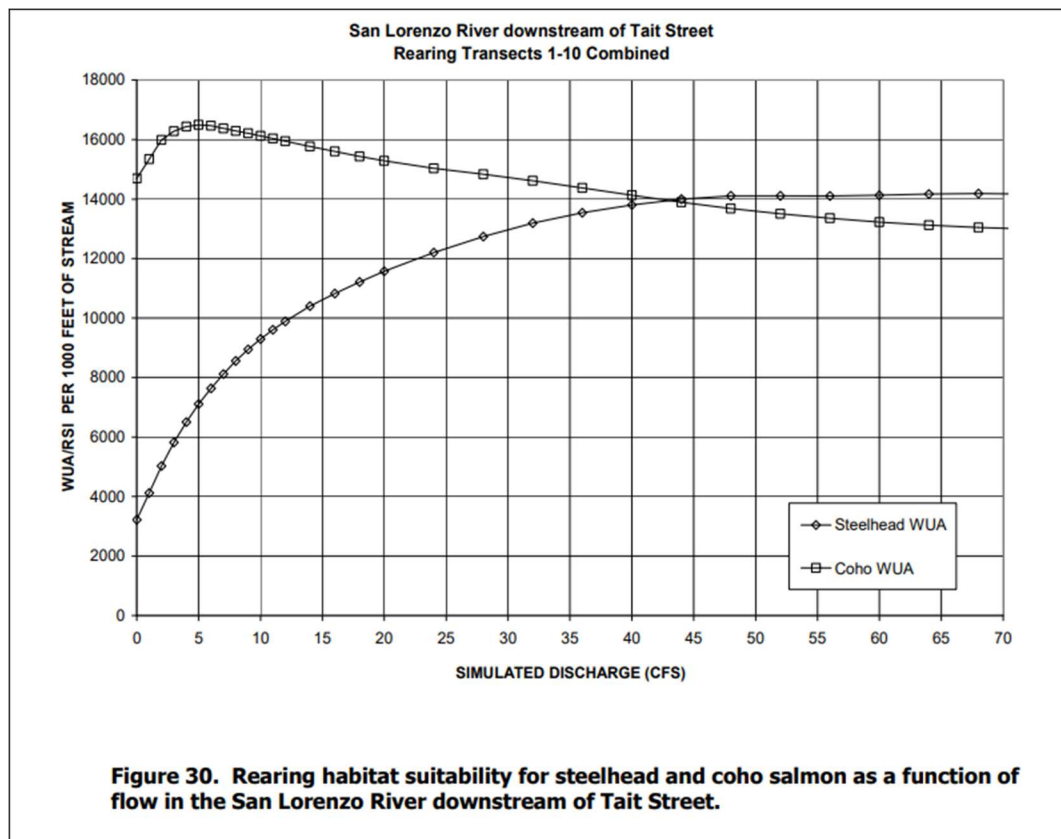
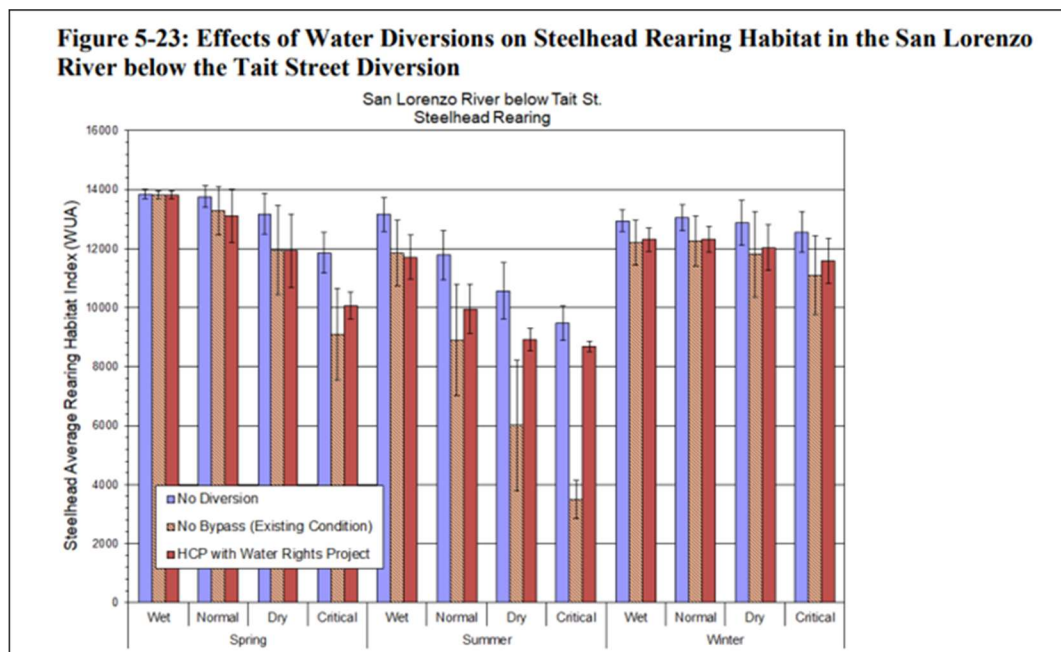


Received via e-mail from Chris Berry, Watershed Compliance Manager, City of Santa Cruz Water Department

Thanks for giving us the opportunity to review this document. It is encouraging to see the progress on Santa Margarita basin management. However, we have a few issues that warrant additional elaboration and/or correction. Overall, the document would benefit from acknowledgement of the following topic, at least at a high level:

Protection of *all life stages* (not just summer rearing) of both coho and steelhead should be included as a fundamental planning goal for the amendment. Obviously, protection of the various life stages of these fish species requires restoration and maintenance of their instream and riparian habitat – which is dependent on hydrology. Unfortunately, the relationship between hydrology and habitat availability for both these species is not well understood upstream of Felton. Therefore, the use of City of Santa Cruz Anadromous Habitat Conservation Plan (ASHCP) minimum rearing flows as targets for the GSP amendment is positive but may not provide enough information to understand basin management effects on beneficial uses downstream and enable effective future conjunctive use planning by basin managers. While ASHCP- required minimum flows are a marked improvement over historical conditions, they do not provide 100% optimal habitat for all life stages of these special status fish species in all hydrologic conditions. For example, the highest minimum rearing flows below Tait St. required by the ASHCP is 18.5 cfs. However, the optimal steelhead rearing flow there is not reached until approximately 50 cfs is present (see graphs below). Therefore, there may be biological effects related to basin management discussed in the amendment that cannot be fully understood at this time and which warrant further analysis. This is illustrated clearly by the graphs below.



Therefore, water resource management (be it surface or groundwater, past, present or future) in the basin will need to be evaluated more thoroughly in order to understand its

effects on riparian and instream fisheries habitat and, indirectly, its effects on the City's ability to manage its own water resources challenges downstream. Preferably, this effort would follow methods already employed by the City in development of the ASHCP and related water rights and supply planning efforts. To that end, it seems appropriate at this time to provide more qualifying context around statements in the draft amendment to the effect of the MTs supporting GDEs and priority species by maintaining sufficient instream flows and plan for additional analysis of these issues moving forward.

We have provided some additional less substantive questions, comments and clarifying remarks on the draft amendment attached to this email as well. We appreciate your consideration. Please do not hesitate to follow up with us if there are any questions.

Chris Berry

Watershed Compliance Manager

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2.2.7 Mount Hermon Association Groundwater Monitoring and Management

MHA has 2 active and 1 inactive supply well that are used to measure groundwater levels and extraction (Table 2-5). Also, MHA's exploration well, MHA-MW1, was converted to a monitoring well that supplements the groundwater level monitoring network.

Table 2-5. Wells Used for the Mount Hermon Association Groundwater Management & Monitoring Program

Well Name	Well Status	Reference Point Elevation (feet msl)	Primary Producing Formation	Screen Interval Depth (feet bgs)
MHA Production Wells – Measurements taken monthly for both static and dynamic levels				
MHA #1	inactive	727.1	Monterey, Lompico	255-265, 285-395, 435-495
MHA #2	active	746.8	Lompico	290-300, 400-415, 430-480, 490-590, 600-615, 625-725
MHA #3	active	584.0	Lompico	680-800, 860-980
MHA Monitoring Wells – Measurements taken monthly				
MHA-MW1	active	279.0	Lompico	120-300

2.2.8 City of Santa Cruz Surface Water Monitoring and Environmental Management

As both an in-Basin user (Loch Lomond Reservoir, Felton diversion) and downstream user (Tait diversion) of San Lorenzo River watershed surface water, the City of Santa Cruz actively participates in surface water monitoring and management in the Basin. The key issues that have implications on the City of Santa Cruz water supply are nitrate impacts on surface water quality from the more than 13,000 septic systems in the San Lorenzo River watershed and groundwater use impacts on surface water baseflow supporting anadromous fisheries, particularly in Bean and Zayante Creeks. Reduced surface water baseflow in the Basin that may impact important salmon rearing programs increases the regulatory burden on the City, as any impact caused by the City's operations is evaluated within the context of overall habitat and population conditions. Finally, water resource management in the Basin also has impacts on the City of Santa Cruz's ability to fully exercise its water rights, which further complicates its ability to maintain supply reliability and improve habitat conditions for special status salmonids in the watershed.

2.2.8.1 Surface Water Monitoring and Management

The City of Santa Cruz monitors surface water stage and discharge in conjunction with their surface water supply diversions on the San Lorenzo River and Newell Creek. The City of Santa Cruz contributes financially to operation of the USGS flow gage on the San Lorenzo River at Big Trees, upstream of the City-operated diversion in Felton. The City monitors surface water

Summary of Comments on Santa Margarita Basin GSP

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Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 9:35:37 AM

Surface diversions, persistent turbidity and bacteria levels are also concerning. re: protection of downstream beneficial uses

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 9:37:07 AM

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 9:37:30 AM

Water quality issues also a challenge to steelhead, particularly during summer rearing in the San Lorenzo lagoon.

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 9:36:47 AM

discharge on Newell Creek both upstream and downstream of the Loch Lomond Reservoir, at locations shown in Section 6.6.1.

2.2.8.2 Habitat Management

The City's Anadromous Salmonid Habitat Conservation Plan (HCP) was adopted by the Santa Cruz City Council in September 2025 (City of Santa Cruz, 2025). The HCP had been in development since 2001 and intends to restore habitats and populations of steelhead and coho salmon, which are priority species in the Basin, while minimizing the impacts of the City's water diversion to meet its long-term water supply needs. The City worked with the California Department of Fish and Wildlife (CDFW) and National Marine Fisheries Service (NMFS) to develop the HCP.

The City continues to monitor various attributes related to fish habitat in the San Lorenzo River watershed and is evaluating development of monitoring to support the 2025 HCP. Under the existing City of Santa Cruz Water Department Watershed Monitoring Program, the following are specifically monitored:

- Temperature monitoring in a variety of locations throughout the San Lorenzo River watershed
- Turbidity monitoring upstream of Loch Lomond
- Dissolved oxygen and pH monitoring below Loch Lomond
- Juvenile salmonid and habitat in a variety of locations throughout the San Lorenzo River watershed, as a part of a collaborative effort funded by the City of Santa Cruz, SLVWD, SVWD and the County

2.2.9 Environmental Monitoring Programs

There are currently no contamination sites undergoing groundwater extraction and treatment remediation within the Basin. Ongoing remediation and mitigation efforts taking place include soil vapor extraction, passive *in-situ* remediation using injection barriers, soil excavation, and land use controls, as described in the subsections below. SCEH is the local agency authorized by the CCRWQCB and California Department of Toxic Substances Control (DTSC) to oversee investigation and cleanup of waste releases in Santa Cruz County. To protect their potable water supplies and more effectively manage the Basin, SMGWA member agencies are informed about local environmental compliance sites where groundwater quality has been impacted by pollution or chemical spills. SMGWA has a management action in this GSP to coordinate annually with SCEH to share updates on groundwater quality cleanup sites and supply well monitoring, discussed further in Section 8.2.2.

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 9:38:37 AM

The City does lots of other monitoring, as well but I'm not sure if that is worth getting into here. Let us know, if so. In that case, it might be good to check in with WQ folks in FW and Water to get their input as well.

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 9:40:57 AM

We aren't monitoring turbidity upstream of Loch Lomond much anymore.

2.4.1.8 Ecological Users

GDEs in the Basin support many different species, some of which are listed as priority species by either the federal Endangered Species Act of 1973 (U.S.C. §1531 *et seq.*; USFWS, 2021) or the California Endangered Species Act of 1970 (Fish and Game Code § 2050 *et seq.*; CDFW, 2021). For example, Central California Coast coho salmon and Central California Coast steelhead trout are federally listed as endangered and threatened, respectively. Other priority species that depend on instream flows for sustenance including lamprey, California red-legged frog, western pond turtle, and California giant salamander.

The San Lorenzo River is an important river for local fisheries. Historically, the river supported the largest coho salmon and steelhead trout fishery south of San Francisco Bay. While coho salmon are critically endangered in the San Lorenzo Watershed (and Santa Cruz and San Mateo Counties, in general), the federal recovery plan identifies the San Lorenzo Watershed as an “independent watershed” and critical for recovery within the Central California Coast evolutionary significant unit. Coho salmon successfully reproduced in the San Lorenzo Watershed in 1981, 2005, and 2008 in limited areas. In addition, adult coho salmon have been observed in the lagoon and in Felton during other years. Coho salmon do have the capacity for recovery, as shown by their new intermittent (i.e., not every year) population in Laguna Creek. As required by SGMA, the GSP should conform with existing management plans such as federal recovery plans.

The San Lorenzo River has been designated as a fully appropriated stream during the summer months to maintain environmental flows in the river to support fish habitat. While these bypass flows produce important instream benefits in riverine environments, they produce equally important benefits for the San Lorenzo River estuary/lagoon that provides critical habitat for rearing of juvenile steelhead.

Critical species in the Basin that likely rely on GDEs are compiled from the California Natural Diversity Database and information available from the CDFW and The Nature Conservancy (TNC; CDFW, 2020a; TNC, 2021). The priority species, and their locations either known or thought to be found in the Basin are summarized in Table 2-9. GDEs in the Basin are discussed in more detail in Section 3.4.9. Additional species that should be considered but are not listed as priority species and are likely co-beneficiaries of the priority species, are presented in Table 2-10. If the habitat requirements of the priority species are met then the habitat requirements of the co-beneficiary species are also met. The co-beneficiaries are currently not listed as threatened or endangered species.

Table 2-9. Groundwater Dependent Species Identified for Priority Management

Species Common Name	Type of Species	Occurrence Frequency	Location(s)
California Giant Salamander	Amphibian	Frequently present	Probably distributed widely in basin. Bean Creek, Lockhart Gulch, Ruins Creek, Zayante Creek, Lompico Creek, San Lorenzo River
California Red-Legged Frog	Amphibian	-	Bean Creek, Mountain Charlie
Coho Salmon	Fish	Rare	Bean Creek, Zayante Creek, San Lorenzo River
Lamprey	Fish	Occasional to Common	Bean Creek, Zayante Creek, Newell Creek, San Lorenzo River
Steelhead	Fish	Common	Bean Creek, Zayante Creek, Lompico, Mackenzie, San Lorenzo River, Newell Creek, Love Creek, Boulder Creek
Western Pond Turtle	Reptile	Rare	Zayante Creek, Newell Creek, San Lorenzo River

Species with no quantified frequency marked with "-"

Table 2-10. Groundwater Dependent Species Identified as Co-Beneficiaries of Priority Species

Species Common Name	Type of Species	Occurrence Frequency
Belted Kingfisher	Bird	Occasional
California Dipper	Bird	Rare; feeds in streams
California Newt	Amphibian	-
California Roach	Fish	Common
Coastrange Sculpin	Fish	Common
Common Merganser	Bird	Uncommon
Dace	Fish	Common
Deceiving Sedge/Santa Cruz Sedge	Plant	-
Downy Woodpecker	Bird	Common
Marsh Sandwort	Plant	-
Mount Hermon June Beetle	Insect	-
Prickly Sculpin	Fish	Common on Newell Creek
Rough Skinned Newt	Amphibian	-
Sacramento Sucker	Fish	Common
Santa Cruz Black Salamander	Amphibian	-
Slender Salamander	Amphibian	-
Swamp Harebell	Plant	-
Tidewater Goby	Fish	Rare
Warbling Vireo	Bird	Uncommon
Western Bumble Bee	Insect	-
Western Pearshell	Bivalve (Mussel)	-
Western Red Bat	Mammal	CA species of special concern
Western Sycamore	Plant	-
Western Wood-Pewee	Bird	Uncommon

Species with no quantified frequency marked with "-"

Current regulatory instream flow requirements exist on Fall Creek upstream of its confluence with the San Lorenzo River, Newell Creek below Loch Lomond Reservoir, and the San Lorenzo River at Felton. For Fall Creek, the minimum November through March bypass flow is 0.75 cubic feet per second (cfs) for dry years, and 1.5 cfs for other years; April through October bypass flow is 0.5 cfs for dry years, and 1.0 cfs for other years. Dry years are defined based on cumulative flow volume in the San Lorenzo River at Big Trees from the beginning of the water year. On Newell Creek below Loch Lomond Reservoir, a flow of 1.0 cfs must be maintained year-round to provide adequate depths for fish passage and spawning. On the San Lorenzo River at Big Trees, if flows fall below monthly minimum rates of 10.0 cfs in September, 25.0 cfs in October, or 20.0 cfs November through May, diversions from Fall and Bull Creeks must be terminated (Exponent, 2019).

While these are currently the only locations with mandated flows in the Basin, there are many resources available to evaluate instream flows if a basin-wide approach is warranted. North Coast Instream Flow Policy (R2 Resource Consultants, Inc and Stetson Engineers, 2008) provides guidelines for maintaining instream flows to protect anadromous salmonids. In general, summer rearing flows are just as critical, if not more so than spawning and passage flows. Summer rearing flows when the creek flow mostly comprises baseflows fed by groundwater are more impacted by groundwater extraction than spawning and migration flows, which are primarily influenced by rainfall and runoff. Table 2-11 lists minimum stream depth and dates for passage, and Table 2-12 lists dates, minimum stream depths, favorable velocities, and useable substrate for spawning.

Table 2-11. Steelhead and Coho Minimum Passage Criteria

Species	Dates	Minimum Passage Depth Criterion (feet)
Steelhead	November 1 to March 31	0.7
Coho	October 1 to February 28	0.6

Source: R2 Resource Consultants, Inc and Stetson Engineers, 2008

Table 2-12. Steelhead and Coho Spawning Criteria

Species	Dates	Minimum Depth (feet)	Favorable Velocities (feet/second)	Useable Substrate D ₅₀ (millimeter)
Steelhead	December 1 to March 31	0.8	1.0-3.0	12-46
Coho	November 1 to February 28	0.5	1.0-2.6	5.4-35

Source: R2 Resource Consultants, Inc and Stetson Engineers, 2008

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 9:55:03 AM
This is partially correct but doesn't address the non-diversion season in wet years when we release natural flow. Also, the 1 cfs requirement is for rearing and doesn't fully support passage and spawning. Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 9:55:25 AM



Some discussion of the comparability of this data to ASHCP data seems appropriate since different methods were used. Simple acknowledgement of that fact may suffice for now.

A variety of other methods and models can be used to estimate instream flow requirements that provide the minimum depths required for fish passage or spawning:

- 1-D and 2-D hydraulic models to assess flow depths and velocities for streams with available topographic data.
- Physical Habitat Simulation developed by the USGS combines both biologic and hydraulic inputs to simulate the relationship between streamflow and physical habitat to establish instream flow requirements (USGS, 2012).
- Regression equations are another option when site-specific topographic data are absent, but streamflow data are available (R2 Resource Consultants, Inc and Stetson Engineers, 2008). These equations were developed by establishing a relationship between cross-sectional data with mean annual flow for unimpaired gaged.
- Field-based approaches such as the Wetted Perimeter Method can also be used by performing repeat transects at various flow rates at known hydraulic bed controls (CDFW, 2020b).

Understanding the biological response of priority species to available habitat is an important consideration. Santa Cruz County's Juvenile Steelhead and Stream Habitat Monitoring Program measures the density of juvenile steelhead and assesses habitat conditions for steelhead and coho salmon in 4 watersheds in Santa Cruz County including the San Lorenzo River watershed. Presence/absence data are collected for select species of fish, amphibian, and reptiles including all the priority species listed in Table 2-9. Habitat data are also collected in select stream reaches. The species and habitat data are compiled into an annual report and a geodatabase for spatially referenced information. This work is ongoing and has occurred in every fall since 1994 (Beck *et al.*, 2019), and can be used to establish links between streamflow, groundwater conditions, GDE habitat, and presence or absence of priority aquatic species.

The City of Santa Cruz is implementing 3 different HCPs that will help protect environmental beneficial users of groundwater (City of Santa Cruz, 2011 and 2025). An HCP is a planning document required as part of an Incidental Take Permit under the Endangered Species Act. The HCP describes effects of City activities that may result in any harm or damage to threatened and endangered species (incidental take), and how those effects will be tracked, avoided, minimized, and mitigated.

Multiple species are covered by 3 different HCPs for City activities:

- Anadromous Salmonid HCP adopted in 2025
- Administrative draft USFWS HCP for 10 species that are state or federally listed as threatened, endangered, or species of special concern is currently in final review
- Low Effect Mount Hermon June beetle HCP currently being implemented

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 10:00:10 AM
Dates are incorrect. Should be 2013, 2021 and 2025

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 10:01:20 AM

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 10:01:43 AM
Note this is the federal HCP. The state HCP for coho is still a work in progress.

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 10:01:14 AM
Final

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 10:00:51 AM

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 10:00:59 AM
This was done in 2021.

Table 4-1. Santa Margarita Basin Septic System Distribution

Water Supplier	Estimated Number of Septic Systems (2013)	Percent
SLVWD	5,275	68%
Private domestic wells	784	10%
SVWD	747	10%
Mount Hermon Association	586	7%
Small Water Systems	397	5%
Total	7,789	

Nitrogen, primarily from urine, feces, food waste, and cleaning compounds, is present in sanitary wastewater. If sited or operated incorrectly, septic systems can be a significant source of groundwater contamination. Even properly functioning conventional septic systems may contribute nitrogen to groundwater exceeding this standard (USEPA, 2001).

The CCRWQCB has historically delegated authority to oversee and regulate the installation of septic systems to SCEH through a memorandum of understanding. The County must comply with the minimum standards contained in the Basin Plan in order to keep the authority to permit septic systems. The County Board of Supervisors has adopted Section 7.38 of the County Code (the Sewage Disposal Ordinance) which specifies the standards for septic system installation in Santa Cruz County. The County's current LAMP which is in compliance with the California Water Board's 2012 Water Quality Control Policy for Siting, Design, Operation and Maintenance of Onsite Wastewater Treatment Systems was adopted by the Santa Cruz County Board of Supervisors on August 23, 2022.

4.4.4.1.2 Nitrate Concentrations in Groundwater

Nitrate concentrations in the Santa Margarita and Lompico aquifers are well below the nitrate (as N) MCL of 10 mg/L. Maximum nitrate (as N) detections in municipal wells from 2010 to 2025 are approximately 3.6 mg/L in the Santa Margarita aquifer, and less than 1 mg/L in the Lompico aquifer. Nitrate in the permeable Santa Margarita aquifer has relatively higher concentrations due to its widespread exposure at the surface and proximity to potential nitrate contamination sources such as septic tanks and livestock/stables. The description of nitrate concentrations below is limited to areas where groundwater quality data are available.

During the 1970s to the 1990s—the period of the County’s greatest population growth—(Figure 4-2), nitrate concentrations increased in the Santa Margarita aquifer, particularly in the Quail Hollow area. Figure 4-38 plots nitrate (as N) concentrations in various wells screened at different depths from 1970-2025. Near-surface sources of nitrate have a greater impact on shallower wells (Quail Hollow #5 and #5A) compared to the deeper screened Quail Hollow #4 and #4A wells. There are also more septic systems potentially impacting Quail Hollow #5/5A than Quail Hollow #4/4A due to their different locations.

Historically nitrate concentrations peak in the impacted Santa Margarita aquifer wells during drought periods when groundwater levels are lower. Peak concentrations are observed at 3.5 mg/L in WY1987, which was during the 6-year statewide drought that extended from WY1986 through WY1991, and WY2016, which was at the end of the WY2012-2016 drought (Figure 4-38). Johnson (1988) demonstrated with a groundwater model that the nitrate peak at Quail Hollow was associated with late-season, drought-year pumping and the number of septic systems within the wells’ capture zones.

Johnson forewarned that nitrate concentrations had the potential to increase again in the future as the source remained. Updated data through 2025 indicate that nitrate concentration increases during droughts are short-lived, with concentrations returning to typical levels (generally 2 to 3 mg/L or less) following the drought. Comparison of long-term groundwater level and nitrate concentration trends in Quail Hollow on Figure 4-39 does not demonstrate a significant correlation between nitrate concentrations and groundwater levels. It should be noted, however, that the nitrate data are collected every 1 to 3 years per DDW requirements, so may not be collected frequently enough to fully analyze the interrelationship with seasonal groundwater level fluctuation.

Historically, the Santa Margarita aquifer in the Pasatiempo/southern Scotts Valley area was impacted by nitrate with concentrations (as N) up to 6 mg/L. The source of nitrate in this area is also septic and sewer waste disposal (Johnson, 2009). Recent nitrate concentration data are not available in this area since the Santa Margarita aquifer is no longer pumped for municipal use.

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 10:46:51 AM

However, nitrate is elevated above natural levels and even levels below the MCL can have negative effects on downstream beneficial uses (aka lagoon eutrophication impacts on steelhead rearing, benthic algae taste and odor issues, etc.)

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 10:48:00 AM

I think we have additional quarterly nitrate data from surface sources. The nearest sampling location would be the entrance to Henry Cowell.

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 10:56:33 AM
Did this account for upstream diversions' dynamics during this time? We have variable bypasses as I'm sure others did as well and that might obfuscate any interpretation of this relationship.

unconfined aquifer that rapidly recharges and subsequently discharges baseflow to streams. Discharge to streams is accentuated by the Santa Margarita Sandstone being situated above the Monterey Formation, which serves as a barrier to vertical groundwater flow (see Section 3.4.5.3). Figure 4-8 and Figure 4-9 show that the Santa Margarita Sandstone is present throughout much of the Basin with groundwater contours that largely mimic topography with groundwater elevations higher than adjacent streams that receive its discharge through baseflow and basal springs. Because this formation contributes so significantly to baseflow, a comparison of groundwater extraction from the Santa Margarita aquifer is appropriate to compare to the minimum daily flow measured in each year to evaluate the potential impact associated with groundwater extraction.

Figure 4-44 shows the low measured daily flow on the San Lorenzo River at the Big Trees gage in September from 2001 through 2025 compared to water year total groundwater extraction from the Santa Margarita aquifer. The data show a relatively weak positive linear relationship, indicating that groundwater extraction has some influence on minimum flows at the end of the water year. However, some years combine very low groundwater extraction with lower than average flow, while other years have high extraction with above average flow.

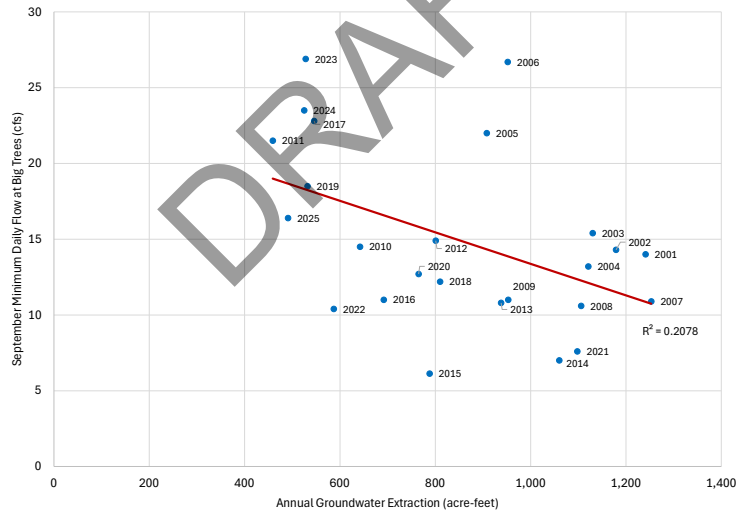


Figure 4-44. Relationship Between Minimum Flow at Big Trees Gage and Water Year Extraction in the Santa Margarita Aquifer

Figure 4-45 shows the low measured daily flow in September from 2001 through 2025 compared to water year total precipitation as measured on the San Lorenzo River at the Big Trees gage. The data show a relatively strong linear relationship, indicating that annual rainfall likely has a stronger influence on dry-season baseflow than groundwater extraction does.

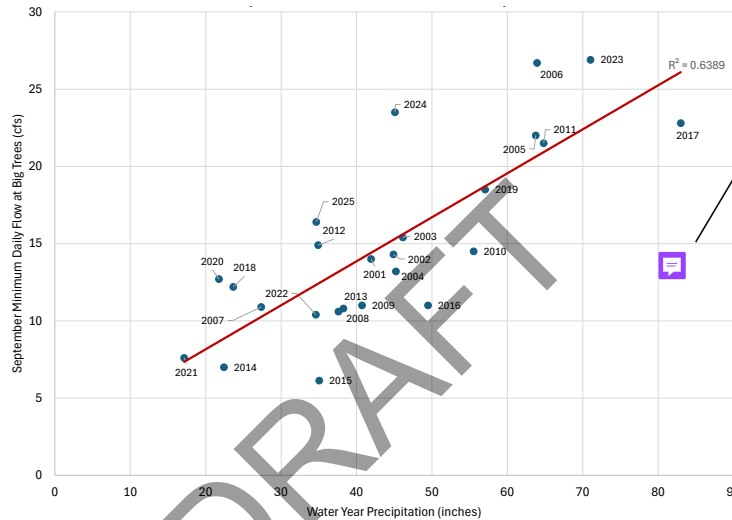


Figure 4-45. Relationship Between Minimum Flow at Big Trees Gage and Water Year Precipitation

4.6.3 Relationship Between Depletion of Interconnected Surface Water and Groundwater Elevation Based on Measured Data

Section §354.28(c)(6) of the GSP Regulations requires that minimum thresholds for depletion of interconnected surface water be based on a rate or volume of surface water depletions. However, Section §354.28(d) allows the use of groundwater elevations as a proxy for multiple SMC when supported by adequate evidence of a relationship. This section provides the rationale for the relationship. The data below indicate that despite a relatively weak correlation between groundwater extraction and baseflow, groundwater elevations are still a good indicator of what baseflow to expect under varying hydrologic conditions.

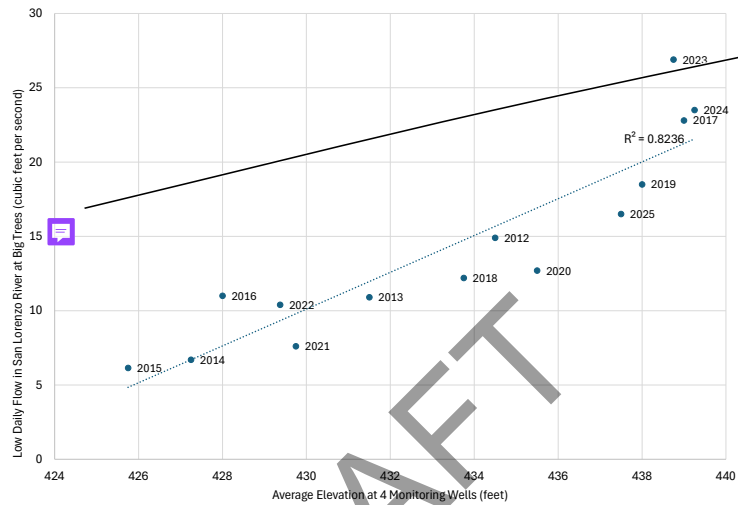


Figure 4-47. Average Annual Fall Santa Margarita Aquifer Groundwater Elevations Compared to Low Daily Flow, 2012 through 2025

4.6.3.2 Comparison of Short-Term Groundwater Levels to Flow at Multiple Locations

A total of 7 new monitoring wells were installed in 2023 (labeled in teal on Figure 4-46), expanding the shallow monitoring network and improving spatial coverage near streams. Some of the new shallow wells are paired with nearby streamflow or stage monitoring gages to improve evaluation of groundwater-surface water interactions. The new monitoring wells are described in more detail in Section 6.9.1.

Figure 4-46 shows the current understanding from the Basin Model of where interconnected surface water occurs in relation to GDE's, private domestic wells, all wells that have groundwater levels monitored as part of the GSP monitoring network, and the 7 monitoring wells installed in 2023 to improve monitoring coverage near streams. Figure 4-46 also indicates areas where groundwater extraction occurs near creeks and where, prior to recent monitoring improvements groundwater level monitoring locations were insufficient to indicate whether the creeks are gaining or losing.

Groundwater inflow totals about 24,100 AFY on average and range from about 17,000 AF in average critically dry years to 31,600 AF in average wet years. Inflow to the groundwater system is dominated by precipitation and streambed recharge, which on average comprise 56% and 36% of total groundwater inflow, respectively. These 2 inflow components vary with climate, with significantly larger recharge volumes from both precipitation and creeks occurring during wet periods. Groundwater recharge from precipitation and streams combined ranges from about 15,100 AF in average critically dry years to 29,700 AF in average wet years.

Recharge to groundwater from septic systems, quarries, landscape irrigation, and other system losses make up only 8% of total annual inflow to groundwater. Groundwater return flows do not vary substantially with water year type but are correlated to population growth because more than half of the return flows are from septic systems. Septic return flows increased with population growth during the 1980s and early 1990s but decreased since the 2000s due to expansion of wastewater treatment systems, and replacement of older septic systems with systems that have less discharge in part to mitigate increasing nitrate concentrations due to septic impacts.

The Basin is hydrogeologically isolated by the bounding faults and relatively impermeable basement rock beneath the Basin; therefore, subsurface inflow and outflow constitute only a very small fraction of the total groundwater budget.

Total outflow from the Basin's groundwater system is approximately 25,300 AFY on average and ranges between 21,800 AF in average critically dry years to 29,200 AF in average wet years. Outflow is dominated by groundwater discharge to creeks and groundwater pumping, which comprise roughly 84% and 15% of total groundwater outflow, respectively.

As discussed in the historical surface water budget section, groundwater discharge to creeks is controlled by climate. Average groundwater discharge to creeks in critically dry years was 17,800 AF and average discharge in wet years was 25,300 AF. In contrast to predominantly agricultural groundwater basins in the state, groundwater pumping in the Basin does not increase greatly in dry years as groundwater is mainly for municipal and private domestic purposes, which have more consistent year-round demands than agriculture. Municipal pumping in the Basin reached a high during a period of relatively rapid population growth in the 1980s and 1990s. Groundwater management adjustments particularly from around 2010 on have reduced total groundwater pumping. More details on changes in groundwater pumping and its impact on groundwater levels are provided in Section 4.2.

Given that the Basin is a relatively closed groundwater system, groundwater discharge to creeks comprises a major component of groundwater outflow, and the Basin's creeks are dependent on groundwater discharge to maintain baseflows in the summer and early fall months. As discussed in the surface water budget section, creeks consistently gain more water from groundwater than

Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 11:08:27 AM
This is confusing. Some rewording might make it a little more accessible to a lay reader.
Author: Chris Berry Subject: Sticky Note Date: 10/5/2026 11:08:53 AM
Are more recent climate projections intended to be used moving forward?

Total inflows and outflows to the groundwater budget are both smaller in the projected period than in the historical and current periods. Compared to the historical period, predicted total inflows and outflows are approximately 700 AFY and 1,800 AFY less, respectively.

Direct groundwater recharge from precipitation is projected to be about 200 AF less per year than the historical period; in comparison, streambed recharge is predicted to be about 300 AF less. Septic return flows to groundwater are expected to decrease about 28% with improved water efficiency as water fixtures are replaced, resulting in about 800 AFY of septic return flows compared to about 1,100 AFY over the historical period. Other components of projected groundwater inflow are expected to be similar to historical inflows.

Reduced projected groundwater outflow is mostly a result of less groundwater pumping and groundwater discharge to creeks. In the projection, groundwater pumping is estimated to average about 2,600 AFY, which is 100 AFY less than average current conditions and about 1,300 AFY less than average historical conditions. Future population growth is expected to be small and therefore the slight increase in water use is expected to be offset with continued water efficiency improvements. It is projected that groundwater discharge to creeks will be about 20,800 AFY on average, which is 500 AF less than the historical annual average and 300 AF more than the current annual average.

Under the repeated WY2007 to WY2012 climate projection, the Basin will experience slightly less precipitation and groundwater pumping compared to historical conditions. This results in a slightly negative, though nearly balanced, average change in groundwater in storage and groundwater levels. Periods of prolonged drought stress the water supply in the Basin and require greater groundwater recharge and/or conjunctive use strategies to increase groundwater in storage in wetter years when water is available. The projected baseline simulation without implementing new projects or management actions results in a cumulative loss of groundwater in storage of about 3,200 AF between 2026 and 2072. The annual average decline in storage in this timeframe is about 100 AFY, which is the rounding error for the simulated values.

Given these results, additional PMAs will not be needed to achieve sustainability under a slightly drier climate than the past 50 years. It is, however, important to recognize that the model projections are highly dependent on estimates of future precipitation. To the degree that actual future precipitation deviates from that predicted by this projection, groundwater conditions could be better or worse than simulated. An alternate climate change projection water budget is provided in Section 5.5.

5.4.4 Baseline Projected Groundwater Budget by Aquifer

The projected groundwater budget is analyzed by aquifer to demonstrate changes in groundwater flows in the various aquifers if no additional projects or management actions are implemented. The projected groundwater budget by aquifer is summarized in Table 5-19.

tributaries throughout the Basin that feed into the San Lorenzo River. Annual discharge at the gage is used to classify the water year type for GSP reporting using a local water year classification system originally developed by the City of Santa Cruz. The classification system is no longer used by the city, but it is used in the GSP for consistency with past classification practices.

There are 7 other stream gages in the Basin that are funded and maintained by the City of Santa Cruz and the County. These gages measure stage and discharge on various tributaries and upstream reaches of Big Trees on the San Lorenzo River. The USGS and City of Santa Cruz stream gages are measured throughout the year and the County stream gages are typically operational during the seasonal baseflow period (approximately May to November) to record flow during the driest time of year.

Past accretion studies were instrumental in understanding the surface water-groundwater relationship in the Basin. Beginning in 2017, Balance Hydrologics conducted annual late-season stream observation walks ("accretion runs"), where flow, nitrate, and specific conductance were measured at locations shown on

Figure 6-6 along the San Lorenzo River and its tributaries. Measurements were collected along the reach from Felton up through Boulder Creek. The goal of the accretion study was to improve understanding of the surface water and groundwater interactions within the Basin. As part of the GSP process, sites along Zayante Creek, Lompico Creek, and Bean Creek were added to the accretion runs in the summer of 2019. Most of the added sites were focused along Bean Creek and its tributaries. During the summer and fall of 2019, 3 separate accretion runs (May, July, and September) were conducted on the San Lorenzo River, Lompico Creek, Zayante Creek, Bean Creek, and Eagle Creek. Measurements were collected at all sites over a period of 1 to 2 days for each run. The number of accretion runs was increased during 2019 to capture the changes in flow during the dry-season recession and to aid in understanding the surface-water groundwater interactions within the Basin.

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I'm not aware of any County stream gaging stations but I know fisheries people make direct observations of flow measurements once in a while. I would be cautious of using that data for basin planning purposes given that (I think) the work typically doesn't use accepted USGS methods.

Table 6-6. Streamflow Gages, Status, and Use

Monitoring Agency	Streamflow Gage Name	Status	Parameters Measured	Frequency Measured
USGS	USGS 11160500 San Lorenzo River at Big Trees	Active	Streamflow	15 minutes
City of Santa Cruz	Newell Creek below Loch Lomond	Active	Streamflow	Daily
	Newell Creek above Loch Lomond	Active	Streamflow	Daily
San Lorenzo Valley Water District	Fall Creek	Active	Streamflow, Temperature	Approximately monthly year-round
	Boulder Creek	Active	Streamflow, Temperature	Approximately monthly during seasonal baseflow
	Foreman Creek	Active	Streamflow, Temperature	Approximately monthly during seasonal baseflow
County of Santa Cruz through 2021 SMGWA 2022 through 2025	San Lorenzo River above Love Creek	Inactive	Streamflow, Specific Conductance, Temperature	Approximately monthly during seasonal baseflow
	Newell Creek upstream of San Lorenzo	Inactive	Streamflow, Specific Conductance, Temperature	Approximately monthly during seasonal baseflow
	Zayante at Woodwardia	Inactive	Streamflow, Specific Conductance, Temperature	Approximately monthly during seasonal baseflow
	Bean Creek at Mount Harmon Camp	Inactive	Streamflow, Specific Conductance, Temperature	Approximately monthly during seasonal baseflow
	Bean Creek near Mackenzie Creek	Inactive	Streamflow, Specific Conductance, Temperature	Approximately monthly during seasonal baseflow

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 Was there any any model calibration involved with this analysis? It seems unlikely that these models could effectively evaluate riparian or instream impacts at a scale that would be useful for having a firm understanding of flow/habitat effects.

6.6.2 Groundwater Dependent Ecosystem Monitoring

SMGWA uses GDE monitoring to collect information on changes to GDE health during GSP implementation. GDE health is evaluated at least every 5 years using satellite-derived vegetation index mapping. GDEs in the Basin support many different species, some of which are listed as priority species by the federal Endangered Species Act. Section 2.4.1.8 describes ecological beneficial users of groundwater including other priority species that may be found within the Basin. GDE health is evaluated alongside data collected by groundwater level, interconnected surface water (ISW) depletion, streamflow, and climate monitoring networks described in Sections 6.2, 6.5, 6.6.1, and 6.6.4, respectively, to determine if groundwater use is impacting GDEs.

Representative GDE monitoring sites are selected based on their proximity to pumping areas, the underlying geology, and inferred or modeled stream connectivity with groundwater (Table 6-7 and Figure 6-7).

Table 6-7. Groundwater Dependent Ecosystem Representative Monitoring Sites

Site	GDE Types	Selection Rationale
Quail Hollow	Springs, Open Water, and Other Groundwater-Supported Wetlands	Near SLVWD pumping in Santa Margarita aquifer
Zayante Creek south of Quail Hollow	Springs, Riverine and Riparian	Near SLVWD and private pumping, near contact between Santa Margarita aquifer and Monterey Formation
Redwood and Ferndell Springs	Springs	Near Mount Hermon Association pumping, springs are in the Santa Margarita aquifer
Eagle Creek Springs	Springs	At southern extent of Basin, springs are in the Santa Margarita aquifer
San Lorenzo River, Zayante Creek, and Bean Creek	Riverine and Riparian	Primary streams connected to groundwater, with nearby municipal and private pumping wells

The vegetation index mapping uses publicly available datasets such as The Nature Conservancy's GDE Pulse Webmap and open access processing tools such as Google Earth Engine, thereby making it a cost-effective indicator to monitor. The common vegetation health indices include Normalized Difference Vegetation Index (NDVI), Enhanced Vegetation Index (EVI), and Normalized Difference Moisture Index (NDMI)^{3,4}.

³https://www.usgs.gov/core-science-systems/nli/landsat/landsat-enhanced-vegetation-index?qt-science_support_page_related_con=0#qt-science_support_page_related_con
⁴ <https://gde.codefornature.org/#/methodology>

Table 6-8. Climate Stations in the Santa Margarita Basin

Monitoring Entity	Station Name	Parameters
San Lorenzo Valley Water District	Boulder Creek	Daily precipitation, daily minimum, maximum, and average temperature
Scotts Valley Water District	El Pueblo Yard	Daily precipitation, daily minimum, maximum, and average temperature

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Confirmation and further elaboration would be useful. I'm not sure everyone is using the same methods.

6.7 Monitoring Protocols

County and SMGWA member agency staff collect groundwater data in the Basin using reliable and effective data collection protocols. Use of standard monitoring protocols ensures data are consistently collected, thereby increasing the reliability of data used to evaluate GSP implementation. There are 5 types of data collected for GSP implementation: groundwater level, groundwater quality, streamflow, groundwater extraction volume, and climate conditions.

6.7.1 Groundwater Level Measurement Protocols

Groundwater level monitoring is conducted to evaluate Basin conditions relative to the SMC for chronic lowering of groundwater levels and depletion of interconnected surface water, as shown in Table 6-1. SMGWA member agencies collect both hand soundings and pressure transducer records, which are stored in a regional DMS managed by the County. All monitoring data uploaded to the DMS is analyzed, compared to SMC, and included on hydrographs in the GSP Annual Reports. The DMS is described in more detail in Section 6.8. Groundwater levels in some wells are measured and recorded at least daily using pressure transducers with dataloggers. Groundwater level measurement in wells without dataloggers are collected monthly in most wells and at least semi-annually as required by GSP Regulations.

All groundwater level measurements are referenced to a consistent elevation datum, known as the Reference Point (RP). For monitoring wells, the RP is typically a mark on the top of the well casing. For extraction wells, the RP is typically the top of the well's concrete pedestal. Per GSP regulations, the elevation of the RP of each well is to be surveyed to the North American Vertical Datum of 1988 (NAVD 88). Currently, the elevation of the monitoring well RPs is accurate to at least 0.5 foot.

Groundwater level measurements are taken to the nearest 0.01 foot relative to the RP using procedures appropriate for the measuring device. Groundwater elevation is calculated using the following equation:

$$GWE = RPE - DTW$$

were very few reports of dry wells during the 2012-2015 drought and so not allowing levels to fall below those historical low levels will protect a vast majority of private domestic wells. If groundwater levels fall below MTs in RMPs, shallow private domestic wells may be at risk of being dewatered.

- **Industrial land uses and users.** Maintaining groundwater elevations at or above historical low levels should benefit industrial land uses and beneficial users by protecting their ability to pump groundwater from industrial wells.
- **Agricultural land uses and users.** For the very limited agriculture in the Basin, maintaining groundwater elevations at or above historical low levels will benefit agricultural users and land use by protecting their ability to pump groundwater from irrigation wells.
- **Ecological land uses and users.** Maintaining groundwater elevations at or above fall 2013 will maintain the very connected nature of groundwater and surface water in parts of the Basin. Baseflows associated with the fall 2013 groundwater elevations would support greater than 10 cfs flow in September. This is greater than the 8 cfs minimum flow required on the San Lorenzo River (measured at Santa Cruz) for rearing of priority species in the City of Santa Cruz 2025 HCP.

7.3.2.6 Relevant Federal, State, or Local Standards

No federal, state, or currently enforced local standards exist for chronic lowering of groundwater elevations.

7.3.2.7 Method for Quantitative Measurement of Minimum Thresholds

Fall groundwater elevations at each RMP are compared to MTs in GSP Annual Reports to evaluate progress toward achieving sustainability.

7.3.3 Measurable Objectives - Chronic Lowering of Groundwater Levels

MOs are set for each RMP at groundwater elevations that allow for operational flexibility to manage drought or other operational changes and keep groundwater levels above the MTs.

7.3.3.1 Measurable Objectives

The MOs are established at the fall 2006 groundwater elevations at each RMP. Fall 2006 was the second of 2 consecutive wet years, which followed 3 consecutive normal water years. Groundwater elevations were at a relatively high level similar to recent wet years like WY 2017, 2018, and 2023. In 2006, San Lorenzo River streamflow supported downstream diversions and met the City of Santa Cruz HCP in-stream flow requirements for a very wet year of 13.3 cfs, further making this year a good target for Basin groundwater level management. Some MOs are

- **Purisima Highlands Subbasin of the Corralitos Basin** (very low priority). The Santa Margarita Basin is hydraulically downgradient from the Purisima Highlands Subbasin but is separated from it by the Zayante-Vergeles fault zone, which acts as a barrier to groundwater flow. With a flow barrier between the 2 basins and a MT based on sustainable yield less than historical pumping, it is highly unlikely Santa Margarita Basin pumping will have a negative influence on groundwater in storage in the Purisima Highlands Subbasin.
- **West Santa Cruz Terrace Basin** (very low priority). The boundary between the Santa Margarita Basin and West Santa Cruz Terrace Basin is located where Tertiary sedimentary rocks that form the principal aquifers in the Santa Margarita Basin thin abruptly against basement rocks that are exposed at the surface or are at shallow depth in the subsurface. Groundwater pumping in West Santa Cruz Terrace Basin is mostly from private wells tapping low-yielding Quaternary alluvium and terrace deposits. These Quaternary deposits are not hydrologically connected to similar deposits scattered in small patches in Santa Margarita Basin. The lack of continuity in the Quaternary deposits and thinning of the Santa Margarita Basin aquifers makes it unlikely that groundwater extraction at MTs in the Santa Margarita Basin would cause a reduction of groundwater in storage in the West Santa Cruz Terrace Basin.

7.4.2.5 Effects of Minimum Thresholds on Beneficial Users and Land Uses

The reduction of groundwater in storage MTs are set at volumes that avoid undesirable results in the other sustainability indicators and therefore maintain groundwater elevations above their MTs. Since groundwater level MTs are intended to avoid undesirable conditions in the Basin, extraction MTs should continue to support similar beneficial use in the future:

- **Urban land uses and users.** Maintaining available groundwater in storage will benefit municipal groundwater pumpers by protecting their ability to pump groundwater from municipal wells and meet public water supply demands.
- **Rural residential land uses and users.** Maintaining available groundwater in storage will benefit all domestic users of groundwater by protecting their ability to pump groundwater from their wells.
- **Industrial land uses and users.** Maintaining available groundwater in storage will benefit industrial land uses and beneficial users by protecting their ability to pump groundwater from their wells.
- **Agricultural land uses and users.** For the very limited agriculture in the Basin, maintaining available groundwater in storage will benefit those beneficial users and land uses by protecting their ability to pump groundwater from irrigation wells.

2016). In this Basin, TDS, arsenic, and nitrate MTs will be monitored at supply wells. Unique MTs and MOs are established for each RMP public supply well based on historical data collected since 2011 and relevant drinking water standards. Several guidance documents were used to develop the SMC approach for the degraded water quality sustainability indicator (DWR, 2017; Moran and Belin, 2019; Community Water Center, 2019).

7.5.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

MTs and MOs are developed relative to the maximum historical groundwater quality concentrations from each well and primary and secondary drinking water standards or MCLs. The metrics are established at progressively higher concentrations above the historical maximum. The MO will alert SMGWA that degradation is starting to occur by establishing the objective at a marginally higher concentration than the historical maximum concentration in the well. The MT is set at a higher concentration than the MO and below the drinking water standard in most RMPs to allow for SMGWA and member agencies to adjust operations if MTs are exceeded prior to exceeding drinking water standards.

7.5.2.2 Degraded Water Quality Minimum Thresholds

Using drinking water standards, or MCLs, to guide MT selection is consistent with the SMGWA defined significant and unreasonable water quality degradation that results in adverse impacts including materially diminished water supplies or undue costs for mitigating such negative impacts. MCLs are designed to protect public health and welfare, and they provide the clearest indication of the point beyond which there is a real risk of an undesirable result (Moran and Belin, 2019).

Nitrate (as N) concentrations in groundwater are typically less than 5 mg/L, which is half the MCL of 10 mg/L. Because nitrate in groundwater influences nitrate concentrations in the San Lorenzo River (described in Section 2.1.2.3), allowing nitrate concentrations in groundwater to increase above 5 mg/L will make it challenging to meet the San Lorenzo River's 0.33 mg/L nitrate TMDL enforced by the CCRWQCB.

An MT of 5 mg/L is established for nitrate (as N) because:

1. Concentrations in RMPs are historically below this threshold.
2. The groundwater quality goal is to prevent concentrations from worsening and concentrations above 5 mg/L are currently uncommon throughout the Basin.
3. Nitrate concentrations in SMGWA-approved project source waters close to 10 mg/L would increase the challenge of meeting the nitrate TMDL in the San Lorenzo River. Feasibility for future projects will need to demonstrate the Basin's good quality

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5mg/l may result in degradation of downstream beneficial uses, obviously. In that light, is it wise to use that as a threshold? As we discussed on the phone on 10/16, having some interim, lower threshold may be helpful.

After reviewing further subsequent to our call on 10/16, I think the existing discussion of nitrate impacts on beneficial uses downstream is fine so I won't be providing another paragraph to add in.

Through project feasibility analysis, cooperating agencies will need to demonstrate to the SMGWA that their projects meet SMGWA's groundwater sustainability goals, water supply goals of the individual cooperating agencies without causing undesirable effects to other groundwater beneficial uses or users.

Feasibility and analysis of projects will require additional information, technical and financial analysis, modeling, and potentially, pilot scale testing. Findings and results of such feasibility and analysis will be provided to the SMGWA Board for final evaluation and approval. SMGWA Board involvement in project evaluation is likely limited to determining if projects interfere with achieving the Basin's sustainability goals or have negative impacts on other GSP-related PMAs. Cooperating agencies are encouraged to coordinate with one another on projects to ensure multi-stakeholder benefits, thereby decreasing the likelihood of project interference.

Aside from feasibility and analysis, each SMGWA member and cooperating agency is responsible for permitting and other specific implementation oversight for its own projects. Inclusion in this GSP does not forego any obligations under local, state, or federal regulatory programs. A complete summary table of PMAs is included in Appendix 8A.

8.2 Primary Projects and Management Actions

The main groundwater condition that PMAs in the Santa Margarita Basin aim to improve is lowered groundwater levels in the Basin's confined aquifer. The Lompico aquifer in the Mount Hermon / South Scotts Valley area has experienced a historical decline of about 150 to 200 feet, as described in Section 4.2.4. This long-term decline has been stabilized largely through successful water use efficiency programs and use of supplying recycled water for non-potable demands. However, maintaining groundwater level recovery will likely require additional PMAs to maintain sustainability with climate change (Section 5.5).

The following subsection provides a project description followed by a summary of objectives and discussion of circumstances for implementation, and other aspects of the Basin's primary sustainability project. This is followed by a description of the Basin's primary management action related to groundwater quality sustainability.

8.2.1 Project 1: SLVWD Expanded Conjunctive Use

Project Description

As discussed in Section 2.3.4.1, SLVWD has been practicing conjunctive use in their North System for decades, however, SLVWD has an opportunity to expand conjunctive use in their South System. The South System is supplied groundwater pumped from the Lompico aquifer by

[DWR] California Department of Water Resources, 2024c. Examples for Estimating Depletions of Interconnected Surface Water Caused by Groundwater Use. September. <https://lab.data.ca.gov/dataset/sgma-depletions-of-interconnected-surface-water/ee29ae8d-40c8-4326-881f-6ee8a152359c>

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City of Santa Cruz, San Lorenzo Valley Water District, Scotts Valley Water District, and County of Santa Cruz, 2017. Memorandum of agreement among the city of Santa Cruz, the San Lorenzo Valley Water District, the Scotts Valley Water District, and the County of Santa Cruz on exploring potential projects for the conjunctive use of surface and groundwater resources in the Santa Margarita Basin and San Lorenzo River watershed. September. Accessed September 20, 2021. <https://www.smqwa.org/media/AgencyDocuments/JPA-Final.pdf>