficient data to characterize ambient groundwater quality in Pala Subbasin.~~

4.4.1 Representative Monitoring Sites

The water quality RMS network is shown in Figure 4-4 and summarized in Table 4-3 below. Additional details regarding the monitoring network are provided in Section 5.2 below. The RMS wells primarily represent active public supply wells completed in the principal alluvial aquifer and subject to existing drinking water monitoring obligations. DDW-reported TDS, nitrate, and perchlorate data from these wells will be used when available. Supplemental GSP sampling will be conducted, as needed, during the fall monitoring event when DDW data are not available for a given year, when a required constituent is not

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included in DDW reporting, or when confirmation, follow-up, or sentinel monitoring is needed following an exceedance or management trigger.

Table 4-34. Summary Water Quality RMS Summary

GSP Well ID	Subbasin	TDS			Nitrate			Perchlorate		
		MT [mg/L]	MO [mg/L]	IM [mg/L]	MT [mg/L]	MO [mg/L]	IM [mg/L]	MT [µg/L]	MO [µg/L]	IM [µg/L]
MW-5*	Pauma	1,000	800	800	39	10	10	7.1	6.0	6.0
MW-7	Pauma	1,000	800	800	10	10	10	-	-	-
MW-8	Pauma	1,000	800	800	10	10	10	-	-	-
MW-11	Pauma	1,000	800	800	10	10	10	-	-	-
MW-19	Pauma	1,000	800	800	10	10	10	-	-	-
MW-25	Pauma	1,000	800	800	10	10	10	6.0	ND	ND
MW-30	Pala	1,000	900	900	10	10	10	-	-	-
MW-31	Pauma	1,000	800	800	10	10	10	ND	ND	ND
MW-34*	Pauma	1,000	800	800	28	10	10	7.9	6.0	6.0
MW-35	Pauma	1,000	800	800	10	10	10	ND	ND	ND
MW-37	Pauma	1,000	800	800	10	10	10	-	-	-
MW-38	Pauma	1,000	800	800	10	10	10	-	-	-
MW-41	Pauma	1,000	800	800	10	10	10	-	-	-
MW-43	Pala	TBD[1]	900	900	TBD[1]	10	10	-	-	-

Notes:
ND = Non-detect
* Well is located within the Upper Pauma Nitrate/Perchlorate-Affected Area
[1] No recent water quality data is available in the vicinity of this well. Therefore, data collected during future monitoring will be used to evaluate TDS conditions and set an appropriate MT.

4.4.2 Undesirable Results (§354.26)

Undesirable Results are defined in the GSP Regulations (§354.26) as occurring when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the Subbasin. The GSA is not responsible for local problems or degradation caused by others. At present, there are no sites under regulatory clean-up within the Subbasin. Undesirable results then are defined aswhen groundwater management activities cause or contribute to significant and unreasonable degradation of groundwater quality that impairs, or substantially threatens to impair,

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~~the long-term viability of beneficial uses and users in the Subbasin. the degradation of groundwater from current ambient conditions, taken to the be the median concentration of average water quality in wells with at least three water quality readings from 2015 through 2020 (see Section 3.3.4.3). The sustainability goal of maintaining water quality applies to specific well locations as well but tracking trends in ambient basin water quality will allow for an evaluation of general water quality throughout the USLR Subbasin.~~

For the decision to set SMCs for water quality, SGMA poses two basic questions:

- Were or are undesirable results occurring due to conditions that predate the SGMA baseline of January 2015? and
- Is there a potential for future undesirable results?

Regarding the first question, TDS, nitrate, and perchlorate exceed SMCLs or MCLs in several areas of the Subbasin (see Figures 3-17 through 3-20 and Figures 3-22 through 3-23). Additionally, recent increases in nitrate concentrations seem to be correlated with increases in groundwater levels, suggesting remobilization of preexisting nitrate mass in the unsaturated zone rather than a new source of degradation. Regarding the second question, continued agricultural practices and use of imported water and septic systems in the subbasin may lead to gradual water quality degradation, in terms of TDS and nitrate, without sufficient amounts of natural recharge to dilute loading from these sources.

Because the GSA does not regulate agricultural nutrient application, septic systems, imported water quality, or historical land use and associated preexisting degradation, response actions will focus on feasible SGMA-related actions such as monitoring, confirmation sampling, sentinel well evaluation, domestic well vulnerability assessments, public supply coordination, grant seeking, and evaluation of whether pumping patterns or groundwater gradients could contribute to the migration of

~~Given the restricted amount of water quality data available in the subbasin (both spatially and temporally), additional data collection efforts and analyses are required to better understand and characterize water quality. Through the incorporation of additional RMSs, as needed, to better protect domestic and tribal users, as well as the establishment of monitoring locations in data gap areas, undesirable effects as they pertain to water quality can be better evaluated to help manage resources for all basin users.~~ degraded water quality.

~~4.6.1.1~~4.4.2.1 Potential Causes of Undesirable Results

There is a tendency in groundwater basins towards the general degradation of groundwater quality through time due to irrigation and septic return flows, use of imported water, and evapotranspiration. In particular, the reduction of historical freshwater recharge associated with surface water diversions from Henshaw Dam has reduced the Subbasin's dilution capacity and may contribute to long-term accumulation of salts and nitrate. These conditions are part of the basin setting and water budget. The GSA does not have the authority to modify surface water diversions or restore pre-1920s recharge conditions. The GSA will continue to monitor and evaluate water quality trends, coordinate with appropriate agencies and water users, and implement feasible groundwater management actions within its authority and funding capacity.~~Therefore,~~ ~~m~~Maximizing recharge from natural precipitation may provide the best means of mitigating undesirable results from routine beneficial use.

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~~4.6.1.2~~4.4.2.2 Potential Effects on Beneficial Uses and Users

Further degradation of groundwater quality with respect to TDS, ~~and~~ nitrate, and perchlorate could cause loss of beneficial use to Subbasin users with regard to landscape and agricultural irrigation due to salinity requirements, expensive treatment of water for municipal and domestic use, and potential increased costs for the few treatment plants that are located within the subbasin.

4.4.3 Minimum Thresholds (§354.28)

The water quality SMC framework evaluates water quality at specific RMS wells. MTs are primarily based on applicable drinking water regulations but vary by constituent and location in the Subbasin, as follows:

- **TDS**: the MT is set at 1,000 mg/L, corresponding to the upper SMCL for TDS. The only exception is MW-43, located at the very end of the Pala Subbasin. No water quality is available for this well and no recent water quality is available for the majority of the Pala Subbasin. Therefore, no MT has been set yet for this RMS. The GSA will collect water quality information for this well, as feasible, and reevaluate conditions at the next periodic evaluation. An appropriate MT will be set at that time as well. Water quality was also unavailable for MW-37. However, based on available measurements in the vicinity, the SMCL is considered an appropriate MT for this well.
- **Nitrate**: For nitrate RMS wells outside the Upper Pauma Nitrate/Perchlorate-Affected Area, the MT is set at 10 mg/L as N, which is the primary drinking water MCL and is equivalent to the San Diego Basin Plan objective of 45 mg/L nitrate as NO_3. For RMS wells within the affected area that already exceed 10 mg/L as N, the MT is a site-specific degradation threshold based on maximum observed conditions. As with TDS, an MT for MW-43 will not be set until the next periodic evaluation period, after sufficient data collection and review.
- **Perchlorate**: For perchlorate RMS wells within the Upper Pauma Nitrate/Perchlorate-Affected Area (MW-5 and MW-34), the MT is set at a site-specific degradation threshold based on maximum observed conditions, which represent pre-2015 (existing) conditions. Wells downgradient of the affected area do not contain measurable amounts of perchlorate. Two perchlorate sentinel RMSs were therefore established (MW-31 and MW-35) to monitor whether the higher concentrations seen in the affected area migrate to downgradient wells. MTs for these two sentinel wells were set to non-detect. For the downgradient well with measurable perchlorate below the MCL (MW-25), the MT was set to the MCL of 6 µg/L. Future monitoring data will be used to assess whether this well represents a localized or temporal condition. Because nearby wells downgradient of MW-25 are limited and not available for monitoring, the USLRGMA will evaluate DDW-reported data from wells that currently report perchlorate to the State, when available, to identify new detections or material changes in downgradient concentrations.

Undesirable results for water quality may be indicated when the average annual concentrations at 25 percent or more of the RMSs (per constituent) exceed MTs for two consecutive annual monitoring events over at least two years, after confirmation sampling and data review. Exceedances must also indicate significant and unreasonable degradation affecting beneficial uses and users. If this MT threshold is met,

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the GSA will first confirm the data, evaluate causation, assess whether beneficial users are significantly and unreasonably affected, and identify feasible responses within the GSA's authority and funding capacity. Expanded monitoring, domestic-well testing, treatment, or mitigation actions may be pursued where supported by grants, partner participation, or future GSA approval.

4.4.4 Measurable Objectives (§354.30)

MOs for the RMS wells are summarized below:

- **TDS**: The MO represents the applicable San Diego Basin Plan water quality objective for the relevant subbasin, which is 800 mg/L in the Pauma Subbasin and 900 mg/L in the Pala Subbasin (Regional Board, 1994).
- **Nitrate**: The MO for all RMS wells represents the MCL of 10 mg/L as N, which is also consistent with the San Diego Basin Plan objective of 45 mg/L nitrate as NO_3. The GSA recognizes that wells already above the MCL (i.e., wells within the Upper Pauma Nitrate/Perchlorate-Affected Area) will require long-term tracking and that the MO may not be immediately achievable at affected-area wells.
- **Perchlorate**: For perchlorate RMS wells within the Upper Pauma Nitrate/Perchlorate-Affected Area (MW-5 and MW-34), the MO is set at the primary drinking water MCL of 6 µg/L, again, recognizing that the MO for wells already above the MCL may not be immediately achievable. The MO for RMS wells downgradient of the affected area (MW-31 and MW-35) were set to non-detect. For the downgradient well with measurable perchlorate below the MCL (MW-25), the MO was also set to non-detect. In California, the detection level for perchlorate is 1 µg/L, so concentrations at the downgradient MW-25 (which range from non-detect to 1.6 µg/L) is hovering around this limit.

4.4.5 Interim Milestones

Recognizing that the GSA has little, if any, control over water quality drivers in the Subbasin, the IM for each RMS well has been set equal to the MO for the duration of the implementation period for TDS, nitrate, and perchlorate. This approach reflects the GSA's objective to maintain groundwater quality at or below the applicable Basin Plan water quality objective where feasible and to avoid significant and unreasonable degradation toward the MT. However, where concentrations are already above MOs, the IMs are not intended to represent a GSA commitment to actively reduce concentrations through remediation or treatment, because water quality concentrations in the Subbasin, especially TDS and nitrate, are influenced by imported water quality, reduced natural recharge, agricultural return flows, septic loading, evapoconcentration, and other factors outside the GSA's direct control. Exceedance of an IM will be used as an indicator for continued monitoring, trend evaluation, and coordination, but will not constitute an undesirable result unless the applicable MT and undesirable result criteria are met.

~~4.6.2 Degradation of Water Quality~~

~~For the decision to set sustainable management criteria for water quality, SGMA poses two basic questions:~~

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- ~~Were undesirable results occurring as of the SGMA baseline of January 2015? and~~
- ~~Is there a potential for future undesirable results?~~

~~Regarding the first question, TDS and nitrate exceed objective levels in several areas of the Subbasin (see Figures 3-18 and 3-20), even though overall ambient water quality is below basin objectives. Regarding the second question, continued agricultural practices and use of imported water and septic systems in the subbasin may lead to gradual water quality degradation without sufficient amounts of natural recharge to dilute loading from these sources.~~

~~As stated in Section 3.3.4.3, basin water quality objectives for TDS and Nitrate as NO_3 in Pauma Subbasin are 800 mg/L and 45.0 mg/L, respectively. The sustainability goal—to protect groundwater quality—is to prevent degradation of water quality by maintaining ambient groundwater quality below basin objectives and maintaining or reducing the percentage of wells with median concentrations exceeding basin objectives. MTs for the degradation of water quality represent basin water quality objectives which also meet state and federal maximum contaminant levels (MCLs) for drinking water.~~

~~4.7~~4.5 Depletions in Interconnected Surface Water

The major stream in the USLR Subbasin is the San Luis Rey River. The San Luis Rey River extends from Lake Henshaw to the Pacific Ocean at Oceanside Harbor. However, as described in Section 3.3.3.1.3, the majority of flow released from Henshaw Dam are diverted into the Escondido Canal, where it is exported for use in Vista Irrigation District (VID) and City of Escondido service areas. Only water unable to be captured by the diversion structure (typically during peak storm flow) and natural flow from rainfall and stormflow downstream of the diversion structure are available to maintain surface flow in the San Luis Rey River. However, very few measurements of surface flow are available in Pauma and Pala Valleys[26]. Therefore, current understanding of surface water and groundwater interactions in the USLR Subbasin are informed by reported observations, near-river groundwater levels (where data are available), and the model-estimated ~~calculated~~ location, quantity, and timing of streamflow depletion associated with groundwater pumping ~~streamflow and groundwater elevations~~ using the USLR~~GM~~ Groundwater Model (what limited gaged measurements of surface flow were available were used to calibrate the ~~surface water~~watershed model component).

Although the model analysis provides useful information regarding the relative location and timing of potential depletion, model-estimated depletion volumes are not the sole enforceable SMC metric for ISW. This determination is based on the intermittent and seasonal nature of streamflow in the Subbasin, the absence of active streamflow gages within the Subbasin, limited shallow groundwater monitoring near potentially interconnected reaches, uncertainty in estimated groundwater pumping volumes, and uncertainty associated with model-estimated streamflow and baseflow conditions. These limitations result in a relatively large margin of uncertainty around model-estimated depletion rates and volumes. Accordingly, defining a specific rate or volume of streamflow depletion that would result in significant and

[26] Limited streamflow data is only available from the USGS 11039800 San Luis Rey River Near Pala gage (1986-1993) and the USGS 11036700 San Luis Rey River Near Pauma Valley gage (2008-2009).

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unreasonable impacts to downstream beneficial users, potential GDEs, or habitat areas is not currently supported by the available monitoring data. Nor would a quantification of ISW depletion be possible for the annual review of conditions relative to SMCs without updating and rerunning the groundwater model with and without groundwater pumping.

For these reasons, ISW SMCs using groundwater elevations at selected RMSs located along or near the San Luis Rey River have been established as a proxy. Groundwater levels are the most reliable, repeatable, and currently available monitoring data for evaluating whether groundwater conditions near potentially interconnected reaches are worsening. Maintaining groundwater levels above historical low conditions (represented by Fall 2016 conditions) at water level RMSs and at these selected sites is expected to prevent material worsening of hydraulic conditions that could increase depletion of ISW relative to the range of conditions experienced historically and during GSP implementation.

This proxy-based SMC framework is supported by the current conceptual understanding of the Subbasin. Groundwater pumping can increase depletion of ISW where groundwater and surface water are hydraulically connected. The ISW depletion analysis showed that groundwater pumping can also cause increased ISW depletion in disconnected reaches through the interception of baseflow. In the USLR Valley Groundwater Subbasin, where direct measurement of streamflow depletion is not available, groundwater elevations provide the most practical indicator of whether groundwater conditions near the river are declining in a manner that could increase the risk of ISW depletion. Maintaining groundwater levels above historical low conditions is therefore used as an indicator that pumping-induced depletion is not materially worsening below historical conditions.

With this approach, modeling analysis of pumping-induced depletion is used as supporting information rather than as the enforceable SMC metric. The model results indicate that potential pumping-induced depletion is not uniformly distributed along the San Luis Rey River and that modeled depletion varies by reach, season, WY type, and groundwater conditions (refer to Section 3.3.4.4). The model results also indicate that depletion may be lagged relative to groundwater pumping and is surface water supply limited (depletion is generally higher in wetter years, when more surface water is available for potential stream-aquifer exchange, and lower in dry or critical years, when surface flow is limited). These results support the use of groundwater levels and hydrologic context as annual indicators, rather than relying on a single annual model-estimated depletion volume for compliance.

ISW-related projects and management actions have been added or revised to address data gap issues that limit the ability to assess the depletion of ISW within the USLR Valley Groundwater Subbasin, which are discussed in more detail in Section 6.0. These include:

- Installation of streamflow gage in the USLR Valley Groundwater Subbasin
- Investigation of potential alternative monitoring sites for ISW
- Installation of transducers in wells being used to monitor ISW
- Initiation of field observations of standing water and wetted area within the San Luis Rey River
- Exploration of the feasibility of using remote sensing or aerial imagery to evaluate riparian vegetation as an indicator of surface water/shallow groundwater

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The most important of these is the installation of a streamflow gage within the Subbasin to provide a measurement of flow and indication of the timing of when flow is present in the San Luis Rey River. In addition, the Pala Subbasin remains the higher priority area for future ISW monitoring and refinement of the SMCs. This prioritization is appropriate because the Pala Subbasin has poorer data resolution, is classified as a subterranean stream, includes reaches where surface water is present near the downstream end of the Subbasin, and is directly upgradient of the Bonsall and Mission Subbasins. The reach-based model results (Section 3.3.4.4) also indicate that Pala Reach 2 and Pala Reach 3 account for a substantial portion of modeled depletion. Future monitoring improvements should therefore prioritize these reaches where feasible. As data gaps are filled, the ability to define more appropriate SMCs for ISW based on a flow or rate will be evaluated in the next periodic evaluation.

4.5.1 Representative Monitoring Sites

Five RMSs for the evaluation of ISW using groundwater levels as a proxy were selected from the broader groundwater level monitoring network and are located along or near the San Luis Rey River where available monitoring points provide the best existing information regarding groundwater conditions near the river. The ISW proxy monitoring sites, which include two in Pala Subbasin and three in Pauma Subbasin, are shown in Figure 4-10 and summarized in Table 4-4 below. In addition to water levels at the proxy monitoring sites, supporting hydrologic data will be reviewed annually to support interpretation of ISW compliance, including WY type, estimated groundwater pumping, streamflow at the Oceanside gage (USGS Gage 11042000, see Figure 4-12), and field observations. Complaints or other evidence that may indicate potential effects on ISW will also be reviewed periodically.

Table 4-~~4~~8. ISW RMS Summary

GSP Well ID	Stream Reach	MT [ft amsl]	MO [ft amsl]	IM [ft amsl]
MW-31	Pauma Reach 1/ Pauma Reach 2	725	775	775
MW-13	Pauma Reach 2	593	643	643
MW-33	Pauma Reach 3	583	633	633
MW-42	Pala Reach 1	439	465	465
MW-43	Pala Reach 3	270	273	273

~~4.7.1~~4.5.2 Undesirable Results (§354.26)

Since surface water is ~~not a significant~~only a minor source of water supply in the USLR Subbasin, undesirable effects from depletions in interconnected surface water primarily relate to potentially groundwater dependent ecosystems (GDEs). Areas of potentially dependent vegetation were identified in Section 3.3.4.5 through a review of historical imagery and available mapping. During the process of developing and revising sustainability goals for depletions in ~~interconnected surface water~~ISW, the ~~calibrated~~ USLR~~GM~~ Groundwater Model (see Section 3.3.5.1) was used to delineate the areas of

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potentially groundwater dependent vegetation to those locations throughout the Subbasin where simulated groundwater levels since 2015 were less than 20 to 30 ft bgs. This depth is considered to be the typical extinction depth for most deep-rooted riparian vegetation; most roots of riparian vegetation would not be able to access groundwater resources if groundwater levels were deeper than this threshold. These areas are shown on Figure 3-~~25~~33. Groundwater dependency of areas outlined as potential GDEs must first be verified through field investigation and additional data collection. RMSs and sustainability management criteria will then be refined as necessary to avoid significant and unreasonable effects to GDEs.

~~4.7.2 Depletions in Interconnected Surface Water~~

Undesirable results and MTs for depletions in ~~interconnected surface water~~ISW would be when groundwater pumping in the Subbasin causes a significant and unreasonable reduction in surface water flow, surface water persistence, or shallow groundwater conditions that support beneficial uses and users of surface water~~groundwater levels falling below the lowest groundwater level since 2015 in the identified areas with potentially dependent vegetation (Figure 3-25)~~.

4.5.3 Minimum Thresholds (§354.28)

The ISW SMCs are consistent with the approach used to establish groundwater level SMCs and are shown in Figure 4-11. The MTs are based on historical low groundwater level conditions (either observed where data are available, or model-predicted where data are unavailable) from the drought period ending in Fall 2016 and are intended to avoid groundwater level declines below the historical range evaluated for potential effects on beneficial users.

Undesirable results for depletion of ISW may be indicated when groundwater elevations fall below the ISW proxy MTs for two consecutive monitoring events in each of two consecutive water years in either:

- Three or more of the five ISW proxy wells,
- Both Pala ISW proxy wells, or
- Two or more of the three Pauma ISW proxy wells, when supported by field observations or other evidence suggesting potential effects on ISW.

A single well below its proxy MT, or two isolated exceedances that do not represent the same management reach or are not supported by other evidence of potential ISW effects, would not constitute a potential undesirable result. Such conditions would instead trigger additional review, including verification of the water level measurement, review of recent hydrologic conditions, evaluation of available pumping information, review of field observations of surface water conditions, and consideration of whether additional monitoring is warranted.

4.5.4 Measurable Objectives (§354.30)

MOs for ISW are also consistent with the approach used to establish groundwater level MOs. The ISW MOs provide a margin of operational flexibility above the MTs to account for dry periods when water levels in the Subbasin would generally fall.~~MOs for the degradation of water quality are to maintain water quality at current ambient conditions. In particular, maintaining TDS and Nitrate as NO_3 at current ambient~~

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~~concentrations (607 mg/L and 25.8 mg/L, respectively). Ambient water quality in the Pauma Subbasin is currently below basin objectives. Water quality at individual wells will be evaluated on an annual basis and the ambient water quality will be recalculated to ensure that MOs are maintained across the groundwater basin.~~

4.5.5 Interim Milestones

The ISW IMs are equal to its respective MO for each five-year milestone through the sustainability horizon, consistent with the approach also used for groundwater level IMs. Establishing IMs at the MOs is appropriate because there is no technical basis for establishing intermediate target elevations below the MOs when current groundwater conditions already meet the MOs at four of the five RMSs. For MW-42, where groundwater level is currently slightly below the MO, setting the IM equal to the MO establishes a clear target for attaining the desired groundwater condition.

~~#### 4.7.2.1 Chronic Lowering of Groundwater Levels~~

~~MOs for the chronic lowering of groundwater levels are defined as an operating range of groundwater levels allowing reasonable fluctuation with changing hydrologic conditions. The MTs represent the bottom of the operating range and are protective of basin pumpers while the MOs for groundwater levels are also subject to the need of each basin pumper. The MO for the USLR Subbasin is set at a groundwater elevation that coincides with three years of operational storage for the basin. The calibrated USLR Groundwater Model (USLRGM) was used to calculate these elevations at the identified Key Wells, which are summarized in Table 4-3. In general, this corresponds to approximately 50 ft of groundwater elevation over MTs.~~

~~Groundwater levels in 2020 approximately represent a three-year volume of storage where a minimum of 18,000 acre-ft/year is required to meet the water demands of the basin. Three years of groundwater storage is equivalent to 54,000 acre-ft. This value is conservative because it allows three years of groundwater reserves to meet water demand, even though much of that demand is currently satisfied through imported water. Therefore, this approach for defining MOs against the lowering of groundwater levels (as well as groundwater storage) also allows protection against periods of prolonged drought or below average precipitation years. Average annual groundwater pumping from 1991 through 2020, as noted in Section 3.0, is approximately 14,000 acre-ft/yr. Imported water use for the last nine years (Water Year 2012 through 2020) was approximately 4,000 acre-ft/yr. Even more recently (Water Year 2018 through 2020), imported water use has been closer to 5,200 acre-ft/yr (Figure 3-31).~~

~~At approximately half of the representative monitoring sites, current (June 2021) groundwater levels are below MOs. These wells are generally located near the center of the Pauma Subbasin where there appears to be a greater pumping depression in the basin. Based on projected water budgets assuming a continuation of water use conditions in the Subbasin, the long-term change in storage is approximately -100 acre-ft/yr. However, in any individual dry year or sequence of wet years, the change in storage can be two orders of magnitude higher or lower.~~

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4.7.2.2 Reduction of Groundwater in Storage

Since the sustainability indicator for groundwater in storage addresses the ability of the groundwater basin to support existing and planned beneficial uses of groundwater, recent drought conditions were considered when establishing sustainability management criteria for groundwater levels and groundwater storage. Figure 3-2 shows the rainfall record from 1943 through 2020 at Lake Henshaw. The chart includes a cumulative departure line which indicates generally hydrologic conditions: a downward trend represents dry conditions while and upward trend represents wet conditions. The average rainfall for the historical water budget base period (1991-2020) is slightly higher than the long-term average rainfall. However, during the most recent extended drought (2012-2016) pumping has continued in the groundwater basin. Pauma hydrographs with records during the most recent drought (see Figure 3-14) show a steady decline. However, with increased rainfall of Water Years 2018 and 2019, basin water levels show recovery (albeit not necessarily to the pre-five-year drought levels). A portion of the groundwater level recovery is also attributed to availability of imported water to augment groundwater pumping. Groundwater level data for the Pala Subbasin within the USLR is very limited. Two wells (WG-1/09S01W31L located at the upstream portion or Pala Subbasin and 10S2W6F2 located in the downstream portion of Pala Subbasin) have water level records spanning the 2012-2016 drought (see Figure 3-15). The data show that groundwater levels remained essentially stable, suggesting that pumping in the Pauma Subbasin was less than the decrease in inflow to this portion of the subbasin during the drought.

Planning for Urban Water Management Plans requires an assessment of available water supplies for a normal, single dry, and five year drought period. For planning purposes, as selected by basin stakeholders, considered herein is a groundwater reserve for a three year dry period. The approach taken was to determine the groundwater elevation which represents a three year supply (approximately 54,000 acre-ft) above the elevation of the MTs at selected wells (see Table 4-3). The MO for storage is also fulfilled by the MO for groundwater levels, which maintains groundwater levels within the operating range to protect operations of municipal, agricultural, and domestic wells in the basin and provide for a minimum three year supply of groundwater.

The MO elevation for groundwater levels was set at an elevation which conservatively represents the volume of a 3 year reserve between the MO elevation and the MT elevation. The 3 year reserve volume does not consider annual inflow to the basin that will occur even during drought periods or availability of imported water, so it is very conservative. Since sustainable management criteria for groundwater levels are being used as a proxy for groundwater storage, the interim milestones would be those discussed above.

4.7.2.3 Degradation of Water Quality

MOs for the degradation of water quality are to maintain water quality at current ambient conditions. In particular, maintaining TDS and Nitrate as NO_3 at current ambient concentrations (607 mg/L and 25.8 mg/L, respectively). Ambient water quality in the Pauma Subbasin is currently below basin objectives. Water quality at individual wells will be evaluated on an annual basis and the ambient water quality will be recalculated to ensure that MOs are maintained across the groundwater basin.

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~~4.7.2.4 Depletions in Interconnected Surface Water~~

~~Due to the lack of measured observations for surface water flow and groundwater levels near areas of potentially groundwater dependent vegetation, an initial evaluation was made using the calibrated surface water and groundwater model for the USLR. Model calculated groundwater levels in these identified areas indicate that groundwater levels are within three feet, at, or above ground surface. MOs for the depletion of interconnected surface water would be to maintain seasonal groundwater levels since 2015 in the identified areas with potentially dependent vegetation. Since the current evaluation is limited to model simulated surface flows and groundwater levels in the areas identified as having vegetation that may be dependent on groundwater, site specific monitoring of groundwater levels and surface flow gages will be needed to confirm groundwater / surface water interactions. Sustainability management criteria may require refinement following collection of field data.~~

~~4.8~~4.6 Land Subsidence

~~Land subsidence is not of concern for the USLR Groundwater Subbasin due to a lack of significant thickness of compressible fine grained sediments and the overall shallow character of the alluvial basin, as discussed in Section 3.3.4.7. Therefore, land subsidence as a sustainability indicator is not applicable to the USLR Groundwater Subbasin and no sustainability management criteria were developed. However, the GSA has determined that any land subsidence caused by the lowering of groundwater levels in the subbasin would be considered significant and unreasonable. Evidence of or potential for land subsidence will be reevaluated in the five year report.~~Land subsidence is considered as a sustainability indicator for the USLR Valley Subbasin because SGMA requires evaluation of potential significant and unreasonable land subsidence caused by groundwater extraction. However, available information indicates that the Subbasin is at relatively low risk for pumping-induced land subsidence. The Subbasin is small and relatively shallow, with no known documented history of significant pumping-induced land subsidence and no identified record of damage to infrastructure, land use, drainage, or flood-control features attributable to subsidence.

Although the USLR Valley Subbasin has no known history of subsidence, the GSA recognizes that groundwater levels in some RMSs may be permitted to fall below measured lows under the groundwater level SMCs. However, many wells in the Subbasin have relatively short periods of record. This limits the ability to assess true historical low groundwater level elevations and conclude with certainty that groundwater extraction cannot induce subsidence under future conditions. For this reason, the GSA will monitor land subsidence as a sustainability indicator using available remote sensing data and an adaptive management framework rather than installing a dedicated ground-survey network at this time.

4.6.1 Representative Monitoring Sites

The Subbasin's land subsidence monitoring network will rely primarily on DWR's statewide InSAR dataset available through the SGMA Data Viewer[27] and related DWR tools. RMSs for subsidence were selected throughout the Subbasin using specific InSAR grids as the monitoring sites. Points were chosen represent

[27] https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#currentconditions

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the area of greatest risk for subsidence (corresponding to the Paleo Lake Pauma footprint area, which has a documented and consistent fine-grained layer and also coincides with an area of significant groundwater production) and substantial infrastructure within the Subbasin. Subsidence RMSs are shown in Figure 4-13 and summarized in the following table.

Table 4-~~52~~. Land Subsidence RMS Summary

Monitoring Area	InSAR Point ID	Basis for Selection	MT [ft]	MO [ft]	IM [ft]
Pala Casino	ACXL41F	Major infrastructure area	0.1 ft in 1 yr or 0.2 ft over 5 yrs	0.0	0.0
Casino Pauma	ACC5IBP	Major infrastructure area	0.1 ft in 1 yr or 0.2 ft over 5 yrs	0.0	0.0
Harrah's Resort	AB72LLX	Major infrastructure area	0.1 ft in 1 yr or 0.2 ft over 5 yrs	0.0	0.0
Paleo Lake Pauma Area	ACDCDIV AC2MKN6 ABOC650	Pumping area within extent of documented fine-grained deposit	0.1 ft in 1 yr or 0.2 ft over 5 yrs	0.0	0.0

This approach is appropriate because: 1) there is no known historical evidence of significant pumping-induced subsidence in the Subbasin; 2) existing geologic understanding suggests relatively low susceptibility compared to deeper alluvial basins with thick compressible fine-grained deposits; and 3) the statewide InSAR dataset provides a cost-effective screening-level monitoring tool appropriate for current Subbasin conditions. If future monitoring identifies a persistent and spatially coherent subsidence signal, the GSA may refine the network by adding field verification or additional site-specific monitoring. In addition to these specific sites, InSAR data over the entire Subbasin will be reviewed annually to evaluate any apparent vertical changes that might not be occurring at the selected RMS cells.

Groundwater elevation monitoring wells will serve as a companion dataset for interpretation of subsidence conditions. Any apparent deformation identified in InSAR data will be evaluated to see whether it is temporally and spatially associated with groundwater level declines, particularly in areas where groundwater levels approach or fall below observed historical lows.

4.6.2 Undesirable Results (§354.26)

An undesirable result for land subsidence occurs when groundwater pumping-induced land subsidence causes significant and unreasonable impacts to surface land uses or infrastructure within the Subbasin. Such impacts may include, but are not limited to, measurable damage or loss of function affecting roads, utilities, drainage facilities, flood-control features, buildings, or groundwater production infrastructure, or measurable alteration of land-surface elevations sufficient to increase flood, drainage, or infrastructure risk. This impact-based definition is consistent with DWR's current guidance that subsidence sustainability

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criteria should be tied to impacts to land uses and infrastructure, not solely to the existence of measurable deformation (DWR, 2026a).

4.6.3 Minimum Thresholds (§354.28)

The MT for each RMS is a vertical displacement of greater than 0.1 ft in one year or 0.2 ft cumulatively over five years. However, for purposes of GSP implementation, an isolated or minor apparent change in InSAR output may not automatically be considered an MT exceedance. Because InSAR is a remote-sensing product that may reflect localized artifact, signal noise, or non-groundwater-related movement, a confirmed exceedance will require review of the magnitude, persistence, spatial coherence, and likely cause of the observed signal. A potential subsidence exceedance will be identified when the following conditions are observed at a subsidence RMS:

1. Apparent land surface lowering greater than 0.10 ft over a one-year period; or
2. Apparent cumulative land surface lowering greater than 0.20 ft over a five-year period; and
3. The apparent lowering is spatially coherent across a meaningful area of 20 acres or more (representing approximately nine InSAR grid cells), rather than limited to a single isolated pixel or cell; and
4. The apparent lowering persists across multiple update periods or annual evaluations; and
5. Available evidence indicates the signal may be associated with groundwater level decline and not solely with artifact, grading, construction, or other unrelated surface processes.

This evaluation is intended to distinguish true groundwater pumping-induced subsidence from seasonal vertical changes, localized artifact, or unrelated land-surface change. These are important considerations for the USLR Valley Subbasin, which is located within a tectonically active area. Fault movement and resultant uplift or down-dropping can cause non-pumping-induced land surface changes. Historical estimates of vertical movement at the selected RMS sites are provided in Figures 4-14 through 4-19.

Undesirable results for land subsidence may be considered to occur when confirmed MT exceedances occur at two or more RMS locations, or when a confirmed exceedance at a single RMS causes or is reasonably expected to cause significant and unreasonable impacts to major infrastructure, drainage, flood-control features, or other beneficial uses of the land surface.

4.6.4 Measurable Objectives (§354.30)

The MO for land subsidence is 0.0 ft of average annual vertical displacement at each subsidence RMS. This approach is consistent with DWR's current guidance that in areas with no history of subsidence, MOs should be set to zero.

4.6.5 Interim Milestones

IMs for land subsidence are set at zero feet of average annual vertical displacement at each subsidence RMS for the entirety of the implementation period.

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4.7 Seawater Intrusion

Given the distance of the downgradient boundary from the ocean, seawater intrusion is not of concern for the USLR Groundwater Subbasin. In addition, while seawater intrusion has historically occurred in the downgradient Lower San Luis Rey Groundwater Subbasin, minimum threshold groundwater elevations designed to maintain a seaward groundwater gradient are currently being implemented in the Mission Subbasin to protect inland areas from further seawater intrusion (see Section 2.4.1). Therefore, seawater intrusion as a sustainability indicator is not applicable to the USLR Groundwater Subbasin and no sustainability management criteria were developed. The absence of seawater intrusion will be verified in each Periodic Evaluation.

4.94.8References (§354.4(b))

DWR (California Department of Water Resources), 2026a. Best Management Practices for the Sustainable Management of Groundwater – Land Subsidence. Dated January, 2026. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Land_Subsidence_BMP.pdf

DWR, 2026b. TRE Altamira InSAR Dataset. Available at: SGMA Data Viewer (ca.gov).

DWR (California Department of Water Resources), 2018. Sustainable Groundwater Management Program Resource Guide: DWR-Provided Climate Change Data and Guidance for Use During Groundwater Sustainability Plan Development. Dated July 2018.

DWR, 2017. Best Management Practices for the Sustainable Management of Groundwater: Sustainable Management Criteria. Dated November 2017.

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FIGURES PLACEHOLDER

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5.0 Monitoring Network (§354.32; §354.34)

Groundwater and related monitoring is key to SGMA compliance as it provides the basis to evaluate groundwater level trends for sustainability and can be used to demonstrate measured progress toward achieving sustainability goals through implementation of the GSP. During development of the GSP, available well information was reviewed to identify wells in the groundwater Subbasin that would provide a good foundation for characterizing current groundwater level and water quality conditions and which could be used for future, on-going monitoring after GSP implementation. 30 existing wells were identified that were available for the monitoring and sampling conducted in 2021 for the initial GSP (~~Figure 5-1~~PVGSA, 2022). Changes have since been made to replace monitoring points with lost access and improve spatial distribution throughout the Subbasin. Additional monitoring networks have also been established to monitor conditions relative to water quality, ISW, and land subsidence.

~~During the development of the GSP, quarterly groundwater level measurements were obtained from the monitoring network. In addition, 15 or the wells were sampled semi-annually (in March and October 2021) to provide a representation of ambient groundwater conditions in the basin. The wells used for sampling are depicted on Figure 5-2. Monitoring events were conducted by Geoscience and team member SCS Engineers (SCS), and the semi-annual sampling was conducted by SCS Engineers. This section summarizes the proposed monitoring network for on-going monitoring in support of GSP implementation.~~

5.1 Monitoring Network Objectives (§354.34(b))

The monitoring networks for the USLR Valley GSP ~~was~~ were designed to provide sufficient data from the Subbasin to establish ambient conditions for Subbasin characterization and demonstrate short-term~~, seasonal,~~ and long-term trends in groundwater and related surface water conditions, including annual changes in water budget components. ~~After~~ The monitoring network also provides representative data to evaluate Subbasin conditions relative to SMCs for each GSP sustainability indicator during the implementation of the GSP, ~~the monitoring network will also provide representative data to evaluate GSP sustainability indicators and objectives, including groundwater levels, groundwater storage, water quality, and depletions in interconnected surface water,~~ in accordance with the specific sustainability goals established by the GSA. Recommendations for additional monitoring locations and considerations are provided in Section 5.5. A periodic re-evaluation of the representative monitoring sites (RMSs~~; see Section 4.1.1~~) will be conducted at each periodic evaluation and as data are collected and analyzed.

The monitoring network and monitoring plan is designed to evaluate groundwater and surface water conditions in the Subbasin to demonstrate progress toward achieving the measurable objectives described in the GSP. With on-going collection of groundwater level and quality data, impacts to beneficial uses of groundwater will be continually evaluated. If impacts are occurring, one or more of the proposed projects and management actions outlined in Section 6.0 may be implemented to mitigate impacts, protect beneficial uses, and avoid undesirable results.

The monitoring network functions to allow collection of data relative to groundwater levels, and groundwater flow direction and gradient. From this data, an evaluation can be made of changes in groundwater conditions such as storage (groundwater depths), and water quality. These data are used to quantify changes in the water budget components, and to evaluate sustainability indicators. Data may

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also be used to update the groundwater flow model of the subbasin to refine estimates of sustainable yield and improve the model's reliability for evaluating future projects and management actions.

5.2 Monitoring Locations (§354.34(h))

5.2 Monitoring Locations (§354.34(h))The wells monitored during the GSP development process are shown on Figure 5-1 for water level and Figure 5-2 for water quality. Well information is summarized in attached Table 5-4. These wells were selected based on available data, geographic and vertical distribution, and willingness of owner to participate in GSP monitoring effort. Where good well coverage was available, selected monitoring locations were determined based primarily on available data (wells with greater historical data coverage were prioritized over wells with less or no available information) in order to take advantage of the historical data record. To maintain confidentiality of the well locations and well owners, wells selected for GSP monitoring have been given a unique ID.

5.2.1 Groundwater Levels

The wells monitored during the GSP development processGSP monitoring network for water levels areis shown on Figure 5-1 for water level and Figure 5-2 for water quality. It consists of 37 wells: 33 in Pauma Subbasin and four in Pala Subbasin. Well information is summarized in attached Table 5-41. These wells largely represent pumping wells owned and operated by various water agencies and private agricultural operations and were selected based on available data, geographic and vertical distribution, and willingness of owner to participate in GSP monitoring effort. Where good well coverage was available, selected monitoring locations were determined based primarily on available data (wells with greater historical data coverage were prioritized over wells with less or no available information) in order to take advantage of the historical data record. To maintain confidentiality of the well locations and well owners, wells selected for GSP monitoring have been given a unique ID. These include pumping wells owned and operated by various water agencies and private agricultural operations. At present, no de minimis users have come forward in response to requests for well information or following discussion at GSP workshops. Using existing wells also reduces GSP implementation costs by minimizing costs associated with drilling new monitoring wells.

However, the monitoring network does include two monitoring wells drilled specifically for GSP monitoring (MW-32 and MW-33). The wells were installed in May and June of 2023 through YMWD SGMA grant funding. The wells are clustered near the San Luis Rey River and were constructed at different depths (one shallow, one deep) to provide discrete information on differences in shallow and deep groundwater conditions. Since the USLR Subbasin is relatively shallow, previous available well information was not able to provide information on potential perched or shallow groundwater conditions – particularly in the central Pauma Subbasin area where the presence of a clay layer from Paleo Lake Pauma is well

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documented. These wells are formally added to the groundwater level monitoring network through this 2027 GSP Amendment.~~In addition, many of the wells used in the GSP monitoring well network have the benefit of previous groundwater level measurements and water quality results, providing a record of previous hydrologic conditions that is used to evaluate trends.~~

Several other wells in both Pauma and Pala Subbasins are also being added through 2027 GSP Amendment to increase spatial coverage of groundwater level measurements and replace wells with lost access since development of the GSP (see subsection below). Changes in the monitoring wells between the 2022 GSP and 2027 GSP Amendment networks are shown in Figure 5-2. MW-31 provides coverage in the previously identified data gap area downgradient of the Rincon Reservation. Four other wells (MW-36, MW-37, MW-39, and MW-40) are located in the alluvial fan areas also previously identified as data gap areas. However, while MW-39, and MW-40 provide important information in the northeastern Pauma alluvial fan area, they are completed in bedrock and it's unclear if the water levels will be reflective of alluvial conditions. Two new wells were also added in Pala Subbasin, where limited groundwater data still make it difficult to reliably characterize conditions. One of these wells, MW-43, represents a former CASGEM well (06F02) at the end of Pala Subbasin. MW-42 was added to the GSP groundwater level monitoring network, which is adjacent to MW-30. This well was added to the network because well construction information is known for this well, allowing it to be used as an RMS.

RMSs for water level represent as subset of the monitoring network, also shown in Figure 5-1. During this 2027 GSP Amendment, RMSs were reevaluated. Some newly added wells were designated as RMS to replace those with lost access, provide alternative locations more representative of conditions within the principal alluvial aquifer (specifically replacing wells identified as bedrock wells), and to provide a better spatial distribution throughout the Subbasin. Of importance, two RMSs were designated in the Pala Subbasin, which was unable to be done in the 2022 GSP. The RMS network incorporates 14 monitoring points (same as in the 2022 GSP), 12 of which are within Pauma Subbasin and two within Pala Subbasin.

Changes to the groundwater level monitoring network are reflected in the SGMA Monitoring Network Module. Well information will continue to be updated as needed during routine water level measurement uploads.

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Table 5-12. ~~Water~~ Monitoring Network Well Information

GSP Well ID	Subbasin	Well Type	Aquifer[1]	Elevation	Reference Point Stick-Up [ft]	Well Screen Interval(s) [ft bgs]	Total Depth [ft]	Monitoring Network[2]		
								Water Level	Water Quality	ISW
MW-1	Pauma	Public Supply	A/B	1,588.91	2.0	160-371	371	No longer accessible		
MW-2	Pauma	Public Supply	A/B*	1,531.64	1.81	282-582	582	No longer accessible		
MW-3	Pauma	Public Supply	A/B*	1,276.59	1.61		368	No longer accessible		
MW-4	Pauma	Public Supply	A/B	1,199.12	0.54	75-124, 128-284, 284-405	405	No longer accessible		
MW-5	Pauma	Public Supply	A/B*	997.61	2.68	150-285	340	X	X	
MW-6	Pauma	Public Supply	A	802.56	2.51	120-200	210	X		
MW-7	Pauma	Public Supply	A/B	800.40	1.48	115-255	265	X	X	
MW-8	Pauma	Public Supply	A	797.25	2.51	116-214	214	X	X	
MW-9	Pauma	Public Supply	A	796.52	1.54	120-220	240	X		
MW-10	Pauma	Public Supply	A/B	805.98	2.68	139-224	229	X		
MW-11	Pauma	Public Supply	A	765.32	2.73	100-200	200	X	X	
MW-12	Pauma	Public Supply	A	759.12	3.30	114-194	204	X		
MW-13	Pauma	Public Supply	A	748.84	3.21	110-210	230	X		X
MW-14	Pauma	Public Supply	A	743.90	0.85	110-200	210	X		
MW-15	Pauma	Monitoring	P	754.26	1.50		51	X		
MW-16	Pauma	Monitoring	P	746.61	1.16		45	X		
MW-17	Pauma	Monitoring	P	745.86	1.07		49	X		
MW-18	Pauma	Irrigation	B	952.39	2.57	375-1,812	1,812	X		

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GSP Well ID	Subbasin	Well Type	Aquifer[1]	Elevation	Reference Point Stick-Up [ft]	Well Screen Interval(s) [ft bgs]	Total Depth [ft]	Monitoring Network[2]		
								Water Level	Water Quality	ISW
MW-19	Pauma	Irrigation	A	808.37	3.10	218-318	325	X	X	
MW-20	Pauma	Irrigation	A	802.25	1.93			X		
MW-21	Pauma	Public Supply	B	738.11	3.49	576-1,075	1,075	X		
MW-22	Pauma	Public Supply	A	738.20	3.56			X		
MW-23	Pauma	Public Supply	A/B*	708.32	2.19		231	X		
MW-24	Pauma	Public Supply	B	716.73	2.97	136-196, 276-356	364	X		
MW-25	Pauma	Public Supply	B	757.70	3.07	197-397, 417-910	910	X	X	
MW-26	Pauma	Public Supply	A*	682.53	4.65			No longer accessible		
MW-27	Pauma	Public Supply	A*	681.03	1.34	100-180	241	No longer accessible		
MW-28	Pauma	Public Supply	A*	748.82	1.10			No longer accessible		
MW-29	Pala	Irrigation	A/B*	1,247.15	2.18		220	X		
MW-30	Pala	Irrigation	A	499.34	1.71		140	X	X	
MW-31	Pauma	Irrigation	A*	822.00	0.65	57-97	107	X	X	X
MW-32	Pauma	Monitoring	P	700.37	1.45	35-55	65	X		
MW-33	Pauma	Monitoring	A	699.62	1.55	95-125	148	X		X
MW-34	Pauma	Public Supply	A/B*	1,313.86	2.61		542	X	X	
MW-35	Pauma	Public Supply	A	806.95	3.65	110-160	163	X	X	
MW-36	Pauma	Irrigation	A*	902.78	3.13		317	X		

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GSP Well ID	Subbasin	Well Type	Aquifer[1]	Elevation	Reference Point Stick-Up [ft]	Well Screen Interval(s) [ft bgs]	Total Depth [ft]	Monitoring Network[2]		
								Water Level	Water Quality	ISW
MW-37	Pauma	Irrigation	A*	909.34	1.92		407	**X**	**X**	
MW-38	Pauma	Public Supply	A	773.57	2.72			X	**X**	
MW-39	Pauma	Public Supply	B	1,099.58	3.48	680-1,115	1,115	X		
MW-40	Pauma	Public Supply	B	1,122.98	3.55	640-1,200	1,515	X		
MW-41	Pauma	Public Supply	A*	709.40	2.17		100	**X**	**X**	
MW-42	Pala	Irrigation	A	534.74	2.74	10-148	140	**X**		**X**
MW-43	Pala	Monitoring	A*	214	1.63			**X**	**X**	**X**

Notes:
[1] A = Alluvial (principal) aquifer, B = bedrock, P = Perched, * = aquifer assumed
[2] Bolded "X" indicates RMS

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5.2.1.1 Initial GSP Monitoring Network

During the development of the GSP, quarterly groundwater level measurements were obtained from the monitoring network. In addition, 15 or the wells were sampled semi-annually (in March and October 2021) to provide a representation of ambient groundwater quality conditions in the Subbasin. -These wells were selected based on available data, geographic and vertical distribution, and willingness of the well owner to participate in the GSP monitoring effort. Where good well coverage was available, selected monitoring locations were determined based primarily on available data (wells with greater historical data coverage were prioritized over wells with less or no available information) in order to take advantage of the historical data record. ~~The wells used for sampling are depicted on Figure 5-2. Monitoring events were conducted by Geoscience and team member SCS Engineers (SCS), and the semi-annual sampling was conducted by SCS Engineers. This section summarizes the proposed monitoring network for on-going monitoring in support of GSP implementation~~Data from this initial monitoring provided a good foundation for characterizing groundwater conditions. The wells monitored during initial GSP development efforts were also retained for GSP implementation.

Wells selected for initial water quality sampling consisted of existing operable wells with dedicated pumps. During purging, water was poured into a flow-through cell and calibrated water quality meter (YSI ProDSS) capable of measuring pH, dissolved oxygen, conductivity, salinity, total dissolved solids, temperature, turbidity, and oxidation/reduction potential. Water quality measurements were recorded approximately every 5 minutes as the wells were pumping. Generally, the wells were sampled after approximately 15 minutes of pumping. Samples were collected directly into appropriate laboratory-supplied containers. The groundwater sampling data and lab results are provided in Appendix 3b.

During GSP implementation, several water level monitoring locations have become inaccessible due to well transfers. This includes MW-1, MW-2, MW-3, MW-26, MW-27, and MW-28, shown in Figure 5-2. No replacement wells are readily available in the majority of these locations, though MW-34 was added near MW-3. Other data gap areas were addressed or partially addressed through the addition of wells identified above. A discussion of the remaining data gap areas is provided in Section 5.3 below.

5.2.2 Groundwater Storage

Since groundwater levels are used as a proxy for the evaluation of the reduction of groundwater in storage, groundwater level monitoring network is also used to monitor groundwater storage.

5.2.3 Groundwater Quality

Water quality information used for the 2022 GSP and last five annual reports primarily came from State databases and supplemental sampling at GSP monitoring locations. Supplemental water quality sampling over the last five years focused on non-public water supply wells in the GSP monitoring network, for which no State-reported data were available. Results from this supplemental sampling and laboratory reports are provided in Appendix 3b. With the revised approach to evaluating degraded groundwater quality in the 2027 GSP Amendment and the establishment of SMCs discussed in Section 4.4, the water quality monitoring network was also refined. The groundwater quality monitoring network for TDS and nitrate includes 14 wells: 12 within the Pauma Subbasin and two within the Pala Subbasin. The perchlorate

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monitoring network includes a subset of four of these wells, all in Pauma Subbasin. Well locations are shown in Figure 5-3 while well information is summarized in Table 5-1.

5.2.4 Interconnected Surface Water

The current proxy monitoring network for depletion of ISW consists of selected groundwater level monitoring sites located along or near the San Luis Rey River, supplemented by hydrologic context from available surface water data, field observations, and model results. Because there is no active, permanent streamflow gage within the USLR Valley Groundwater Subbasin, the proxy monitoring network does not directly measure pumping-induced streamflow depletion. Instead, an ISW monitoring approach has been established based on groundwater elevations at selected near-river alluvial wells that provide the best available annual indicators of groundwater conditions near potentially interconnected reaches.

The ISW monitoring sites were selected from the broader groundwater level monitoring network based on their location within the alluvial aquifer and proximity to the San Luis Rey River. These wells are intended to serve as proxy monitoring sites for evaluating whether near-river groundwater conditions are declining below historical low conditions in a manner that could increase the potential for depletion of ISW. The current ISW proxy monitoring network includes five wells distributed along the San Luis Rey River corridor: MW-31, MW-13, and MW-33 in the Pauma Subbasin, and MW-42 and MW-43 in the Pala Subbasin, as shown in Figure 5-4. Well information is provided in Table 5-1. These wells provide coverage of key river reaches where existing monitoring access is available, including Pauma Reaches 1 through 3 and Pala Reaches 1 and 3. The ISW monitoring network also incorporates supporting information reviewed as part of annual reporting and periodic evaluations.

5.2.5 Land Subsidence

The USLR Valley Groundwater Subbasin's land subsidence monitoring network uses the DWR statewide InSAR dataset available through the SGMA Data Viewer and related DWR data services. The InSAR data provide vertical ground surface displacement estimates for 100-meter by 100-meter areas derived from satellite data, with a record beginning in 2015 for most areas within the Subbasin and periodic updates over time. This dataset provides a practical and cost-effective means of monitoring subsidence conditions in the Subbasin, particularly because the Subbasin has no active survey monuments, extensometers, or other dedicated ground-based subsidence monitoring infrastructure.

The subsidence monitoring network consists of six representative InSAR points selected to provide coverage of the areas within the Subbasin where subsidence, if it were to occur, would be most likely to develop or would be of greatest management concern (Figure 5-5). Three points were selected in major infrastructure areas: Pala Casino (ACXL41F), Casino Pauma (ACC5IBP), and Harrah's Resort (AB72LLX). Three additional points were selected in the Paleo Lake Pauma area (ACDCDIV, AC2MKN6, and ABOC650), which represents a pumping area within the extent of a documented fine-grained deposit and therefore an area of relatively greater theoretical susceptibility to compaction than the rest of the Subbasin. Together, these locations provide a targeted network that captures the primary areas of infrastructure concern and the area with the greatest apparent geologic susceptibility, while remaining appropriately scaled to a small Subbasin with no known history of significant pumping-induced land subsidence. This monitoring approach is consistent with current DWR guidance.

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5.3 Data Gaps (§354.38(a),(b),(c))

Data availability in the USLR Valley Groundwater Subbasin is limited, both spatially and temporally. Spatially, the majority of data available for evaluation of hydrologic conditions were located in major pumping areas of the Pauma Subbasin, such as the valley area along the San Luis Rey River and between Potrero and Yuima Creeks. Insufficient data control in Pala Subbasin and the alluvial fan areas of Pauma makes it difficult to reliably interpret conditions away from the center of the Pauma Subbasin. Well information associated with what limited data there are is also often unavailable, such as well depth and screening information, which makes it difficult to accurately characterize conditions. This is especially true when two nearby data points are inconsistent with each other and not enough is known about either to determine what factors may be leading to these differences. Other available data sets contained questionable or inaccurate data (such as visible transducer drift) and were unable to be used. Temporally, data frequency is often sporadic or limited to annual measurements, making it impossible to assess seasonal characteristics and trends. Given these significant data gaps, the GSP has identified the importance of additional data collection as a Tier 1 management action going forward (see Sections 6.2.2 and 6.3.1). Addressing data gaps will allow the ~~PVGSA~~ USLRGMA to more accurately and completely understand Subbasin conditions (as they relate to groundwater levels and storage, water quality, and groundwater/surface water interactions), refine estimates of sustainable yield to improve basin management, and track progress towards maintaining sustainability and meeting management objectives.

While the USLRGMA has made some progress towards addressing these data gaps during GSP implementation, data limitations still exist. Specific data gaps as they pertain to general basin characterization and monitoring efforts during the GSP development and implementation phases are discussed in the following sections.

5.3.1 Well Location and Information

Identification of wells in the area involved use of several state and county databases (including DWR Bulletin 91-18, DWR ~~well logs~~OSWCR, CASGEM, GAMA, USGS NWIS, DDW, and San Diego County Department of Environmental Health records), submitted information obtained from data request efforts during the development of the GSP, air photo interpretation, and information included in previous investigations and reports. However, ~~many~~much of the information in public databases ~~are~~ is incomplete or inaccurate. Well locations in particular typically have a high degree of uncertainty associated with them and many are located in the centroid of sections based on State Well Numbers. Well screen information and/or well depth is also often missing, making it difficult to determine which wells might be impacted by changes in shallow groundwater. Well log information is often inaccurate, making it difficult or impossible to match a well log to a well location in order to evaluate lithology and verify well characteristics. In addition, databases and previous records are often lacking an updated well status, meaning a given well may no longer be active or may even have been destroyed and is no longer there.

Available well logs throughout the USLR Valley Groundwater Subbasin were reviewed for the 2027 Periodic Evaluation. Information from the logs was used to refine well locations, catalogue well screen intervals and construction information, and determine depth to bedrock. This information was used to increase understanding of well characteristics, inform the well impact assessment, appropriately modify SMCs for water level, and refine groundwater pumping in the updated model. Well information –

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particularly well locations within the subbasin and well status – will continue to be refined as additional information becomes available. Additional information is needed to verify well locations, identify well type (e.g., agricultural or domestic use), and refine understanding of basin geometry (i.e., depth and geologic layering). A well inventory program has been identified in the Projects and Management Actions section (Section 6.0) to help address this need.

5.3.2 Groundwater Level Data

As discussed above, current groundwater level data are insufficientmake it difficult to reliably characterize certain areas of the USLR Subbasin. The changes made to the groundwater level monitoring network, described above, help improve the spatial coverage of water level measurements, providing additional control and improving the ability to interpret groundwater conditions – particularly within Pauma Subbasin where the majority of monitoring points are available. The USLRGMA has successfully incorporated new monitoring points in previously identified data gap areas, including the area just downgradient of the Rincon Reservation (MW-31; see Figure 5-2), within the alluvial fan area along the western half of the Subbasin (MW-36, MW-37, MW-39, and MW-40), and within a central gap area (MW-38). However, the loss of monitoring locations in upper Pauma Subbasin (MW-1 and MW-2) and lower Pauma Subbasin (MW-26, MW-27, and MW-28) produces new data gap areas in these areas of Pauma. The USLRGMA will continue to look for appropriate replacement monitoring points in these areas. The Rincon Reservation also remains a data gap area.

Some progress was also made addressing water level data gaps within Pala Subbasin, with the addition of MW-42 and MW-43. While these upgradient and downgradient monitoring locations at least provide an indication of gradient through the Pala Subbasin – which includes the Pala Reservation – remains a data gap. Tribal cooperation and data sharing with regards to tribal wells and groundwater levels will be important if the USLRGMA is to evaluate and prevent undesirable results while fully respecting Federal Reserved Water Rights in the Pala and Pauma Subbasins.

The USLRGMA will continue to assess the groundwater level monitoring network and replace wells as needed, or fill in data gap areas as access to new wells becomes available. – primarily in Pala Subbasin, northeast alluvial fan areas of Pauma Subbasin, and southern portion of Pauma Subbasin. These data gaps include tribal areas, areas identified as containing SDACs, potential GDEs, or interconnected surface waters, and domestic well owners. Depending on tribal involvement in the future, additional potential monitoring locations could be added to the monitoring network to provide control in current data gap locations. As data are collected and reviewed, future recommendations may be made to add new monitoring locations or revise the selected monitoring locations. Tribal cooperation and data sharing with regards to tribal wells, tribal surface water diversions, and groundwater levels in the Pala Subbasin will be paramount if the PVGSA is to prevent undesirable results while fully respecting FRWR in the Pala Subbasin.

Within the Pauma Subbasin, a total of 28 wells were monitored for water level during the development of this GSP. The San Luis Rey River flows from the Lake Henshaw basin along the south side of the eastern Palomar Mountain range and then through a fractured crystalline bedrock canyon east of the Pauma Subbasin. It flows into the basin through the Rincon Reservation, entering public lands at the reservation boundary west of the Rincon Ball Fields at roughly latitude 33.273, longitude -116.963. From that point, the first monitoring well location is approximately 2 miles downstream (well MW-6). A monitoring well could be added closer to the reservation boundary to provide a monitoring point near the upstream end

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~~of the San Luis Rey River within the Pauma Subbasin depending on the availability of land for a new monitoring well. RMSs for the evaluation of sustainability management criteria may also need to be added to be representative of domestic, SDAC, tribal, and environmental users.~~

Additional monitoring recommendations are provided in Section 5.5 below to help address some of these data gap areas. The ~~PVGSA~~ USLRGMA is also hopeful that the well inventory program will result in supplemental water level data becoming available through provided records or additional information allowing datasets to be matched to appropriate well locations. Inclusion of a more comprehensive data set for water levels – both spatially and temporally – is critical for understanding general water level conditions throughout the Subbasin (leading to increased reliability of mapped elevations and depth to groundwater), understanding the interaction of groundwater and surface water systems, delineating GDEs, refining sustainability management criteria to ensure they are protective of all groundwater users in the subbasin (including tribal and SDAC areas and shallow domestic wells), and informing management actions.

5.3.3 Groundwater Quality Data

Groundwater quality data is even more limited than groundwater level data. In particular, since there are no public water supply agencies in the Pala Subbasin, apart from the Pala Water Program that does not have to report to the State, very little water quality data is available in that area and almost no recent water quality data. Water quality data is currently restricted to the upper portion of Pala Subbasin, at GSP monitoring wells MW-29 and MW-30. The USLRGMA is exploring the feasibility of collecting water quality at the two former CASGEM wells in Pala Subbasin, which will provide some additional detail of the upper and lower reaches. However, the center portion of the Subbasin remains a data gap area. The Rincon Reservation in Pauma Subbasin also remains a data gap area. The USLRGMA will continue to request available water level and water quality data from stakeholders to support the sustainable management of groundwater resources in the USLR Valley Groundwater Subbasin.~~In addition, the same concerns exist regarding the quality of known data, such as well information. 13 of the wells monitored during the development of the GSP were sampled for water quality. Additional water quality monitoring locations are required to understand water quality conditions in the subbasin.~~

5.3.4 Groundwater Pumping Data

The majority of groundwater pumping records collected for the development of this GSP were from municipal or public water supply entities and agricultural users in Pauma Subbasin. Unrecorded pumping for the rest of the subbasin, including that from tribal-owned lands, was estimated based on land use, crop coverages, and previous studies (refer to Section 3.3.5.3.1) in order to assess groundwater budgets and sustainable yield for the subbasin. Refining these estimates of pumping is important for groundwater management going forward. Therefore, the ~~PVGSA~~ USLRGMA intended~~s~~ to initiate a well inventory and metering program within the first five years of GSP implementation (see Section 6.0). The USLRGMA intended to initiate a well inventory and metering program, but the funding identified for this effort was withdrawn and this project is therefore still pending. The USLRGMA continues to rely on voluntary submission of pumping records in response to data requests sent to Subbasin stakeholders annually. Of particular note, almost no pumping records are available in Pala Subbasin, including within tribal areas, despite repeated requests for information. The Rincon Reservation in Pauma Subbasin also remains a data gap area. Tribal cooperation and data sharing with regards to tribal pumping will be important if the

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USLRGMA is to evaluate and prevent undesirable results while fully respecting Federal Reserved Water Rights in the USLR Valley Groundwater Subbasin. Increased knowledge of Subbasin pumping will allow estimates of sustainable yield to be improved and provide additional information for groundwater model refinement to guide the evaluation of potential management activities.

5.3.5 Interconnected Surface Water Data

Streamflow data is important to evaluate long-term and seasonal changes in surface flow and potential depletions of ~~interconnected surface water~~ISW and impacts on verified GDEs. Historical streamflow gaging data in the subbasin has been very limited. Several USGS gages have existed in the past, but their records are sporadic and narrow. Furthermore, discussions with USGS personnel indicate that many of the available data have high uncertainty associated with them due to the inability to verify weir or channel geometry. There are no current streamflow gages in the Subbasin. Recommendations for the establishment of streamflow gaging station(s) are provided in Section 5.5 below. At a minimum, monitoring stations could be set up at the upstream end, downstream end, and between the Pala and Pauma Subbasins.

The lack of streamflow data, combined with limited data providing resolution of groundwater conditions near surface water, prevent direct confirmation of model-estimated depletion volumes and limit the ability to independently evaluate annual ISW depletion conditions or delineate GDEs. Accordingly, the current ISW monitoring network presented in Section 5.2.4 will be refined as additional data, access, and funding become available. Future improvements to the ISW monitoring network are expected to focus on increasing data resolution in priority reaches, particularly in the Pala Subbasin and other areas where the model indicates greater potential for pumping-induced depletion.

Additional projects and management actions are included in this 2027 GSP Amendment to improve the monitoring network for ISW. These actions include pursuing funding for a permanent or semi-permanent stream-stage or streamflow gage in the Pala Subbasin, investigating potential alternative or additional monitoring sites along priority reaches (especially within Pala Subbasin), installing transducers in wells used to monitor ISW, conducting recurring field observations of standing water and wetted channel extent, and evaluating the potential use of remote sensing or aerial imagery tools to assess riparian vegetation as an indicator of surface water and shallow groundwater. These improvements, which are discussed in more detail in Section 6.3 below, are intended to support future refinement of the ISW monitoring network and, if sufficient data become available, development of a more direct depletion-volume SMC framework during future periodic evaluations. Due to the data resolution issues, data gaps associated with ISW should take funding priority for monitoring network improvements.~~contribute to the inability to identify gaining and losing reaches in the subbasin (and therefore determine interconnectivity of surface water with underlying groundwater) and delineate GDEs.~~

Because groundwater dependency has not been field verified and the monitoring network does not yet include sufficient streamflow or shallow groundwater data, the evaluation of potential GDE effects remains a data gap to be addressed through future monitoring and model refinement. The USLRGMA will revisit the potential GDE evaluation as additional monitoring data, field observations, and model results become available. If future data indicate that mapped potential GDE areas are supported by groundwater from the Subbasin and are sensitive to pumping-induced streamflow depletion or shallow groundwater

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declines, the USLRGMA will consider whether additional monitoring, SMC refinements, or management actions are warranted. However, the GSA is not aware of any adverse impacts to ISW or potential GDEs.

5.4 Evaluation of Sustainability Indicators (§354.34(c))

5.4.1 Chronic Lowering of Groundwater Levels

Groundwater in the USLR Subbasin occurs primarily in alluvium under unconfined conditions. The existing monitoring network provides adequate data to understand the unconfined nature of the Subbasin and to evaluate over time whether changes in groundwater levels are occurring and to what magnitude. On-going groundwater monitoring during implementation of the GSP will be conducted at least semi-annually in the spring and fall to represent high and low groundwater conditions, respectively. In particular, *static* groundwater elevations in spring and fall will be used to evaluate potential exceedance of Minimum Thresholds (MTs) and progress towards Measurable Objectives (MOs) and Interim Milestones (IMs) presented in Section 4.0 (Sustainable Management Criteria).

5.4.2 Reduction of Groundwater Storage

Because the aquifer in the USLR Subbasin is generally unconfined, and the size and shape of the Subbasin is generally understood, changes in water levels will allow evaluation of changes in groundwater storage in the Subbasin. Overall, declining groundwater levels would suggest a negative change in storage and vice-versa. However, pumping and groundwater level data collected ~~over the first five years of~~during GSP implementation will be used to periodically refine and recalibrate the groundwater model, ~~-~~which in turn will be used to reevaluate and plot the annual ~~-~~change in storage.

5.4.3 Degraded Water Quality

Elevated nitrate and perchlorate ~~is~~are known to be detected in some portions of the Subbasin, particularly within the Upper Pauma Nitrate/Perchlorate-Affected Area. As previously stated, the ~~existing~~ water quality monitoring network was developed to provide sufficient coverage within the Subbasin (using existing wells), and certain wells were chosen for the monitoring network because they have historic monitoring and/or water quality data that assists in evaluating trends in groundwater conditions over time or provide coverage in key areas. Routine groundwater-quality monitoring will be conducted annually during the fall monitoring event. The USLRGMA will work with public water suppliers to determine whether or not they plan to submit water quality data to the State for any given year. Supplemental sampling by the USLRGMA will occur in years for which water quality for the designated monitoring wells will not be submitted and available online. Where multiple water quality results are available within a given year, an average annual concentration will be evaluated.

Annual monitoring is appropriate for the Subbasin because the constituents of concern — TDS, nitrate, and perchlorate — are expected to vary primarily over multi-year periods in response to recharge, pumping, irrigation return flows, imported water use, and septic loading, rather than requiring seasonal characterization for purposes of SGMA compliance. The USLRGMA may conduct additional confirmation or focused sampling if an RMS exceeds an MT, if a sentinel well detects perchlorate where it was previously non-detect, if data quality concerns are identified, or if available DDW data are insufficient for GSP reporting. Temporary increased monitoring will not be construed as a permanent expansion of the

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monitoring program unless adopted through a future GSP update or periodic evaluation.~~Implementation of the GSP will include continued periodic groundwater sampling (semi-annual, as stated above) and collection of data throughout the basin (using the existing network and possibly with additional wells added, see Section 5.5 below) in order to analyze trends in concentrations of constituents of concern, such as nitrate.~~

Where increasing TDS or nitrate trends are observed, the GSA will evaluate the trend relative to groundwater levels, pumping patterns, imported-water use, land use, well construction, and available water-quality data. Increasing trends will be used as early-warning and management triggers. A SGMA undesirable result will be determined only when the quantitative criteria established in the GSP are met and the condition results in significant and unreasonable effects on beneficial uses and users.

5.4.4 Depletions of Interconnected Surface Water

The ISW SMC framework presented in Section 4.5 uses a groundwater level proxy, supported by model-estimated depletion and a monitoring improvement plan. The model-derived depletion analysis is the current technical basis for identifying the location, timing, and quantity of depletion and supports the future path toward establishing more formal ISW SMCs based on a rate or volume of surface water depletion caused by groundwater use. However, due to limited data and uncertainty, meaningful volume-based SMCs that can be reasonably evaluated on an annual basis are unable to be supported by available monitoring data. Therefore, use of SMCs associated with an ISW proxy water level monitoring network provides the best quantitative solution for annual assessment while additional monitoring points are established.

The revised ISW SMCs are appropriate given available information, but they should be considered adaptive. Important data gaps remain, as detailed above. Accordingly, annual reports will use a weight-of-evidence approach that considers supporting hydrologic data, including WY type, estimated groundwater pumping, streamflow at the Oceanside gage (USGS Gage 11042000), field observations, and any complaints or other evidence that may indicate potential effects on ISW. Annual precipitation and WY type provide important context for interpreting ISW conditions because streamflow in the Subbasin is strongly controlled by precipitation and runoff. Lower surface flow is expected during dry years, with lower rates of ISW depletion, and higher surface flow and ISW depletion are expected during wet years. Though the ISW modeling analysis does not indicate a reliable direct relationship between total annual subbasin pumping and modeled annual depletion, groundwater pumping provides important management context because pumping and groundwater level decline are the primary mechanisms by which groundwater use could increase ISW depletion. Observed flow at the downstream USGS San Luis Rey River at Oceanside gage represents the only gage along the San Luis Rey River and has a long period of record. While it provides a regional hydrologic context, it cannot be used to directly assess ISW depletion because it is located approximately 15 miles downgradient of the Subbasin and is affected by groundwater management and use in the intervening reaches (Bonsall and Mission Subbasins), which is outside the jurisdiction of the USLRGMA. Official complaints submitted to the USLRGMA or the Water Board alleging the inability of downstream senior water rights holders to divert sufficient surface water may provide important context for evaluating whether and when significant and unreasonable effects

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have been observed or reported because of groundwater management in the USLR Valley Groundwater Subbasin, though the absence does not necessarily by itself demonstrate that ISW impacts are absent.

A more detailed quantitative comparison to the model-derived ISW SMCs will occur during the next periodic evaluation and model update.The monitoring network will include collection of surface flow and water level data. At a minimum, such data should be collected at the downstream end of the Pala Subbasin, possibly from an existing gauging station. Streamflow monitoring will facilitate evaluation of seasonal and on-going flow along the San Luis Rey River. The monitoring plan will include evaluation of historic and current river/stream flow as compared with historic and current climatic indicators (temperature and rainfall), and historic (to the degree known) and current fluctuations in groundwater levels in the basin.

5.4.5 Land Subsidence

A relatively shallow alluvial aquifer composed primarily of boulders, cobbles, sand, and silt derived from nearby granitic rock highlands is not expected to undergo subsidence. For the purposes of the GSP, potential land subsidence will be evaluated annually using DWR-provided InSAR data at the selected proxy monitoring points identified above. Any apparent InSAR displacement will be evaluated for persistency, association with groundwater level decline, spatial confirmation over approximately 20 acres (or nine InSAR cells), location relative to critical infrastructure, or association with non-groundwater related causes. This may include apparent displacement caused by construction, grading, slope movement, shallow soil processes, vegetation or atmospheric artifacts, measurement noise, or other non-groundwater-related causes. Similarly, elastic seasonal ground surface movement that does not represent permanent inelastic compaction is not considered an undesirable result. This approach reflects the management objective of avoiding permanent compaction of aquifer materials and avoiding damage or interference with infrastructure and other land uses. Groundwater level data will provide supporting context for the InSAR evaluation. As with seawater intrusion, the monitoring network will not include components specifically designed to monitor possible land subsidence. However, conditions within the basin will be evaluated, including reviewing DWR-provided InSAR data from the SGMA portal and/or any physical observations that might suggests local subsidence, during the annual and five-year reporting periods. If evidence for subsidence develops during each subsequent five-year reporting period, the development of sustainability goals will be revisited.

5.4.55.4.6 Seawater Intrusion

The western end of the Pala Subbasin (western end of this project area) is approximately 17 miles from the nearest approach of the Pacific Ocean coastline near the town of Oceanside. Within the Pala and Pauma Subbasins, based on well information, the alluvium is understood to be up to approximately 600 feet deep in Pauma Valley and 240 feet deep in the Pala Subbasin, overlying crystalline rock of the Southern California Peninsular ranges batholith. Given the relatively shallow depth of alluvium in the Subbasin and distance to the ocean, seawater intrusion is considered to be a highly unlikely undesired result of groundwater extraction in the Subbasin. Therefore, the monitoring program does not include a component to evaluate seawater intrusion. The absence of seawater intrusion will be verified in the five-year reportduring periodic evaluations.

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~~5.4.60.1.1 Land Subsidence~~

~~A relatively shallow alluvial aquifer composed primarily of boulders, cobbles, sand, and silt derived from nearby granitic rock highlands is not expected to undergo subsidence. As with seawater intrusion, the monitoring network will not include components specifically designed to monitor possible land subsidence. However, conditions within the basin will be evaluated, including reviewing DWR provided InSAR data from the SGMA portal and/or any physical observations that might suggests local subsidence, during the annual and five year reporting periods. If evidence for subsidence develops during each subsequent five year reporting period, the development of sustainability goals will be revisited.~~

5.5 Recommended Changes to the Monitoring Networks

Based on the data collected and incorporated into this GSP, and the conditions of the existing monitoring networks, the following recommendations are presented. Many of these recommendations also represent identified projects and are discussed further in Section 6.3.

- Groundwater Level **Monitoring Well Network**
  - ~~New well: As discussed in Section 5.3.2 (above), a monitoring well could be added close to the Rincon Reservation boundary (near coordinates latitude 33.273, longitude -116.963) to provide a monitoring point near the upstream end of the San Luis Rey River within the Pauma Subbasin.~~Incorporation of monitoring wells within reservation areas: The main data gaps remaining for the GSP groundwater level monitoring data represent tribal lands, particularly within the Rincon and Pala Reservations (see Figure 5-6). Potential monitoring points within these areas would significantly improve the ability to assess sustainability efforts across the entire USLR Valley Groundwater Subbasin to confirm appropriate SMCs are in place to protect beneficial use and ensure federally reserved water rights are being respected.
  - Existing well(s):
    - USGS well: There is indication that a USGS well (USGS-331957116584601) may be present along the northeastern boundary of the Pauma Reservation near Pauma Reservation Road. If this well is present and accessible, it may be added to the monitoring network to provide data within the northern portion of the Pauma Subbasin.
    - CASGEM wells: Several wells formerly included in the California Statewide Groundwater Elevation Monitoring (CASGEM) Program are located within the Pala and Pauma Subbasins. Three of these four wells have already been incorporated into the USLR Valley GSP monitoring network and available ~~H~~historical data ~~from these wells should be~~have been obtained. The USLRGMA has requested access to the WG-1 well in upper Pala Subbasin.~~and used in the evaluation of long-term effects of groundwater extraction in the basin, and i~~If this well becomes accessible, ~~these wells should be evaluated for~~it will be includedsion in the monitoring network for future monitoring.
  - Network Refinement: During the course of implementation of the GSP, the monitoring network will be periodically re-evaluated and refinements will be made to improve the effectiveness and efficiency of the well network. This may involve adding wells in areas where

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additional data is needed, or removing wells from the network where adequate data may be obtained from fewer wells than are currently in the network. In addition, RMSs for the evaluation of sustainability management criteria may also need to be added to be representative of shallow domestic, SDAC, tribal, and environmental users.

- **Groundwater Quality Monitoring Well Network**
  - Incorporation of monitoring wells within reservation areas: As with water level, water quality data within tribal lands is limited to non-existent. Potential monitoring points within these areas (see Figure 5-6) would significantly improve the ability to assess sustainability efforts across the entire USLR Valley Groundwater Subbasin to confirm appropriate SMCs are in place to protect beneficial use and ensure federally reserved water rights are being respected.
  - Network Refinement: As with the water level monitoring network, the water quality monitoring network will be periodically re-evaluated and refined as necessary. One noted data gap for potential refinement is in the lower Pauma Subbasin, downgradient of MW-25, which has observed perchlorate. Nearby wells downgradient of MW-25 are limited and not available for monitoring. The USLRGMA should therefore evaluate DDW-reported data from wells that currently report perchlorate to the State, when available, to identify new detections or material changes in downgradient concentrations, and incorporate additional monitoring points should they become available.
- **Interconnected Surface Water Monitoring Network**
  - Stream and Surface Flow Gauging: At a minimum, stream and surface flow gauging data should be collected at the upstream and/or downstream end of the Pala Subbasin. There is indication that a stream gauging station already exists in this location. If that station cannot be located and/or accessed, then a stream gauging station should be established and used for future monitoring of streamflow to facilitate evaluation of seasonal and on-going flow along the San Luis Rey River and provide necessary information for the evaluation of the depletion of ISW.
  - Addition of Wells in Proxy Monitoring Network: The current groundwater level poxy monitoring network for ISW consists of five wells completed within the principal alluvial aquifer and in close proximity to the San Luis Rey River. These wells provide coverage of key river reaches where existing monitoring access is available, including Pauma Reaches 1 through 3 and Pala Reaches 1 and 3. An additional existing monitoring point should be pursued to provide resolution relative to Pala Reach 2.
  - Dedicated Monitoring Locations: The feasibility of installing dedicated monitoring points, such as piezometers or shallow PVC monitoring wells, throughout the Subbasin that could provide near-river information for the evaluation of ISW and GDEs (i.e., shallow groundwater level data).
  - Installation of Transducers: To better understand the response of near-river water levels to precipitation and streamflow events, pressure transducers should be installed in wells being used to monitor conditions relative to ISW. Priority should be granted to monitoring locations

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within the Pala Subbasin where model results indicate greater groundwater/surface water interconnectivity.

- Collection of Field Observations: Recurring field observations of surface water conditions should be initiated along the San Luis Rey River to document the presence or absence of surface water, standing or ponded water, wetted channel extent, and visible flow conditions. Field observations may include standardized photo points, GPS documentation of wetted or dry channel segments, notes regarding recent precipitation or stormflow, and observations of riparian vegetation condition. These observations would not replace a streamflow gage or provide direct measurement of pumping-induced depletion, but would improve the understanding of seasonal surface water patterns, support the annual interpretation of modeled ISW depletion, and provide additional information for future periodic evaluations and SMC refinement.
- Riparian Habitat: ~~With the potential that riparian habitat exists along the San Luis Rey River within the Pala and/or Pauma Subbasins, the existence of such habitat should be evaluated and, if such habitat is found to exist within the subbasins, monitoring should be conducted to evaluate the condition of such habitat and how that condition informs the sustainability goals and criteria in the GSP.~~ The feasibility of utilizing remote sensing, aerial imagery, infrared or near-infrared imagery, vegetation indices, and/or related geospatial tools to support future assessment of surface water conditions along the San Luis Rey River should be considered as an alternative form of shallow groundwater monitoring and provide additional information in data gap areas.

~~California Irrigation Monitoring Information System (CIMIS) precipitation station: Establishing and utilizing a local CIMIS station would provide more accurate evapotranspiration (ET) estimates and other climatic data for the USLR Subbasin microclimate. This would allow agricultural users in the subbasin to adjust their irrigation system timing – leading to increased efficiency and reduced water demand, as encompassed within the agricultural management plan and best management practices.~~

~~Riparian Habitat: With the potential that riparian habitat exists along the San Luis Rey River within the Pala and/or Pauma Subbasins, the existence of such habitat should be evaluated and, if such habitat is found to exist within the subbasins, monitoring should be conducted to evaluate the condition of such habitat and how that condition informs the sustainability goals and criteria in the GSP.~~

5.6 Sampling and Analysis Plan (SAP)

The groundwater monitoring program outlined in this SAP presents a standard methodology for the collection of data in sufficient quantities and of adequate quality to enable informed decisions regarding Subbasin conditions. It also outlines all field sampling procedures (groundwater level measurement and water quality sample collection methodology), Quality Assurance and Quality Control (QA/QC), and reporting procedures to be used for the GSP monitoring program. The data collected from that monitoring

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effort will allow the GSA to demonstrate measured progress toward achieving the sustainability goals set forth in the GSP and inform management decisions.

5.6.1 Monitoring Frequency (§354.38(e))

The scale and frequency of the monitoring effort was considered so that monitoring events would provide a cost-effective means to characterize groundwater conditions (i.e., groundwater elevation and water quality) following implementation of the GSP. Static groundwater levels ~~and water quality~~ will be measured twice per year: once in the spring and once in the fall, to represent seasonal high and seasonal low, respectively. Supplemental water quality sampling for those monitoring wells not reporting to the State will be conducted each fall. Additional monitoring events may be conducted on an as needed basis to monitor areas of interest, provide adequate detail regarding site-specific surface water and groundwater conditions and to assess the effectiveness of management actions. This includes potential exceedances of MTs, highly variable spatial or temporal conditions, and adverse impacts to beneficial uses/users of groundwater.

5.6.2 Monitoring Protocols (§354.34(i))

Per SGMA, a GSP must contain monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem (~~not considered a threat in the USLR Groundwater Subbasin~~provided through DWR InSAR data), and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin. Monitoring protocols discussed below have been developed to ensure efficient, accurate, and consistent data collection through the course of the monitoring program.

5.6.2.1 Water Level Monitoring

~~Attached~~ Table 5-~~4~~ 1 lists the group of monitoring wells included in the ~~initial~~ GSP water level monitoring network. Water level monitoring well locations are shown on Figure 5-1. Any updates to the monitoring network (refinement of monitoring location, inclusion of additional monitoring location(s), etc.) will be discussed in future ~~the five-year report~~Periodic Evaluations.

Prior to taking water level measurements, well totalizer readings will be recorded on the field monitoring form, along with noting any nearby pumping wells (i.e., within eyesight, or approximately 100 yards). Groundwater level measurements should be made using an electric water level sounder calibrated to the nearest 0.01 ft. Measurements will be made to the nearest 0.01 ft relative to an established reference point (RP) at the top of each well casing (or sounding tube). Existing survey data for well RP elevation will be available in the monitoring database. If the well does not have an existing reference point elevation, the well will be surveyed and added to the database.

Depths to groundwater will be compared, in the field, to previous measurements and remeasured if significantly different. Groundwater level measurements will be recorded using a permanent ink pen on appropriate field forms. Depth to groundwater measurements will be converted to groundwater elevations (above mean sea level [amsl]) by subtracting the depth to water from the known RP elevation. Whenever possible, water level measurements from all the monitoring wells shall be collected within a

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24-hour period. Personal Protective Equipment (PPE) to be worn while performing this task consists of modified nitrile gloves.

Since many of the wells in the monitoring network represent active pumping wells, the sampling team will need to coordinate with well owners prior to a water level monitoring event so that readings may be representative of static water level conditions. If possible, it is recommended that wells be measured after a period of no pumping to allow local water levels to recover (e.g., coordinate well shut off the night before and measure water levels the next morning). The recovery time will vary from well to well and the sampling team will work with the well owner to ensure that water levels used for the evaluation of sustainability criteria represent static conditions.

5.6.2.2 Water Quality Sampling

~~Attached~~ Table 5-~~4~~1 lists the group of monitoring wells included in the ~~initial~~ GSP water quality monitoring network. Water quality monitoring well locations are shown on Figure 5-~~2~~3. Any updates to the monitoring network (refinement of monitoring location, inclusion of additional monitoring location(s), etc.) will be discussed in future Periodic Evaluations~~the five-year report~~. DDW-reported TDS, nitrate, and perchlorate data from monitoring network wells will be used when available. Supplemental USLRGMA sampling will be conducted, as needed, during the fall monitoring event when DDW data are not available for a given year, when a required constituent is not included in DDW reporting, or when confirmation, follow-up, or sentinel monitoring is needed following an exceedance or management trigger.

The primary goal of groundwater quality sampling is to collect representative water samples to evaluate and track potential groundwater quality degradation. Water quality analysis can be compromised by field personnel in two primary ways: by collecting samples that are not representative of the aquifer to be tested, and by improperly handling the sample after collection. For these reasons, water quality samples should be collected by personnel thoroughly trained in the proper techniques and procedures as detailed below. National guidelines for groundwater sampling are described by the United States Environmental Protection Agency (USEPA) in the *Field Sampling Guidance Document #1220 – Groundwater Well Sampling*. Additionally, procedures, methods and guidelines specific to California standards are described in California Code of Regulations (CCR), Title 22, Social Security, Chapter 15, *Domestic Water Quality and Monitoring*.

Prior to collecting groundwater samples, the following activities should be performed:

- Review of the SAP
- Assembly of proper sampling equipment and forms
- Decontamination of purging and sampling equipment
- Calibration of field instruments following the manufacturer's instructions

5.6.2.2.1 Decontamination Procedures

Decontamination is a requirement to eliminate the transfer of contaminants from one groundwater monitoring well to another and protect the health and safety of personnel who may come in contact with equipment. All equipment must be decontaminated prior to use and between wells. Decontamination procedures described herein shall be performed at the beginning of each day of field work, between each well, at the end of each day of field work and whenever the equipment is suspected of having been

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contaminated. A simple triple-rinse system is utilized to decontaminate the water level meter and any other piece of equipment prior to installation into a monitoring well. The triple-rinse system consists of non-phosphate soap solution followed by tap water rinse and final rinse with deionized (DI) water. Submersible pumps, if needed for sampling, are decontaminated by allowing the impellers to run and recirculate while immersed in a non-phosphate solution followed by immersion in a DI or distilled water baths. The final rinse of any equipment entering a monitoring well should be performed with de-ionized or distilled water.

5.6.2.2.2 Well Purging

Properly purging, or removing stagnant water from, a well ensures that the water tested is as closely representative of the in-place groundwater as possible. Because standing water in a monitoring well is typically in contact with the atmosphere, it may not be representative of the surrounding aquifer conditions. Contact with the atmosphere allows influx of atmospheric oxygen, changing the reduction/oxidation (redox) potential of groundwater, and hence, the solubility of certain dissolved species. It should be noted that purging may induce stresses that can bring small particles into suspension and draw them into the monitoring well.

Common purging equipment for groundwater monitoring wells include pumps (peristaltic, positive-displacement, or submersible), bailers, and in-situ devices. All pumping equipment should also be operated at reduced flow rates during purging and sample collection to avoid as much agitation as possible. Since the selected monitoring wells ~~for the basin monitoring during development of the GSP~~ consist primarily of existing, operable wells with dedicated pumps, submersible sampling pumps should not be necessary[28]. In addition, since sampling will be conducted on operating wells, no pump to waste should be necessary.

For inactive wells (non-pumping), to ensure that representative groundwater samples are collected, a minimum purge volume of three (3) and up to a maximum of five (5) times the volume of standing water in the well should be removed. For active pumping wells, purging should continue a minimum of 15 minutes to allow consecutive water quality field parameters measurements, as detailed below.

During the purging process, water quality field parameters should be monitored for stabilization, as detailed in the table below.

[28] If, at any time ~~during the initial monitoring period,~~ pumps are removed from selected monitoring wells, a submersible pump should be used to collect necessary water quality samples. The pump should be lowered into the well and suspended immediately above the screen interval of the well using a cable marked and measured so that the pump intake is not lowered past the target depth. It is important that all submersible pumps are equipped with a check-valve between the pumping unit and tubing, to ensure that water cannot flow back into the well at the event of a power outage/surge or pump failure, causing agitation of the source water. Additionally, it is important that all components of the pump that will be in direct contact with the sample water be constructed of inert materials (i.e., stainless steel, or glass), to ensure that truly representative samples are collected. Groundwater in contact with pump components that are not constructed of inert materials may not yield representative water quality results as trace metals can be introduced, thereby changing the physical or chemical properties of the water sampled.

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Table 5-2~~1~~. Purged Groundwater Stabilization Criteria for Water Quality Indicators

Parameter	Criteria
pH	+/- 0.1
SEC	+/-3 - 5%
ORP	+/- 20 mV
Turbidity	+/- 10% (or <10 NTUs)
DO	+/- 0.2 mg/L

Notes:
- SEC = specific electrical conductance
- ORP = redox potential
- DO = dissolved oxygen
- mV = millivolts
- NTU = nephelometric turbidity units
- mg/L = milligrams per liter

Should water quality parameters not stabilize after the removal of three well volumes, additional well volumes may be removed. The following table provides the casing volumes of commonly sized monitoring wells.

Table 5-3~~2~~. Well Casing Diameter vs. Volume

Well Casing Diameter [inches]	Volume [gal/ft]
6	1.469
8	2.611
10	4.286
12	6.122
14	7.996
16	10.444
18	13.218

In order to reduce unnecessary runtime of private or active pumping wells being used for water quality monitoring, it is suggested that water quality sampling be made on a later date than water level monitoring events. The sampling team could therefore coordinate with well owners to sample the monitoring wells while they are being operated and therefore already be sufficiently purged (i.e., have been pumping for a minimum of four hours prior to water quality sampling).

5.6.2.2.3 Monitoring of Field Parameters

During the purging process, a handheld multi-parameter meter should be used to continuously monitor changes in, at a minimum, pH, specific electrical conductance (SEC), turbidity, and temperature. Other

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commonly monitored water quality constituents include redox potential (ORP) and dissolved oxygen (DO) in the groundwater. There is no set criterion for the number of measurements to be taken to determine stability. Generally, measurements should be taken every 15 minutes during purging, however, measurements must be taken more frequently if the purge volume is low.

For active pumping wells, these field parameters should be measured at the start of purging and approximately every 15 minutes until stable or until approximately five well volumes have been purged. For inactive wells, parameters will be measured at the start of purging, at removal of each well volume up to three volumes, and if not stable at three volumes, then approximately every ½ volume thereafter until stable or until approximately five well volumes have been purged. After the volumetric purging requirement has been met, and all field parameters have stabilized, groundwater samples can be collected.

For active production wells, the sampling team and applicable parties will coordinate and allow for a minimum of four hours pumping prior to collecting samples. Even if a well has been pumping a sufficient period of time, field parameters should still be checked prior to sampling.

If the groundwater monitoring well has a slow recharge rate, then a slower purge rate must be implemented to ensure that three casing volumes have been evacuated. In situations where groundwater monitoring wells are pumped dry (regardless of whether three casing volumes have been removed from that well or not), an adequate purge volume is assumed and, following recovery, groundwater samples can be collected. In these cases, the water chemistry dictates the appropriateness of sample collection. A minimum of four measurements showing consistent parameters from the recovered volume constitutes stability. Once observed and reported to show consistency, the well can be sampled during the next groundwater recharge (US EPA, 2004).

5.6.2.2.4 Sample Collection, Preservation, and Containers

Groundwater samples shall be collected immediately following the purging activities described above. Sampling personnel must wear new nitrile gloves during sampling events and must replace and discard nitrile gloves between purging and sampling of subsequent wells. Samples prepped for analysis should be collected directly from the dedicated sampling port into appropriate laboratory-cleaned containers with Teflon®-free lined caps (when required) and labeled for identification.

The following guidelines should be followed when transferring groundwater from the sampling device into the proper container:

- Sample containers should not be opened until immediately prior to filling.
- The insides of sample containers should not be touched.
- Sampling containers will be filled slowly and with minimal aeration with the pump.
- Sampling containers will not be overfilled, as this can result in the loss of preservative.
- Sampling containers will be filled completely without bubbles or headspace unless specified by the lab.
- Sampling containers will be filled as expeditiously as possible to minimize the time between filling the first sample container and the last.

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- Immediately after collection, water quality samples should be placed in a cooler and be maintained at a temperature of 39.2 degrees Fahrenheit (4 degrees Celsius) until they are delivered to the water quality laboratory performing the analysis.

The type of bottles, preservatives, holding times, and filtering requirements depend on the type of laboratory analysis required. Sampling personnel are advised to review the proposed schedule of analysis for each monitoring point with laboratory staff prior to the start of fieldwork, in order to assure that the proper bottles/containers, preservatives, holding time, and filtering procedures are in order.

Groundwater samples will be analyzed for the following general mineral and physical constituents along with selected inorganic parameters, according to each well's identified constituent(s) of concern:

Table 5-~~4~~3. Water Quality Sampling Analytical Suites and Approved Methods

Constituent	Method
Physical Properties	
Oxidation-Reduction Potential (Field)	Field Meter - Myron L 6PII
pH (Field)	Field Meter - YSI Pro Plus
Turbidity (Field)	Field Meter - Hach 2100P
Temperature (Field)	Field Meter - YSI Pro Plus
Dissolved Oxygen (Field)	Field Meter - YSI Pro Plus
General Minerals and Inorganic Chemicals	
~~Alkalinity~~	~~SM 2320B~~
~~Aluminum by ICP~~	~~EPA 200.7~~
~~Arsenic by ICPMS~~	~~EPA 200.8~~
~~Chromium by ICPMS~~	~~EPA 200.8~~
~~Dissolved Boron by ICP~~	~~EPA 200.7~~
~~Dissolved Calcium by ICP~~	~~EPA 200.7~~
~~Dissolved Chloride~~	~~EPA 300.0~~
~~Dissolved Iron by ICP~~	~~EPA 200.7~~
~~Dissolved Manganese by ICPMS~~	~~EPA 200.8~~
Dissolved Nitrite	EPA 300.0
Nitrate as N (NO3-N)	EPA 300.0
~~Dissolved Potassium by ICP~~	~~EPA 200.7~~

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Constituent	Method
Dissolved Sodium by ICP	EPA 200.7
Dissolved Sulfate	EPA 300.0
Hardness Package	Varies
Nitrate + Nitrite Package CalcNitrate + Nitrite (as N)	VariesEPA 300.0
Perchlorate	EPA 314.0
Specific Conductance	SM 2510B
Total dissolved Phosphorous	SM 4500P B E
Total Filterable Residue/Total dissolved solidsTDS	SM 2540C
Zinc by ICPMS	EPA 200.8

After the two water quality sampling events proposed during GSP development, tThe suite of analytes, along with all available water quality data, will be reviewed during each Periodic Evaluation to determine if all the analytes are required for future sampling under implementation of the GSP, or if other analytes should be added (e.g., organic compounds)modifications should be made for continued GSP implementation. The water quality analytical work will allow on-going evaluation of potential water quality changes occurring in the Subbasin in relation to identified GSP sustainability indicators and objectives.

5.6.2.2.5 Sample Handling and Documentation

Each containerized groundwater sample should be immediately stored in an ice chest or cooler and transported under proper chain-of-custody (COC) protocol to a State-certified laboratory for analysis. Because of their prior experience in the basin, it is proposed that Babcock Clinical Laboratories Laboratory of San Bernardino be used for analytical testing. The COC should be filled out completely by the field personnel responsible for sample collection and be maintained up to date throughout the sampling event. The COC should also include water quality field parameters recorded at the time of sample collection. Samples should be submitted to the laboratory well before their holding time is over, and ideally submitted less than 24 hours from the time of collection (i.e., same day, if possible, due to the actual time of day the sample is collected).

5.6.2.2.5.1 Field Documentation

A field data sheet with recorded purging parameters should be completed and stored in a site logbook. Example field forms are provided as Appendix 5a and Appendix 5b for water level and water quality monitoring events, respectively. Additional information to be recorded will include, but not necessarily limited to, the following:

- Date and time of fieldwork
- Monitoring point identification and location

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- Summary of daily activities including time of arrivals/departures of Field Technician and/or other visitors to the sampling site(s)
- Weather conditions
- Well totalizer reading
- Note of any nearby wells actively pumping (i.e., within eyesight, or approximately 100 yards)
- Any deviations from the associated work plan or this SAP
- Sample date, time, types, numbers, and quantities
- Sample container preservation steps performed (if required)
- Sampling equipment used
- Decontamination steps performed
- Calibration and maintenance performed
- Multi-meter manufacturer and model number and serial number
- Monitoring point screened interval(s)
- Measured depth to groundwater within well casing(s)
- Calculated casing volume based on depth to the groundwater
- Purge method, device, frequency and discharge rate
- Measured water quality parameters
- Sample collection time, method, and device
- Confirmation that COC forms were properly completed and sample custody transferred in accordance with this SAP

5.6.2.2.5.2 Sample Identification and Labeling

Unique sample numbers must be assigned to identify and describe each groundwater sample collected in the field. Samples should be identified and tracked by sample point number where the sample originated and the date the sample was collected. For example, a sample collected from monitoring well MW-1 on March 4, 2021, at 2:30 pm would be identified as "MW-1-210304-1430." Trip blanks should be identified using the sample ID assigned by the laboratory. Duplicate samples should be identified in the same way regular samples are identified (i.e., SAMPLE POINT ID-DATE-TIME) but they will be identified as duplicates in the sampler's notes. Each sample container will be clearly labeled using an indelible permanent ink pen on waterproof adhesive labels.

Each sample container will contain the following information:

- Project name
- Project number
- Site/project location
- Sampling point ID (i.e., MW-1)
- Date and time of collection
- Name of the sampler(s)
- Any preservatives added or present in container
- Analysis to be performed

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5.6.2.2.5.3 Chain-of-Custody Procedure

The COC procedure provides a record of the possession and handling of individual samples from the time of collection in the field to receipt by the laboratory for analysis. The field COC record is used to record the custody of all samples collected and maintained by sampling personnel. All sample sets shall be accompanied by a COC. This record documents transfer of custody of samples from the sampling personnel to another person, to the laboratory. The COC also serves as a sample logging mechanism for laboratory personnel. The COC form shall contain the following information:

- Individual sample identification
- Name and signature of sampler(s)
- Project manager and contact information
- Sample collection time(s)
- Sample matrix
- Sample preservative(s)
- Total number of sample containers
- Chain-of-custody record
- Analyses to be performed

5.6.3 Quality Assurance and Quality Control (QA/QC)

QA/QC procedures are important to verify that measured water level and quality data are accurate and representative of actual Subbasin conditions. Therefore, water quality sampling will follow a set of rigorous QA/QC procedures. Many of these procedures are incorporated in the monitoring protocols outlined above to ensure the accurate and reliable collection of water level and water quality data.

In addition, field quality control (QC) samples will be collected and analyzed to assess the consistency and performance of the groundwater sampling activities. QC samples for the sampling program will include field duplicates, equipment blanks, and trip blanks. As part of the water quality analysis, the laboratory will be required to run QA/QC per the method requirements and provide a QA/QC report for each analytical method.

General quality assurance (QA) procedures include documenting field data sheets within site logbooks, and operating instrumentation in accordance with manufacturer instructions, specification, and work plans.

5.6.3.1 Field Duplicates

Field duplicates consist of two samples (an original and a duplicate) of the same matrix that are collected at the same time from the same sampling point. Field duplicate samples are used to evaluate the precision of the overall sample collection and analysis process. Field duplicates shall be collected at a frequency of 1 per 10 regular samples and will be analyzed for the full set of analyses requested for the original sample. Exact locations of duplicate samples and sample identifications shall be recorded in the sampler's field notes.

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5.6.3.2 Equipment Blanks

Collection and analysis of field equipment blanks (EBs) are provided as QC checks of the integrity and effectiveness of field equipment decontamination procedures. Equipment blank samples are prepared by rinsing field sampling equipment, such as a multi-meter, with deionized water and collecting the rinsate in sample bottles. EB samples are assigned unique sample numbers so as to not be identified by the laboratory as EB samples. One EB sample shall be collected for every day of sampling when using non-dedicated equipment to collect groundwater samples. The EB samples will be analyzed for the same compounds as those analyzed for the regular groundwater samples.

5.6.4 General Field Equipment

The following is a list of, at minimum, the general field equipment and supplies used during monitoring and sampling:

- Water level indicator (i.e., electric sounder)
- Log book and field forms
- Calculator
- Water quality bottle sets and COC forms
- Tape measure and engineer's rule
- Basic hand tools, including
  - Screwdriver
  - Pliers
  - Hacksaw
  - Hammer
  - Flashlight
- Adjustable wrench
- Leather work gloves
- Nitrile gloves
- Appropriate personal protective equipment (PPE)
- 5-gallon buckets
- Decontamination supplies, including
  - Tap Water
  - Distilled or deionized water
  - Non-phosphate soap
  - Brushes
- Appropriate monitoring well purge equipment (if necessary), including
  - Submersible pump
  - Generator
  - Hose clamps
  - Safety cable
  - Tubing
  - Bailer

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- Filters (as required)

5.6.5 Reporting

~~A well inventory~~Water level and water quality databases ~~was~~ were developed during the GSP development as ~~an~~ Excel spreadsheets. This includes well elevations so that water level measurements can be converted into elevation. New water level monitoring data and groundwater analytical data will be included in the database to create chemographs comparing groundwater quality data to groundwater elevation data over time and to generate quality parameters in the Subbasin. The hydrographs and chemographs will also allow the GSA to track temporal changes in groundwater levels and water quality as new data are collected. Data entered will be compatible with Global Information System (GIS) to generate groundwater elevation and water quality maps of the Subbasin.

~~Groundwater quality data will be submitted to the GSA approximately 30 days after each sampling event, or at the earliest possible date, depending on normal sample turn-around times and laboratory reporting.~~

5.7 References (§354.4(b))

California Code of Regulations (CCR), Title 22, Social Security, Chapter 15, Domestic Water Quality and Monitoring. https://www.law.cornell.edu/regulations/california/title-22/division-4/chapter-15

USEPA (United States Environmental Protection Agency), 2004. Groundwater Well Sampling, Field Sampling Guidance Document #1220, Method 314.0.

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6.0 Projects and Management Actions (§354.42; §354.44)

6.1 Introduction (§354.42)

The projects and management actions described in this section provide a framework to achieve the sustainability goal for the USLR Valley Groundwater Subbasin, in accordance with §354.42 and §354.44 of SGMA regulations. Within the USLR GSP, management actions are considered programs or policies that support groundwater sustainability and do not require infrastructure while projects are groundwater sustainability supporting activities that do require infrastructure. Current water use efficiency practices and potential additional management actions and/or projects will be utilized to ensure that the USLR Valley Groundwater Subbasin is operated in such a way to ensure long-term sustainability. Future undesirable results will be mitigated through active monitoring and adaptive basin management. In addition, the implementation of future projects may allow for the increase of sustainable yield in the Subbasin through additional or supplemental recharge.

6.2 Management of Groundwater Extractions and Recharge (Water Balance) (§354.44(a))

A groundwater basin is generally regarded as being in overdraft when pumping exceeds natural and artificial groundwater recharge. Sustainability is considered to be achieved when the seasonal range of groundwater changes, driven by the availability of rainfall and aquifer recharge, remains within the range of elevations that will have no long-term negative impacts on Subbasin pumpers. Under these conditions, sustainable yield is maintained through balanced recharge and groundwater extraction.

As discussed in Section 3.0 (Basin Setting), the USLR Valley Groundwater Subbasin is generally operating sustainably under current water demand and water supply conditions. While groundwater levels show a period of decline from the 1990s through the early 2000s, increased imported water usage in conjunction with average to average to wet hydrological conditions have contributed to the ~~stabilization or~~ increase in groundwater levels within the last ~~five to~~ ten years. However, future unanticipated increases in water demand and/or reduced imported water supplies could result in the subbasin falling out of sustainable management. Projects and management actions that support the efficient use of groundwater resources and increase basin recharge will help the USLR Valley Groundwater Subbasin remain sustainable through normal and drought hydrologic conditions. Key management approaches to avoid undesirable results are discussed in the following sections.

6.2.1 Current Management Actions

6.2.1.1 Agricultural Management Plan and Best Management Practices

In 2016, the San Diego Regional Agricultural Water Management Plan (RAWMP) was prepared by the San Diego County Farm Bureau (SDCFB) and fourteen participating retail water agencies that serve commercial agricultural customers in the northern half of San Diego County, including Yuima Municipal Water District (YMWD) (Weinberg and Jacoby, 2016). The RAWMP describes and documents the San Diego Region's existing and proposed water management programs and activities that affect water use efficiency. As

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noted in the RAWMP, San Diego County agricultural users are some of the most efficient water users in the state. During development of the GSP, input from representative agricultural users indicated that growers have already enacted water conservation techniques such as using micro sprinklers/drip for irrigation, adjusting watering timing/schedules, regulating irrigation system pressure, and the removal or canopy reduction of low-producing areas.

Typical management practices for agricultural growers in the area include:

- Identify crop type and root zone depths.
- Identify soil and its ability to hold moisture.
- Install moisture sensing devices (i.e., tensiometers) in root zones to monitor moisture levels and use probes or shovels to verify actual moisture content.
- Use micro or drip irrigation and adjust duration of watering so that irrigation does not extend significantly deeper than root zone, except during periods of necessary leaching to remove salts buildup.
- Monitor evapotranspiration (ET) through California Irrigation Management Information System (CIMIS) and periodically adjust watering to meet water needs of crop.
- Continually inspect irrigation system for leaks, etc., and test distribution uniformity at least once a year to ensure proper irrigation coverage.

Additional information on best management practices is available from the University of California Cooperative Extension and University of California Agriculture and Natural Resources (Bender, 2015; Faber, 2015). Agricultural users in the USLR Subbasin plant to continue to implement water use best management practices (BMPs) described above and explore additional water efficiency opportunities, such as investigating the feasibility of installing a local CIMIS station.

6.2.1.2 Drought Response Conservation Program

Currently, efforts to reduce water demand in the subbasin through conservation are increased during times of drought. For example, YMWD institutes a drought response conservation program (Ordinance No. 100-08) to delay or avoid implementing measures such as water rationing or more restrictive water use regulations pursuant to a declared water shortage emergency as authorized by the California Water Code. This plan supports requirements outlined in San Diego County Water Authority's Urban Water Management Plan and Drought Management Plan. Under this program, regulations are implemented in several phases under drought conditions, ranging from voluntary actions (Level 1) to mandatory actions with violations subject to penalty (Level 2 and above). This program, and conservation activities outlined within it, are provided here as Appendix 6a.

Recent water consumption data have indicated that YMWD customers have reduced water usage from 7 to 16% ~~over the last year alone (~~from 202~~0~~1 ~~versus~~to 202~~1 alone~~0)~~. Water demand reduction and efficient water practices, like the ones enacted through the drought response program, provide opportunities to reduced groundwater pumping and surface water depletions. These reductions support maintaining and possibly raising groundwater levels.

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6.2.1.3 Groundwater Level and Water Quality Monitoring

Groundwater level and water quality monitoring programs are essential for effective management of groundwater resources and evaluating sustainability. A clear and continuous understanding of the subbasin groundwater conditions is required for adaptive sustainable management of the subbasin water supply. The collection of water level and water quality data provides important information to evaluate the effects of other projects and management actions, or to determine if additional management actions are necessary to maintain sustainability. On-gong collection of data will also provide a tangible measurement of the benefit of each project or action and ongoing operational effects on groundwater conditions. Since many of the sustainability indicators of the USLR Valley Groundwater Subbasin are measured directly by, or tied to, groundwater elevation data, evaluation of these data will be particularly important. A discussion of the current monitoring network and recommended modifications is provided in Section 5.0 (Monitoring Network).

~~After~~ During implementation of the GSP, the GSA will continue groundwater level monitoring at least twice a year (spring and fall, as described in Section 5.0), but additional monitoring events may take place at the discretion of the GSA. Water quality data, supporting ISW information, and vertical displacement data will be reviewed annually. ~~Supplemental groundwater level and water quality monitoring would provide data, as needed,~~These data will be used to track conditions in areas of concern, effects of other management actions and/or programs, and allow for effective subbasin management to promote groundwater sustainability. Monitoring results will be presented ~~in the 5-year update report~~in annual reports and Periodic Evaluations, which occur every five years.

Changes to the monitoring networks regarding the addition and/or modification of any monitoring location will also be described in the ~~5-year update repor~~Periodic Evaluation~~t~~. ~~In particular, the inclusion of monitoring at de minimis domestic users' wells would be beneficial to evaluating undesirable results to domestic beneficial use, as well as helping track sustainable management of the subbasin. At present, no de minimis users have come forward in response to requests for information or following discussion at GSP workshops. Part of the ongoing groundwater level and water quality monitoring action will be for the GSA to take a more proactive approach in engaging de minimis pumpers.~~

While local districts ~~have~~ generally maintained records within their individual service areas prior to GSP development, this unified monitoring effort will provide a holistic view of the subbasin and allow the GSA to identify and adapt to changing conditions before undesirable results are encountered. In addition, it is hoped that future involvement of local tribal entities may allow for even greater understanding of groundwater conditions through the incorporation of additional monitoring locations – to the benefit of all users.

6.2.2 Additional Data Collection (§354.44(c))

Projects and management actions shall be supported by best available information and science. In addition, understanding the amount of groundwater pumping in the Subbasin is a crucial aspect in establishing long-term sustainability. Therefore, the GSA plans to initiate pumping record collection efforts ~~upon~~ during implementation of the GSP. This would include registration of each groundwater extraction facility within the management area of the GSA (as allowed under §10725.6), and annual

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reporting of groundwater extractions (with the exception of de minimis users and federally reserved tribal lands §10725.8l and §10725.8(e)). This management action would compliment the use of groundwater extraction fees and associated charges that are currently being used by the GSA to create a local source of funding for ongoing GSP implementation. Currently, a pumper is charged based on an assumed pumping volume (calculated based on land use and acreage) in lieu annual pumping volumes reported to the GSA through a self-certification and reporting form.

~~Following implementation of the GSP, the GSA intends to encourage voluntary registration and pumping record collection. However, recognizing the importance of understanding pumping amounts for managing long-term sustainability, a metering program will likely be evaluated.~~ Requiring all groundwater producers to provide pumping records as well as requiring the registration of all groundwater extraction facilities (including non-municipal private wells) ~~would~~ allows the GSA to refine the understanding of Subbasin conditions and assist with the sustainable management of the subbasin.

Currently, as discussed in Section 3.3.5, the characterization of groundwater budgets and determination of sustainable yield relies heavily on the calibrated ~~surface water~~watershed/groundwater models and assumptions associated with them in place of recorded pumping records. The collection of additional information will lead to greater understanding and allow previous estimates of groundwater extraction to be refined. This in turn will affect the estimate of sustainable yield presented in this GSP. Therefore, sustainable yield estimates may need to be refined during the ~~5-year reporting~~periodic evaluation and reporting periods as pumping data become available.

Updated pumping records could also be used to update and recalibrate the integrated ~~surface water~~watershed and groundwater model of the subbasin, which can be used to evaluate effects of proposed projects and management actions through feasibility studies. Additional data collection that could be used for model refinement includes conducting aquifer testing in the Subbasin to provide a check on the reasonableness of calibrated aquifer parameters in the model. A refined and recalibrated groundwater flow model would help reduce uncertainty when the GSA performs cost/benefit analyses, and can be used to understand what projects and/or actions are likely to provide satisfactory results, identify areas that may require focused actions to reach and maintain MOs, and project future groundwater conditions with greater certainty.

6.3 Potential Future Management Actions/Projects (§354.44(b))

The GSA ~~intends to take~~uses an adaptive management approach in the USLR Groundwater Subbasin. Frequent assessment of progress towards maintaining sustainability ~~would~~ allows the GSA to proactively enact management actions and/or projects as needed to curb any potential issues before they lead to undesirable results. This proactive approach ~~may~~ allows corrections to be made with smaller adjustments instead of requiring larger and potentially costlier projects at a later date. The adaptive management approach ~~would~~ also helps Subbasin users achieve and maintain groundwater levels and other sustainability indicators above MOs to ensure drought resilience.

If Subbasin monitoring indicates that additional action is necessary, the GSA will research the feasibility of implementing supplementary management actions and/or projects. Proposed projects will be prioritized by considering potential cost, available funding, and anticipated benefits to groundwater

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levels, storage, water quality, and/or interconnected surface water (ISW). For planning purposes, proposed projects and management actions have been grouped into four tiers, generally corresponding to the order of potential implementation (i.e., projects and management actions in Tier 1 are anticipated to be considered before those in Tier 2, etc.). Potential projects are listed below.

Although not all of the projects and management actions presented here will be needed for the USLR Valley Groundwater Subbasin to reach its long-term sustainability goal, each may be considered during GSP implementation. Attached Table 6-1 summarizes how the applicable sustainability indicators for the USLR Valley Groundwater Subbasin will be affected by the proposed projects and management actions. Land subsidence and sSeawater intrusion are is not considered applicable for the Subbasin and are is therefore not included in Table 6-1 (refer to Sections 4.3.5 and 4.3.67).

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Table 6-1. ~~Tier~~ Summary of Sustainability Indicator Management by Proposed Projects and Management Actions

Tier/ Implementation Schedule	Project or Management Action	Sustainability Indicator				
		Chronic Lowering of Groundwater Levels	Reduction of Groundwater in Storage	Degraded Water Quality	Depletions of Interconnected Surface Water	Land Subsidence
1	Convening an Interactive Tribal Work Group	This working group would encourage tribal participation, promote basin balancing maintenance activities, and ensure that federal reserve water rights are protected. Groundwater management working groups will also encourage the active, on-going involvement of Subbasin stakeholders – providing diverse input and raising awareness and providing rationale for the need of existing or new management activities and projects enacted to ensure groundwater sustainability in the subbasin. This level of involvement will help increase the effectiveness of any management action or project implemented under the GSP, encourage community investment in preserving and managing the shared groundwater resource, and ensure water rights and beneficial use of all subbasin users are protected.				
1	Convening a Drought Resilience Work Group	This working group will help identify avenues to obtain resiliency, minimize impacts of drought conditions on sustainability criteria, and develop long-term plans to facilitate groundwater conservation in the subbasin. The group would review the current understanding of drought in the USLR Groundwater Subbasin, identify any data gaps, and develop a reliable recovery plan. Groundwater management working groups will also encourage the active, on-going involvement of Subbasin stakeholders – providing diverse input and raising awareness providing rationale for the need of existing or new management activities and projects enacted to ensure groundwater sustainability in the subbasin. This level of involvement will help increase the effectiveness of any management action or project implemented under the GSP, encourage community investment in preserving and managing the shared groundwater resource, and ensure water rights and beneficial use of all subbasin users are protected.				
1	Domestic Well Vulnerability Assessment for Wells in the Upper Pauma Nitrate/ Perchlorate-Affected Area	-	-	This well vulnerability assessment will identify potential nitrate and perchlorate concerns in domestic wells within the Upper Pauma affected area, educate well owners, and connect well owners with potential assistance programs and solutions.	-	-
1	Outreach and Coordination with the Irrigated Lands Group/ San Diego Farm Bureau	-	-	Outreach will focus on water quality programs, technical assistance, monitoring resources, grower outreach opportunities, and potential funding to better characterize and understand gradual increases in TDS and nitrate being observed in the Subbasin.		
1	Installation of Streamflow Gage in the USLR Valley Groundwater Subbasin	-	-	-	The installation of a stream gauging station will provide important information for the evaluation of seasonal and on-going flow along the San Luis Rey River and provide necessary information for the evaluation of the depletion of ISW and establishment of volume or rate-based SMCs for ISW.	-
1	Investigate Potential Alternative Monitoring Sites for ISW	Additional monitoring sites would provide supplemental water level information in data gap areas (i.e., Pala Subbasin) for the characterization of near-river water levels. In particular, the additional water level data would help confirm appropriate SMCs are in place to protect beneficial use and ensure federally reserved water rights are being respected.		-	Additional water level monitoring points within ISW data gap areas would significantly improve the ability to assess ISW conditions.	
1	Installation of Transducers in Wells Being Used to Monitor ISW	Increased water level measurement frequency will improve understanding of changes in water level in these wells due to storms or periods of increased pumping demand associated with heat spells.		-	Increased water level measurement frequency will improve understanding of ISW conditions and timing.	-

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Tier/ Implementation Schedule	Project or Management Action	Sustainability Indicator				
		Chronic Lowering of Groundwater Levels	Reduction of Groundwater in Storage	Degraded Water Quality	Depletions of Interconnected Surface Water	Land Subsidence
1	Initiation of Field Observations of Standing Water and Wetted Area within the San Luis Rey River	-	-	-	This effort would provide a cost-effective screening tool for tracking changes in river corridor conditions and identifying priority areas for future field verification and monitoring. These observations would improve the understanding of seasonal surface water patterns, support the annual interpretation of modeled ISW depletion, and provide additional information for future periodic evaluations and SMC refinement.	
1	Explore the Feasibility of Using Remote Sensing or Aerial Imagery to Evaluate Riparian Vegetation as an Indicator of Surface Water/Shallow Groundwater	-	-	-	May support future assessment of riparian vegetation and surface water conditions along the San Luis Rey River for the evaluation of potential GDEs and for future ISW evaluations and SMC refinement.	
1	Adaptive Groundwater Management	Adaptive management allows the GSA to react to changing groundwater conditions, evaluate the success or failure of projects and management actions, and make management decisions to redirect efforts to achieve sustainability goals more effectively.				
1	Ongoing Groundwater Level and Water Quality Monitoring	Ongoing monitoring will allow the GSA to identify areas trending towards undesirable effects and proactively enact projects and/or management actions as needed to improve management of groundwater resources above MTs and help reach MOs.				
1	Agricultural Management Plan and Best Management Practices	Conservation techniques and best management practices currently being enacted in the Subbasin reduce pumping demand - thereby lessening potential declines in groundwater levels and groundwater storage.		Agricultural best management practices can reduce unnecessary salt and nitrate loading on underlying groundwater.	Reduced water demand leads to reduced groundwater pumping. This can lessen declines in groundwater levels, potentially leading to greater surface flow or maintaining flow in areas of ISW.	Reduction of potential declines in groundwater levels will further minimize subsidence risk.
1	Water Conservation Activities: - Community Outreach - Irrigation efficiency and BMPs - Use of pumping fees	Water demand reduction and efficient water practices provide opportunities to reduce groundwater pumping, support the ability to maintain and even raise groundwater levels, and allow more groundwater to remain in storage.		Water conservation activities could cause slight decreases in water quality. This is a trend being observed by many treatment facilities in Southern California: the population generates the same amount of salts but less water is being used in the home to dilute influent to treatment facilities (or entering the subsurface through septic systems). Water quality in the Subbasin will need to continue to be monitored.	The management of groundwater levels through reduced pumping may prevent additional depletion of ISW.	Reduction of potential declines in groundwater levels through reduced pumping will further minimize subsidence risk.
1	Outreach to San Diego County to Layout a Framework for GSA Collaboration	GSA involvement with County to develop a well permit notification communication system can help maintain subbasin groundwater pumping within sustainable limits. Operating within the sustainable yield will prevent declines in groundwater levels and storage.		GSA involvement with County to develop a well permit notification communication system may help avoid cross-contamination of the aquifer in localized areas of elevated TDS, nitrate, and perchlorate.	The management of the locations of new wells and thus groundwater levels through managed pumping by location may prevent reductions in interconnected surface flow.	Reduction of potential declines in groundwater levels by keeping pumping within the sustainable yield will further minimize subsidence risk.
1	Pumping Record Collection	Support the refinement of sustainable yield estimate for the subbasin, assisting with sustainable management of groundwater pumping to ensure groundwater levels are maintained in such a way to avoid undesirable results.				
1	Well Registration and Meter Installation	Support the refinement of sustainable yield estimate for the subbasin, assisting with sustainable management of groundwater pumping to ensure groundwater levels are maintained in such a way to avoid undesirable results.				
2	Indirect Recharge through Reduced Evapotranspiration	Removal of high water use, invasive vegetation will reduce evapotranspiration - lessening potential declines of groundwater levels.		Removal of high water use vegetation may result in a benefit to water quality. Typically, plants take the water and leave the salts behind. Therefore removal of high water use plants can beneficially impact water quality.	Removal of high water use, invasive vegetation will reduce evapotranspiration - lessening potential declines of groundwater levels and surface flow	Reduction of potential declines in groundwater levels will further minimize subsidence risk.

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Tier/ Implementation Schedule	Project or Management Action	Sustainability Indicator				
		Chronic Lowering of Groundwater Levels	Reduction of Groundwater in Storage	Degraded Water Quality	Depletions of Interconnected Surface Water	Land Subsidence
2	Water Conservation Activities: - Rebate programs - Rainwater capture - Low impact development - Crop swap programs - Leak detection assessment - Voluntary fallowing - Identify new sources of funding for all potential Management Actions	Water demand reduction and efficient water practices provide opportunities to reduce groundwater pumping, support the ability to maintain and even raise groundwater levels, and allow more groundwater to remain in storage.		Water conservation activities could cause slight decreases in water quality. This is a trend being observed by many treatment facilities in Southern California: the population generates the same amount of salts but less water is being used in the home to dilute influent to treatment facilities (or entering the subsurface through septic systems). Water quality in the Subbasin will need to continue to be monitored.	The management of groundwater levels through reduced pumping may prevent reductions in interconnected surface flow.	Reduction of potential declines in groundwater levels through reduced pumping will further minimize subsidence risk.
3	In-Lieu Groundwater Recharge	Increase groundwater levels by replacing a portion of groundwater pumping with imported water supply or potential supplemental supply from VID.		Effects would depend on water source: imported or local surface water supply. Recharge of imported water may improve water quality in areas with high TDS, but imported water is typically higher in TDS than natural recharge. Recharging local surface supplies would likely provide water quality benefits, especially in areas with increased TDS levels.	The management of groundwater levels through reduced pumping may prevent reductions in interconnected surface flow.	Reduction of potential declines in groundwater levels through reduced pumping will further minimize subsidence risk.
3	Outreach to VID/City of Escondido/Rincon to Explore Potential Supplemental Water Supplies for In-Lieu Use or Managed Recharge	If able to be obtained, in-lieu use of supplemental water from VID would reduce groundwater pumping. Alternatively, recharging supplemental surface flows from VID would increase groundwater recharge. Both options would lessen potential declines in groundwater level and storage.		Recharge of supplemental surface water (through either in-lieu use or managed recharge) would likely provide water quality benefits, especially in areas with increased TDS levels.	The management of groundwater levels through reduced pumping may prevent reductions in interconnected surface flow. In-lieu use through a transfer of surface supplies may increase flow in certain areas of the Subbasin. This would need to be considered in a feasibility study and areas of potentially groundwater dependent vegetation will need to be monitored for potential impacts.	Reduction of potential declines in groundwater levels through reduced pumping will further minimize subsidence risk.
3	Stormwater and/or Dry Weather Capture	Enhanced groundwater recharge and increased groundwater storage are typically associated with increases in groundwater levels and storage.		Stormwater runoff is typically very good quality water. Capture and infiltration of this water source could provide water quality benefits, especially in areas with increased TDS levels.	Depending on location of stormwater capture activities, diverting stormwater may reduce available surface water and cause reductions in surface flow. This would need to be considered in a feasibility study and areas of potentially groundwater dependent vegetation will need to be monitored for potential adverse impacts	Increased groundwater levels through additional recharge will further minimize subsidence risk.
3	Aquifer Storage and Recovery (ASR) / Managed Aquifer Recharge	Groundwater recharge would be increased, leading to increases in groundwater levels and storage.		Effects would depend on water source: imported or local surface supply. Recharge of imported water may improve water quality in areas with high TDS, but imported water is typically higher in TDS than natural recharge. Recharging local surface supplies would likely provide water quality benefits, especially in areas with increased TDS levels.	The management of groundwater levels through additional groundwater recharge may prevent reductions in interconnected surface flow.	Increased groundwater levels through additional recharge will further minimize subsidence risk.
4	Groundwater Pumping Curtailment	Groundwater pumping curtailment or restrictions halts or lessens the decline of groundwater levels, allowing water levels to recovery and groundwater storage to increase.		Groundwater pumping curtailment may lead to increased imported water use, which is typically higher in TDS than natural recharge.	The management of groundwater levels through reduced groundwater pumping may prevent reductions in interconnected surface flow.	Reduction of potential declines in groundwater levels through reduced pumping will further minimize subsidence risk.

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6.3.1 Tier 1 Projects/Management Actions

- **Convening an Interactive Tribal Work Group:** This working group would encourage tribal participation, promote basin balancing maintenance activities, and ensure that federal reserve water rights are protected. *(In Planning)*
- **Convening a Drought Resilience Work Group:** This working group will help identify avenues to obtain resiliency, minimize impacts of drought conditions on sustainability criteria, and develop long-term plans to facilitate groundwater conservation in the subbasin. The group would review the current understanding of drought in the USLR Groundwater Subbasin, identify any data gaps, and develop a reliable recovery plan. *(Initiated)*
- **Domestic Well Vulnerability Assessment for Wells in the Upper Pauma Nitrate/Perchlorate-Affected Area:** YMWD is currently exploring a nitrate treatment system for some of their wells within the Upper Pauma Nitrate/Perchlorate-Affected Area. The proposed nitrate treatment system does not address nitrate loading or change the raw groundwater nitrate concentration, but it will address nitrate compliance for public water supply and will allow these wells to continue being used for beneficial use and to provide water to municipal and agricultural users within the YMWD service area. The GSP will continue to evaluate raw groundwater quality at RMS wells to evaluate changes in groundwater conditions within the affected area.

  To address domestic well users within the Upper Pauma Nitrate/Perchlorate-Affected Area, the USLRGMA will conduct a domestic well vulnerability assessment. This domestic well assessment will include: a well inventory based on County records, DWR well completion records, parcel/use data, and local knowledge; identification of domestic wells within the affected area that may have high concentrations of nitrate and perchlorate, outreach to well owners through mailers or direct contact to inform owners of groundwater quality conditions within the area and convey any water quality testing opportunities; and one-time nitrate and perchlorate sampling for domestic wells within the affected area (pending funding). If nitrate or perchlorate exceedances are identified in domestic wells, the USLRGMA will coordinate with appropriate regulatory and assistance programs and evaluate whether the results indicate expansion of nitrate-affected groundwater requiring revision of the monitoring network, affected-area boundary, or SMC. Anonymized results will be summarized in the annual report following the assessment, which is anticipated to be WY 2027. The USLRGMA will also explore funding opportunities to support the private well sampling effort. *(Planning)*
- **Outreach and coordination with the Irrigated Lands Group/ San Diego Farm Bureau:** To address gradual increases in TDS and nitrate concentrations in the Subbasin, the USLRGMA will initiate coordination with the San Diego Region Irrigated Lands Group and the San Diego County Farm Bureau within the first year following submittal of this Periodic Evaluation. The purpose of this coordination will be to identify existing agricultural water quality programs, technical assistance, monitoring resources, grower outreach opportunities, and potential grant or partner funding that

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may help reduce or better characterize nitrate and salt loading associated with irrigated agriculture. This management action recognizes that the USLRGMA does not regulate fertilizer application, irrigation practices, or agricultural discharges. Accordingly, the USLRGMA's role will be limited to coordination, information sharing, and evaluation of feasible voluntary actions that could support SGMA implementation and protect beneficial uses and users. Any follow-up actions, including expanded outreach, grower workshops, focused monitoring, nutrient-management assistance, or implementation of specific practices, would be dependent on available funding, partner participation, and GSA approval. *(Planning)*

- **Installation of streamflow gage in the USLR Valley Groundwater Subbasin:** Preliminary outreach regarding the installation of a streamflow gage in the Subbasin occurred after implementation of the GSP in 2022, and installation was slated to be covered under grant funding. However, funding was lost and no further progress was made towards establishing a streamflow gage in the Subbasin. Efforts to coordinate with appropriate entities (e.g., USGS and/or DWR) will be reinitiated with the goal of having a streamflow monitoring point for the next periodic evaluation (i.e., 2032). In particular, the USLRGMA will be evaluating the feasibility of reinstating an existing gaging station, either Station 11036700 San Luis Rey River Near Pauma Valley, or Station 11039800 San Luis Rey River Near Pala. Alternate locations will be considered as appropriate. *(Planning)*
- **Investigate potential alternative monitoring sites for ISW:** As discussed in Sections 4.5.1 and 5.3.5 above, monitoring sites have been adopted in the 2027 GSP Amendment to evaluate conditions relative to the depletion of ISW. For lack of a stream flow gage in the Subbasin and dedicated monitoring sites near the San Luis Rey River that reflect conditions in the shallow and deeper alluvial materials in Pala and Pauma Subbasins, the best-available, near-river alluvial wells in the existing groundwater monitoring network have been selected as monitoring sites. The temporary ISW monitoring network provides decent coverage of the upper, middle, and lower reaches of the San Luis Rey River in the Pauma Subbasin, but the middle reach of the Pala Subbasin would benefit from a monitoring site. The USLRGSA will be reaching out to Subbasin stakeholders in that area to see if a suitable monitoring point representing an existing well can be secured. However, monitoring points or potential monitoring points in the USLR Valley Groundwater Subbasin largely represent production wells, since very few true monitoring wells exist. Therefore, as part of this effort, the USLRGMA will also be exploring the feasibility of installing some additional dedicated monitoring sites throughout the Subbasin that could provide near-river information for the evaluation of ISW. Installing these monitoring sites would require the GSA to be able to secure appropriate site access or property rights at strategically selected locations throughout the Subbasin to install, operate, maintain, and periodically monitor dedicated groundwater monitoring wells. The USLRGMA would also need to identify project-specific funding for well design, permitting, drilling, construction, instrumentation, and related implementation costs. *(Planning)*

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- **Installation of transducers in wells being used to monitor ISW:** To better understand the response of near-river water levels to precipitation and streamflow events, the USLRGMA plans to install pressure transducers in the wells being used to monitor conditions relative to ISW. Priority should be granted to monitoring locations within the Pala Subbasin where model results indicate greater groundwater/surface water interconnectivity. The increased measurement frequency will improve understanding of changes in water level in these wells due to storms or periods of increased pumping demand associated with heat spells. Data from the transducers will be downloaded and processed as part of the routine monitoring in the Subbasin, but the equipment purchase, initial setup, and deployment would require additional funding. *(Planning)*
- **Initiation of field observations of standing water and wetted area within the San Luis Rey River:** The USLRGMA will initiate recurring field observations of surface water conditions along the San Luis Rey River within the USLR Valley Groundwater Subbasin, where access and field conditions allow. Observations would be conducted at least four times per year, generally representing spring, summer, fall, and winter conditions, to document the presence or absence of surface water, standing or ponded water, wetted channel extent, and visible flow conditions. Field observations may include standardized photo points, GPS documentation of wetted or dry channel segments, notes regarding recent precipitation or stormflow, and observations of riparian vegetation condition. This effort is intended to provide a cost-effective screening tool for tracking changes in river corridor conditions and identifying priority areas for future field verification and monitoring. These observations would not replace a streamflow gage or provide direct measurement of pumping-induced depletion, but would improve the understanding of seasonal surface water patterns, support the annual interpretation of modeled ISW depletion, and provide additional information for future periodic evaluations and SMC refinement. *(Planning)*
- **Explore the feasibility of using remote sensing or aerial imagery to evaluate riparian vegetation as an indicator of surface water/shallow groundwater:** The USLRGMA will evaluate the feasibility of using remote sensing, aerial imagery, infrared or near-infrared imagery, vegetation indices, and/or related geospatial tools to support future assessment of riparian vegetation as an indicator of surface water conditions along the San Luis Rey River. This task would include identifying available public and commercial datasets, reviewing their spatial and temporal resolution, evaluating how frequently data are collected, and determining whether the available imagery or analytical tools can reliably identify changes in riparian vegetation health, vegetation footprint area, and the presence or extent of standing water, which would provide information on shallow groundwater conditions. The feasibility evaluation would also include an assessment of cost, data processing requirements, technical limitations, and the expected value of the information that could be gained relative to the level of investment required. The purpose of this task is to allow the USLRGMA to determine whether imagery-based monitoring would provide useful information for future ISW evaluations and SMC refinement. Implementation of any identified remote sensing or imagery-based monitoring tool would depend on securing sufficient funding. *(Planning)*

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- **Adaptive groundwater management:** Adaptive management refers to the ongoing review and reaction to groundwater conditions in the subbasin. Frequent evaluation will allow the GSA to react to changing conditions, enact projects and/or management actions as necessary before undesirable results occur, and assess the success or failure of enacted projects and management actions implemented in the USLR Groundwater Subbasin. Annual monitoring and 5-year reporting on the subbasin's progress towards sustainability will provide consistent updates to the GSA, but additional monitoring and evaluation may be pursued as necessary. Investigations into any water quality or unexpected pumping issues would be investigated and addressed promptly by the GSA. *(Ongoing)*
- **Ongoing groundwater level and water quality monitoring:** The collection of water level and water quality data provides important information to evaluate the effects of other projects and management actions, or to determine if additional management actions are necessary to maintain sustainability. On-gong collection of data will also provide a tangible measurement of the benefit of each project or action and ongoing operational effects on groundwater conditions (currently being performed – see Section 6.2.1.~~2~~3). In addition, data gaps identified in Section 5.0 (Monitoring Network) will be evaluated and addressed. *(Ongoing)*
- **Agricultural management plan and best management practices:** Establishing best management practices and conservation techniques for efficient agricultural water use, such as using micro sprinklers/drip for irrigation, adjusting watering timing/schedules, regulating irrigation system pressure, and the removal or canopy reduction of low-producing areas (as described in the San Diego Regional Agricultural Water Management Plan (RAWMP) and currently being implemented by many agricultural users in the area – see Section 6.2.1.1). As mentioned in Section 6.2.1, there are already similar existing programs. These can be expanded upon to help further increase efficiency of groundwater usage. *(Ongoing)*
- **Installation of local CIMIS station:** The USLRGMA successfully installed a local CIMIS station in spring of 2025, near the 5th hole of the Pauma Valley County Club golf course. The next closest CIMIS station, Station 62 in Temecula, stopped recording at the end of 2024. The new Pauma Valley station therefore provides coverage of ~~A local CIMIS station would provide more accurate~~ evapotranspiration (ET) ~~estimates~~ and other climatic data for the USLR Subbasin microclimate. This ~~would~~ allows agricultural users in the subbasin to adjust their irrigation system timing – leading to increased efficiency and reduced water demand, as encompassed within the agricultural management plan and best management practices (above). *(Complete)*
- **Water conservation activities:** Water conservation implements policies and programs promoting and incentivizing conservation and the efficient use of water. This includes water used for municipal as well as agricultural uses. Water demand reduction and efficient water practices reduce stresses on groundwater aquifers as well as on surface water sources, and water conservation actions would assist with achievement of the USLR Groundwater Subbasin sustainability goal. This is especially true for conservation activities geared towards agricultural activities, since agricultural use represents such a large percentage of water use in the Subbasin.

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- ***Community outreach:*** Outreach would cover a wide range of actions, including making the public more aware of water use and the importance of conservation, providing water saving tips and recommendations, informing the public of opportunities for conservation savings and/or funding (i.e., rebate programs, grant funding opportunities, etc.), and other opportunities for the public to become involved in Subbasin sustainability efforts.
- ***Irrigation efficiency and best management practices:*** Assessments of irrigation efficiency can be made to identify area of potential water savings, leading to decreased demand.
- ***Use of pumping fees:*** TThe USLRGMA adopted the groundwater extraction fees and a policy to implement them on July 16, 2024. As of fiscal year 2024-2025, Subbasin pumpers (excluding those on federally reserved tribal lands) are charged an annual wellhead fee and a pumping fee based on assumed or reported pumping. The establishment of pumping fees incentivizes water conservation since Subbasin pumpers are charged per acre-foot of groundwater pumping. *(Ongoing)*

- **Outreach to San Diego County to lay out a framework for GSA collaboration:** GSA collaboration with County procedures involving groundwater management (e.g., developing a well permit notification communication system, updating the San Luis Rey River Watershed Water Quality Improvement Plan (WQIP), etc.) will allow the PVGSA USLRGMA (and potential other San Diego GSAs) to more effectively manage groundwater conditions in the USLR Valley Groundwater Subbasin. Currently, the USLRGMA has developed new protocols and an application template to facilitate coordination with the County and the assessment of potential impacts from any new proposed groundwater production well in the Subbasin. The well permitting provisions of Executive Order N-7-22 were subsequently superseded by Executive Order N-3-23 and ultimately rescinded in September 2024 by Executive Order N-3-24; however, the coordination established between the County and USLRGMA during the evaluation period improved communication between the agencies regarding new groundwater development in the Subbasin. *(Ongoing)*
- **Pumping record collection:** Since understanding the amount of groundwater pumping in the Subbasin is a crucial aspect in establishing long-term sustainability, the GSA plans to initiate pumping record collection efforts upon implementation of the GSP. This would include registration of each groundwater extraction facility within the management area of the GSA and annual reporting of groundwater extractions (with the exception of de minimis users and federally reserved land – see Section 6.2.2). Initial efforts are anticipated to be voluntary but may are planned to transition to the installation of meters (see below).

  Not only do these records support understanding of groundwater pumping for annual reporting and sustainability tracking purposes, but they are now being used for the collection of groundwater extraction fees and associated charges to create a local source of funding for ongoing GSP implementation. Pumpers are provided a self-certification form to document their groundwater pumping or are charged per best-estimate assumptions outlined in the 2024 Cost-of-Service Study (included here as Appendix 7a). It is anticipated that this will enhance the submission of pumping information. *(Ongoing)*

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- **Well registration and meter installation:** Mandatory metering of all pumping entities and pumping, as allowable under SGMA (excepting de minimis domestic users), would allow the GSA to definitively understand the amount of groundwater pumping occurring in the subbasin, refine estimates of sustainable yield, and assist with sustainable management. The GSA had intended to initiate this project in 2024/2025 using funding from a SGMA Implementation Grant, but the funding fell through. *(In Planning)*

6.3.2 Tier 2 Projects/Management Actions

- **Water conservation activities:**
  - ***Rebate programs:*** Rebate programs typically consist of incentives to encourage water users to upgrade to water saving devices such as high-efficiency toilets, washers, and sprinkler systems, replace plants/yards with high water needs to water wise gardens and landscapes, etc.
  - ***Rainwater capture:*** Rainwater catchment systems can be used to offset irrigation demands, especially in domestic settings.
  - ***Crop swap programs:*** Crop swap programs generally provide financial assistance to agricultural water users for crop conversion projects that save water through replacement of higher water use crops with lower water use varieties.
  - ***Low impact development standards for new or retrofitted construction:*** Low impact development refers to systems and practices that use or mimic natural processes to reduce surface runoff and increase infiltration – leading to increased natural recharge.
  - ***Leak detection assessment:*** A leak detection assessment traces the flow of water from its source, through a water distribution system, to customers and other uses with the review of records and data collected. Creation of a leak detection program would help ensure supplied water reaches its destination, supporting water conservation in the subbasin.
  - ***Voluntary fallowing:*** Where appropriate and based on water supply and associated costs, landowners may choose to fallow land during drought conditions, leading to decreased demand.
  - ***Identify new sources of funding for all potential management actions:*** An investigation of available sources of funding (e.g., grants) may facilitate implementation of proposed projects/ management actions and/or provide insight on additional water conservation and management options. *(Preplanning)*
- **Indirect recharge through decreased evapotranspiration:** The Upper San Luis Rey Resource Conservation District (USLRRCD) already has agreements in place to remove Arundo – an invasive, non-native species of reed found in riparian areas – in the subbasin. It is estimated that approximately 40 acres of Arundo are present in Pauma Valley alone. Removal of this vegetation

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could save upwards of 200 acre-ft/yr of water[29] that would otherwise be consumed by this high water use plant. Additional invasive plant species with high water use requirements (e.g., castor bean, tamarisk, etc.) could also be considered at later phases of this project. *(Ongoing)*

6.3.3 Tier 3 Projects/Management Actions

- **In-lieu groundwater recharge**: In-lieu groundwater recharge refers to the "storing" of local groundwater by utilizing surface water "in-lieu" of groundwater pumping. This is already being implemented to an extent in the USLR Groundwater Subbasin through the supplementation of groundwater pumping with imported water. Through its membership in the San Diego County Water Authority (Water Authority), YMWD has access to 16 cubic feet per second (cfs) ~~cfs~~ of flow through the District's connection to the Water Authority's imported water infrastructure. YMWD then sells Colorado River and State Water Project (SWP) water within the subbasin (see Section 2.1.2.3). At any given time, YMWD can draw up to 16 ~~cubic feet per second (~~cfs~~)~~ from the imported water distribution system, depending on the adequacy of supply available to the Water Authority and its member agencies, which corresponds to approximately 11,583 acre-ft/yr. Recent imported water use in the Subbasin over the last five~~5~~ years (~~Fiscal Year 2017~~WY 2021 through ~~2021~~2025) is ~~5,127~~4,353 acre-ft/yr, which is approximately only ~~44~~38% of the potential maximum amount. Increasing imported water usage in the Subbasin, as needed, will allow any exceedances to be addressed using an already established infrastructure and water supply system. In-lieu use of other supplemental water supplies (such as surface water from VID/City of Escondido) may also be explored. *(Preplanning)*
- **Outreach to VID/City of Escondido/Rincon to explore potential supplemental water supplies for in-lieu use or managed recharge:** The GSA is interested in exploring the feasibility of obtaining local surface water from VID/City of Escondido/Rincon to supplement water supply in the USLR Subbasin (through either in-lieu use or managed groundwater recharge). *(Preplanning)*
- **Stormwater and/or dry weather capture:** Stormwater and local runoff could be captured using in-channel or off-channel recharge basins to enhance infiltration and increase groundwater recharge in the USLR Groundwater Subbasin. *(Preplanning)*
- **Aquifer Storage and Recovery (ASR)/managed aquifer recharge:** Surplus imported water could be recharged to increase groundwater storage when surplus water is available. This additional storage would help maintain groundwater levels above MOs and provide resiliency during drought periods. The additional recharge would also serve to increase sustainable yield, thereby increasing the volume of groundwater that can be pumped sustainably. Future agreements with

[29] Assumes an ET for "giant reed" of 63.4 inches (Aspen, 2020). Estimate includes consumption of surface water, soil moisture, and groundwater.

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VID/City of Escondido/Rincon could be explored for the possibility of allowing increased surface flow in the San Luis Rey River through the USLR Subbasin. *(Preplanning)*

6.3.4 Tier 4 Projects/Management Actions

- **Groundwater pumping curtailment/allocation:** Groundwater pumping curtailment or restrictions halts or lessens the decline of groundwater levels, allowing water levels to recovery and groundwater storage to increase. Although recognized as an effective tool for achieving groundwater sustainability, pumping restrictions represent a last resort effort and would only be considered by the GSA in the event that other projects and management actions are unable to allow the subbasin to be managed within sustainability goals. At this time, the Subbasin is thought to be in general sustainability – as indicated by stable or increasing observed groundwater elevations and balance between estimated groundwater inflow and outflow. Any deficit resulting in declining groundwater levels and storage is expected to be able to be addressed through in-lieu recharge and/or the enactment of one or several management actions and/or programs listed above. *(Preplanning)*

6.4 Project/Management Action Implementation and Schedule

In order to meet MOs or address exceedances of MTs, the GSA intends to implement potential projects and management actions on an as-needed basis. In general, projects and actions will be considered in according to the tiered structure presented in the previous section. If a particular project or management action is selected for implementation, a feasibility study will be conducted to determine associated costs, uncertainty, and potential effects/benefits.

~~Immediately following GSP submittal and approval~~Over the next evaluation period, the GSA intends to begin the process of implementing Tier 1 management actions. Priorities~~y~~ for the GSA include the outreach activities (to tribal entities, the County, VID/City of Escondido, and the public) as well as additional data collection (ISW-related data, water levels, water quality, pumping, evaluating data gaps and monitoring recommendations outlined in Section 5.0, etc.). These collaborative and information gathering efforts are deemed to be of utmost importance for establishing cooperative sustainable management of the Subbasin and refining understanding of groundwater conditions. However, the GSA has limited resources; the USLR Valley Groundwater Subbasin is small, with a limited stakeholder base. Local funding is able to provide for continued GSP monitoring and reporting, but the completion of many of the proposed projects and management actions will rely on the identification and securement of additional funding.

In general, tiered projects and management actions are anticipated to be implemented according to the following schedule:

- **Tier 1 Projects and Management Actions:** Begin process of implementing or conducting feasibility study within the ~~first~~ next 5 years of GSP ~~adoption~~implementation (i.e., WY 2026 through 2030).

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- **Tier 2 Projects and Management Actions:** Begin process of implementing or conducting feasibility study as needed in response to change in current Subbasin status to avoid potential undesirable results.
- **Tier 3 Projects and Management Actions:** To be implemented only if undesirable results occur and can not be mitigated with other Tier 1 and/or Tier 2 projects and management actions. ~~Undesirable results are indicated when two consecutive exceedances occur in each of two consecutive years, in 25 percent or more of the RMSs (or Key Wells).~~
- **Tier 4 Projects and Management Actions:** To be implemented as a last resort effort in the event that other projects and management actions are unable to address undesirable results and allow the subbasin to be managed within sustainability goals.

However, while Tier 1 and Tier 2 actions are being pursued, the GSA has the option of bumping up the implementation of additional in-lieu recharge if immediate action is necessary. Based on ~~initial~~ model estimates of future water budgets (Section 3.3.5.7), anticipated operation of the subbasin may result in ~~an average annual~~a fairly stable amount of groundwater in storage (~~decline~~increase of ~~10~~30 acre-ft/yr). This volume of water, along with a margin of safety for any effects of climate change, can be replaced with the in-lieu use of excess imported water available through YMWD's membership with the Water Authority. As mentioned previously (Section ~~-~~6.3.3), infrastructure and water contracts are already in place to allow supplemental imported water to be purchased and brought into the subbasin to offset groundwater pumping. Therefore, this existing system can be relied upon to address any unanticipated exceedances or undesirable results that might arise during the development of priority Tier 1 and Tier 2 activities. Tier classification of other projects and/or management actions may also be adjusted according to funding opportunities, need, and potential benefit.

6.5 Measurable Objective and Expected Benefits

As noted previously, the increased use of imported water has helped ~~create the stable and~~ recover~~ing~~ groundwater elevations ~~observed within~~over the last ~~five to~~ ten years. Current and ongoing best management practices and conservation activities, as well as the evaluation of and implementation of proposed projects or management actions, will help support the continued operation within the current sustainable yield of the groundwater Subbasin. Anticipated benefits of each proposed project and management action as they relate to measurable objectives are listed in Table 6-1. Additional modeling to assess project-specific impacts is anticipated to accompany feasibility studies for larger projects that require significant changes in Subbasin operation or the development of infrastructure (e.g., stormwater capture, in-lieu recharge, etc.).

6.6 Permitting and Regulatory Process

Permitting and regulatory processes associated with proposed projects will be evaluated and identified during the feasibility study conducted prior to implementation. All applicable groundwater laws and rights will be respected during the development of proposed projects.

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6.7 Public Notice and Outreach

Prior to initiating a feasibility study for any of the proposed management actions or projects, the GSA will set up a public meeting to present details about the proposed action/project and feasibility study and receive feedback from Subbasin stakeholders. ~~I~~invitations to participate at GSA meetings will be extended using the public outreach and professional communication lines and noticing techniques used during development of the GSP. In particular, the GSA will continue to keep the SLRIWA aware of all Board meetings, project and management actions, and other related activity. Meeting agendas and associated information will continue to be made available on the USLRGMA website for stakeholder and tribal review. Public notice ~~would~~ will also occur in accordance with all pertinent laws and permits. GSA management operations will be documented and discussed in ~~the 5-year update~~Periodic Evaluation reporting.

6.8 Legal Authority

SGMA gives the GSA certain authority to implement the GSP to provide local control and flexibility consistent with the sustainability goal (§10725). This includes:

- Adopting rules, regulations, ordinances, and resolutions in compliance with any procedural requirements
- Conducting investigations to determine the need for groundwater management, prepare and adopt a GSP and implementing rules/regulations, propose and update fees, and monitoring compliance and enforcement
- Requiring registration of groundwater extraction facilities and installation of water-measuring devices (except for de minimis extractors)
- Requiring reports of diversion of surface water
- Purchasing and providing water in exchange for a groundwater extractor's agreement to reduce or cease groundwater extractions

6.9 Estimated Costs and Funding Plan

The feasibility study conducted prior to initiating any of the proposed management actions or projects will include a cost estimate and funding plan, ~~. This process should~~ includinge identification of any available ~~funding (i.e., grants)~~ for each proposed project/activity.

6.10 Relationship to Additional GSP Elements

The collection of additional data (included in a couple Tier 1 activities) will allow the GSA to refine estimates of sustainable yield in the Subbasin and better define groundwater conditions. In addition, implementation of certain projects (e.g., in-lieu recharge) may increase sustainable yield in the subbasin through increased or supplemental recharge. Updates to the hydrologic conceptual model and sustainable yield estimates will be discussed in ~~the 5-year report~~Periodic Evaluations.

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6.11 References (§354.4(b))

Aspen (Aspen Environmental Group), 2020. Technical Memorandum: Upper Santa Ana River Integrated Model Evapotranspiration Estimates. Prepared for Geoscience Support Services, dated September 4, 2020.

Bender, G.S., ed., 2015. Avocado Production in California: A Cultural Handbook for Growers, Second Edition. Joint publication of the University of California Cooperative Extension, San Diego County, and the California Avocado Society. Supported by the California Avocado Commission. Available at: https://ucanr.edu/sites/alternativefruits/files/228975.pdf.

Faber, B., 2015. Drought Tip: Irrigating Citrus with Limited Water. University of California Agriculture and Natural Resources, ANR Publication 8549, October 2015. Available at: https://anrcatalog.ucanr.edu/pdf/8549.pdf.

UCCE (University of California Cooperative Extension). Best Management Practices (BMP's). Available at: https://ucanr.edu/sites/agwaterquality/files/125550.pdf.

Weinberg and Jacoby (Ken Weinberg Water Resources Consulting LLC and Bill Jacoby Water Resources Consulting), 2016a. San Diego Regional Agricultural Water Management Plan Part I. Prepared for San Diego County Farm Bureau. Dated January.

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7.0 Plan Implementation

7.1 Introduction

This section is intended to serve as a conceptual roadmap for efforts to start implementing the GSP over the first five years and discusses implementation effects in accordance with SGMA regulations sections 354.8(f)(2) and (3). Specific regulations guiding the content of this section were not developed by DWR.

The schedule and budgets presented in this section represent estimates and may need to be altered or revised after during GSP implementation. In addition, as mentioned in the Projects and Management Actions (Section 6.0), not all of the proposed actions/projects may be necessary for sustainability. Therefore, the GSA intends to implement potential projects and management actions on an as-needed basis to meet MOs or address exceedances of MTs. In general, projects and actions will be considered in according to the tiered structure presented in the previous section. If a particular project or management action is selected for implementation, a feasibility study will be conducted to determine associated costs and potential effects/benefits.

Immediately following GSP submittal and approval, tThe GSA intends to begin the process of implementing Tier 1 management actionsactions within the next evaluation period (first five years following GSP/Amendment submittal). Priorities for the GSA include the outreach activities (to tribal entities, the County, VID, City of Escondido, and the public) as well as additional data collection (ISW-related data, water levels, water quality, pumping, evaluating data gaps and monitoring recommendations outlined in Section 5.0, etc.). These collaborative and information gathering efforts are deemed to be of utmost importance for establishing cooperative sustainable management of the Subbasin and refining understanding of groundwater conditions. Gathered information and monitoring data will be stored in the data management system established during development of this GSP.

A general schedule showing the major tasks and estimated timeline for the first next five years is provided in Table 7-1.

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Table 7-1. GSP Implementation Schedule

GSP Implementation Activities	Fiscal Year				
	2021 2027	2022 2027	2023 2028	2024 2029	2025 2030
GSP Amendment Adoption	X				
GSP Submittal to DWR	X	X			
JPA USLRGMA Administration and Operations					
Convene Interactive Tribal Work Group	X	X	X	X	X
Convene Drought Resilience Work Group	X	X	X	X	X
Adaptive Groundwater Management	X	X	X	X	X
Groundwater Monitoring and Data Collection	X	X	X	X	X
Potential Management Actions					
Address Data Gaps	X	X	X	X	X
Outreach to San Diego County to Layout a Framework for GSA Collaboration	X	X	X	X	X
Outreach and Education for Agricultural Best Management Practices	X	X	X	X	X
Water Use Efficiency and Conservation Programs	X	X	X	X	X
Well Registration and Meter Installation Program		X	X	X	X

The implementation plan provided in this section is based on current understanding of USLR Valley Groundwater Subbasin conditions and anticipated administrative considerations that affect the management actions described in Section 6.0. Understanding of USLR Valley Groundwater Subbasin conditions and administrative considerations will evolve over time based on future refinement of the hydrogeologic setting, groundwater flow conditions, and input from Subbasin stakeholders. Therefore, the first few years following GSP implementationnext five years will focus heavily on data collection and outreach.

Implementation of the GSP requires robust administrative and financing structures, with adequate staff and funding to ensure compliance with SGMA. The GSP calls for GSAs to routinely provide information to the public about GSP implementation and progress towards sustainability and the need to use groundwater efficiently. The GSP calls for a website to be maintained as a communication tool for posting data, reports and meeting information. The website may also include forms for on-line reporting of information needed by the GSAs (e.g., annual pumping amounts) and an interactive mapping function for viewing Subbasin features and monitoring information.

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7.2 Administrative Approach

The GSAs will likely hire consultant(s) or hire staff to continue to implement portions of the GSP. If consultants are hired, it is anticipated that qualified professionals will be identified and hired through a competitive selection process. It is also anticipated that the lead GSA representative for a particular task will keep the other GSA members informed via periodic updates to the Cooperative Committee and the public. As needed, the GSAs would likely coordinate on the specific studies and analyses necessary to improve understanding of Subbasin conditions. The GSAs would likely then use new information on Subbasin conditions and projects to identify, evaluate, and/or improve management actions to achieve sustainability. This GSP calls for actions considered by the GSAs to be vetted through a public outreach process whereby groundwater pumpers and other stakeholders will have opportunities to provide input to the decision-making process.

7.3 Implementation Costs and Funding (§354.6(e))

As summarized in Table 7-2, a conceptual planning-level cost of about $8,56610,218,0500 was estimated for planned activities during the first next five years of implementation, or an estimated cost of approximately $1,7132,043,0700 per year, assuming all of the selected projects are implemented. This cost estimate reflects routine administrative operations, monitoring, public outreach, reporting, and potential implementation of select Tier 1 basin- wide and area-specific management actions outlined in Section 6.0. This estimate assumes a centralized approach to implementation and staffing, it does not include CEQA or responding to DWR comments, nor does it include costs associated with any projects undertaken by willing entities.

California Water Code Sections 10730 and 10730.2 provide GSAs with the authority to impose certain fees, including fees on groundwater pumping. The GSA is has used this authority to develop ing a Joint Power Authority (JPA) that will go into place within one to two months following GSP submittal. JPA member agencies will cover initial costs until a permanent source of funding. Subbasin pumpers, excluding those on federally reserved tribal lands and de minimis users, are charged an annual wellhead fee of $300 per well and a pumping fee of $24.59 per acre-ft of water pumped from the Subbasin. These fees establish a reliable, local revenue source to fund ongoing GSP implementation in the Upper San Luis Rey Valley Subbasin. Development of these fees The GSA plan to conduct focusedincluded public outreach and notification, along with and hold meetings and public hearings to educate and solicit input on the proposed fee structure and plan to begin developing the fee structure as soon as administratively feasible after GSP adoption. The fees became effective for the 2024-25 fiscal year, with the first payment due by December 15, 2024. Pumpers are provided a self-certification form to document their groundwater pumping or are charged per best-estimate assumptions outlined in the Cost-of-Service Study (Appendix 7a). is established (e.g., water use tax or fee) to be developed as a Tier 1 action. It is anticipated that an annual operating budget will be established that is considered for approval by the future JPA. This budget information and management action details would be used to conduct a fee study for purposes of developing a groundwater pumping fee to cover the costs of implementing the regulatory program described in the GSP including, but not limited to, costs related to monitoring and reporting, hydrogeologic studies, pumping reduction enforcement where necessary, and public outreach.

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~~The GSA plan to conduct focused public outreach and hold meetings to educate and solicit input on the proposed fee structure and plan to begin developing the fee structure as soon as administratively feasible after GSP adoption.~~

~~California Water Code Sections 10730 and 10730.2 provide GSAs with the authority to impose certain fees, including fees on groundwater pumping.~~ ~~Any imposition of fees, taxes, or other charges would need to follow the applicable protocols outlined in the above sections and all applicable Constitutional requirements based on the nature of the fee. Such protocols would likely include public outreach, notification of all property owners, and at least one public hearing where the opinions and concerns of all parties are heard and considered before the GSA makes a determination to proceed with a fee or other charge.~~

~~It is assumed that any fee structure adopted by the GSA would be adopted by resolution or ordinance and would be identical in all material respects, i.e., with respect to levels and classes of uses. As part of or in conjunction with the feasibility study and in order to reduce the risk of a legal challenge, the GSA plans to obtain the legal advice necessary to ensure that the proposed fee is consistent with all applicable legal requirements and rights.~~

~~With respect to those p~~Pumpers that are not anticipated to be subject to the fee are requested ~~, the GSA plans to develop a program pursuant to which such pumpers will be required~~ to self-certify that they only pump for domestic purposes which would be de minimis to the USLR Groundwater Subbasin.

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Table 7-21. Monitoring Estimated Planning-Level Costs for Next Five Years of Implementation

GSP Implementation Activity	Implementation Tier	Estimated Cost	Cost Unit	Estimated Costs During Next Evaluation Period (2026-2030)
Administration and Reporting				
GSA Management	N/A	$40,000	Annual	$200,000
Legal	N/A	$10,000	Annual	$50,000
GSA Administrative Costs (insurance, audit, memberships, etc.)	N/A	$60,000	Annual	$300,000
Public Outreach (notices, website, etc.)	N/A	$5,000	Annual	$25,000
Annual Reporting and Data Management (excluding monitoring - see below)	N/A	$55,000	Annual	$275,000
Periodic Evaluation Report and Model Update	N/A	$400,000	5-Year	$400,000
Potential Projects and Management Actions				
Convene an Interactive Tribal Work Group		$5,000	Annual	$25,000
Convene a Drought Resilience Work Group		$5,000	Annual	$25,000
Address Data Gaps				
Install Surface Flow Gauge in River		$35,000	Lump Sum	$35,000
Streamflow Gauge Annual Operating Costs		$16,000	Annual	$64,000
Downhole Video of Potential Monitoring Wells in Pala Subbasin		$5,000	Each	$10,000
Installation of PVC Monitoring Well in Pala Subbasin		$75,000	Lump Sum	$75,000
Installation of Transducers in Near-River Wells		$4,000	Each	$24,000
Transducer Maintenance		$2,000	Annual	$8,000
Field Observations of ISW Conditions		$7,500	Annual	$37,500
Remote Sensing Feasibility Study		$15,000	Lump Sum	$15,000
Ongoing Groundwater Level and Water Quality Monitoring		$27,000	Annual	$135,000

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GSP Implementation Activity	Implementation Tier	Estimated Cost	Cost Unit	Estimated Costs During Next Evaluation Period (2026-2030)
Domestic Well Vulnerability Assessment (including sampling)		$15,000	Lump Sum	$15,000
Outreach to Irrigated Lands Group / San Diego Farm Bureau		$5,000	Annual	$25,000
Outreach to San Diego County for GSA Collaboration		$5,000	Annual	$25,000
Agricultural Management Plan and Best Management Practices		$60,000	Lump Sum	$60,000
Water Use Efficiency and Conservation Programs		$15,000	Annual	$75,000
Well Registration and Meter Installation Program		$1,150,000	Lump Sum	$1,150,000
Additional Water Conservation Activities (rebate programs, rainwater capture, crop swap programs, leak detection assessments, etc.)		$225,000	Annual	$1,125,000
In-Lieu Recharge through Increased Surface Water Delivery		$5,750,000	Lump Sum	$5,750,000
Indirect Recharge through Decreased Evapotranspiration (e.g., removal of invasive species)		$290,000	Lump Sum	$290,000

Total Estimated Costs During Next Evaluation Period (2026-2030)	$10,218,500
Average Annual Estimated Costs	$2,043,700

Notes:

These estimates assume a centralized approach to implementation and staffing. They do not include CEQA, legal staff costs (except where noted), GSA costs responding to DWR comments, nor do they include costs associated with any projects undertaken by willing entities.

Not all projects and management actions listed here may be implemented within the next evaluation period since the majority of proposed projects and management actions will only be pursued on an as-needed basis.

Subbasin pumping fees provide for routine GSA administration and SGMA reporting. Capital for additional projects is dependent on the securement of available grants and other funding opportunities.

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7.4 Annual Reporting

SGMA regulations require GSAs to submit an annual report on the implementation of the GSP to DWR (Water Code 10727.2, 10728, and 10733.2). An outline of the procedural and substantive requirements for the annual reports is presented below.

The ~~JPA~~ USLRGMA shall submit an annual report to DWR by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:

1. General information, including an executive summary and a location map depicting the USLR Groundwater Subbasin covered by the report.
2. A detailed description and graphical representation of the following conditions of the Subbasin managed in the Plan:
    a. Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows:
        i. Groundwater elevation contour maps for each principal aquifer in the Subbasin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions.
        ii. Hydrographs of groundwater elevations and water year type using historical data to the greatest extent available, including from January 1, 2015, to current reporting year.
    b. Groundwater extraction for the preceding water year. Data shall be collected using the best available measurement methods and shall be presented in a table that summarizes groundwater extractions by water use sector, and identifies the method of measurement (direct or estimate) and accuracy of measurements, and a map that illustrates the general location and volume of groundwater extractions.
    c. Surface water supply used or available for use, for groundwater recharge or in lieu use shall be reported based on quantitative data that describes the annual volume and sources for the preceding water year.
    d. Total water use shall be collected using the best available measurement methods and shall be reported in a table that summarizes total water use by water use sector, water source type, and identifies the method of measurement (direct or estimate) and accuracy of measurements. Existing water use data from the most recent Urban Water Management Plans or Agricultural Water Management Plans within the Subbasin may be used, as long as the data are reported by water year.
    e. Change in groundwater in storage shall include the following:
        i. Change in groundwater in storage maps for each principal aquifer in the Subbasin.

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ii. A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the Subbasin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.

3. A description of progress towards implementing the Plan, including achieving interim milestones, and implementation of projects or management actions since the previous annual report.

7.5 Periodic (5-Year) Evaluations

SGMA regulations require ~~the~~ GSAs to evaluate this GSP at least every five years and whenever the Plan is amended, and provide a written assessment to the DWR. (Water Code Sections 10727.2, 10728, 10728.2, 10733.2, and 10733.8). The first Periodic Evaluation has been submitted to DWR to accompany this 2027 GSP Amendment. A general~~n~~ outline of the procedural and substantive requirements for ~~the~~ future periodic evaluation~~s~~ reports is presented below. To comply with the regulations, the USLR Valley Groundwater Subbasin's assessment shall describe whether the Plan implementation, including implementation of projects and management actions, are meeting the sustainability goal in the Subb~~B~~asin, and shall include the following:

7.5.1 Sustainability Evaluation

This section will contain a description of current groundwater conditions for each applicable sustainability indicator and will include a discussion of overall Subb~~B~~asin sustainability. Progress toward achieving interim milestones and measurable objectives will be included, along with an evaluation of groundwater elevations (i.e., those being used as direct or proxy measures for the sustainability indicators) in relation to minimum thresholds. If any of the adaptative management triggers are found to be met during this evaluation, a plan for implementing adaptive management described in the GSP would be included.

7.5.2 Plan Implementation Progress

This section will describe the current status of project and management action implementation, and report on whether any adaptive management action triggers had been activated since the previous ~~five-year report~~Periodic Evaluation. An updated project implementation schedule will be included, along with any new projects that were developed to support the goals of the GSP and a description of any projects that are no longer included in the GSP. The benefits of projects that have been implemented will be included, and updates on projects and management actions that are underway at the time of the ~~five-year report~~Periodic Evaluation will be reported.

7.5.3 Reconsideration of GSP Elements

Part of the ~~five-year~~Periodic Evaluation report will include a reconsideration of GSP elements. As additional monitoring data ~~—~~are collected during GSP implementation, land uses and community characteristics change over time, and GSP projects and management actions are implemented, it may become necessary to revise the GSP. This section of the ~~five-year report~~Periodic Evaluation will reconsider the Basin Setting, management areas, sustainable yield, monitoring network locations, undesirable results, minimum thresholds, ~~and~~ measurable objectives, and interim milestones. If appropriate, the ~~five-year report~~Periodic Evaluation will recommend revisions to the GSP. Revisions would be informed by the

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outcomes of the monitoring network, and changes in the SubbBasin, including changes to groundwater uses or supplies and outcomes of project implementation.

7.5.4 Monitoring Network Description

A description of the monitoring network will be provided in the five-year reportPeriodic Evaluation. Data gaps, or areas of the USLR Valley Groundwater Subbasin that are not monitored in a manner commensurate with the requirements of Sections 352.4 and 354.34(c) of the SGMA regulations will be identified. An assessment of the monitoring network's function will also be provided, along with an analysis of data collected to date. If data gaps are identified, the GSP will be revised to include a program for addressing these data gaps, along with an implemented schedule for addressing gaps and how the JPA GSA will incorporate updated data into the GSP.

7.5.5 New Information

New information that becomes available after the last five yearperiodic evaluation or GSP amendment would be described and evaluated. If the new information would warrants a change to the GSP, this would also be included, as described in Section 7.5.3.

7.5.6 Regulations or Ordinances

The five-year reportPeriodic Evaluation will include a summary of the regulations or ordinances related to the GSP that have been implemented by DWR since the previous report, and address how these may require updates to the GSP.

7.5.7 Legal or Enforcement Actions

SGMA gives the GSAs certain authority to implement the GSP to provide local control and flexibility consistent with the sustainability goal (§10725). This includes:

- Adopting rules, regulations, ordinances, and resolutions in compliance with any procedural requirements
- Conducting investigations to determine the need for groundwater management, prepare and adopt a GSP and implementing rules/regulations, propose and update fees, and monitoring compliance and enforcement
- Requiring registration of groundwater extraction facilities and installation of water-measuring devices (except for de minimis extractors)
- Requiring reports of diversion of surface water
- Purchasing and providing water in exchange for a groundwater extractor's agreement to reduce or cease groundwater extractions

7.5.8 Plan Amendments

A description of amendments to the GSP will be provided in the five-year reportPeriodic Evaluation, including adopted amendments, recommended amendments for future updates, and amendments that are underway during development of the five-year reportPeriodic Evaluation.

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