CAMBRIA COMMUNITY SERVICES DISTRICT
WATER RECLAMATION FACILITY
ADAPTIVE MANAGEMENT PLAN

San Luis Obispo County, California

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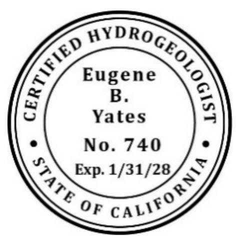
The undersigned certify that this report presents data and information required for biological and hydrological evaluation of Cambria Community Services District's Water Reclamation Facility and adaptive management of facility operations. The facts, statements, and information presented are a complete and accurate account of the findings and conclusions to the best of our knowledge and beliefs.



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Background

Cambria is located in California's central coast region in the northwest portion of San Luis Obispo County (SLO County). The Cambria Community Services District (CCSD or the District) is an independent special district of SLO County that provides water, wastewater, fire protection, parks and recreation, and other community services for this community south of San Simeon, CA. Figure 1 shows the CCSD service area boundaries and the locations of CCSD's existing municipal wells and wastewater percolation ponds along San Simeon Creek. CCSD also obtains some of its water supply from wells along Santa Rosa Creek.

CCSD disposes of treated wastewater effluent by percolated into four ponds located along San Simeon Creek downstream from its production wells. This practice also helps prevent saltwater intrusion into the freshwater water aquifer by maintaining high groundwater levels between the well field and the coast. In dry years, water levels at the well field can become lower than water levels near the percolation ponds, allowing treated effluent and possibly seawater to migrate toward the water supply wells, deteriorating the water quality and potentially rendering the wells non-potable. CCSD monitors groundwater levels throughout the year and maintains a positive differential between CCSD's up-gradient production wells and down-gradient percolation ponds area. In dry years CCSD may periodically pump groundwater from well 9P7 in the percolation pond area to maintain this differential. When this occurs, the discharged water is lost to the ocean and the volume of up-gradient freshwater storage is diminished.

The groundwater basin is recharged primarily by seepage from San Simeon Creek, which typically flows during the winter and spring rainy seasons. The average groundwater levels at CCSD's three San Simeon Creek municipal supply wells ranges from 8 to 20 feet above sea level (NAVD88). In 2013, well levels dropped to 3 feet above sea level in summer and only rose to 4-7 feet above sea level during the winter rainy season.

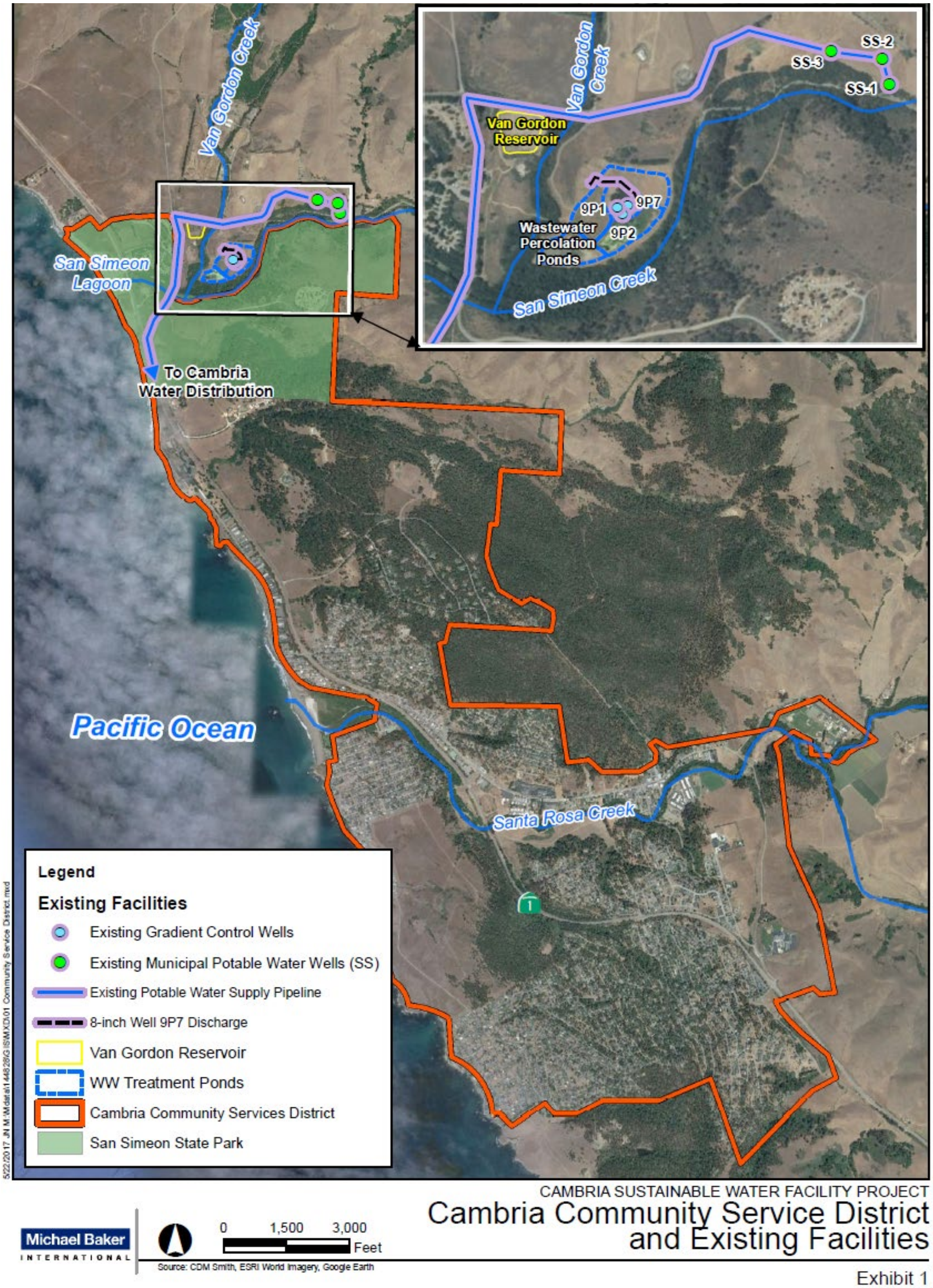


Figure 1 CCSD Water and Wastewater Facilities

The 2013-2014 drought prompted CCSD to develop the Emergency Water Supply Project (EWSP) to provide increased water supplies during the drought. The EWSP operated periodically during 2015-2016 but has been idle since then. CCSD subsequently changed the Project name to Sustainable Water Facility (SWF). Within this document, there are references to earlier Project reports, which referred to EWSP and SWF. More recent reports, including this update to the Adaptive Management Plan (AMP), refer to the Project as the Water Reclamation Facility (WRF).

The original AMP was prepared by Michael Baker International in 2017 and relied on technical studies available at that time. Those included a groundwater modeling study (CDM Smith, 2014), a study of instream flows in San Simeon Creek and the lagoon (CDM Smith, 2016), and a Supplemental Environmental Impact Report (Michael Baker International, 2017; SEIR). Those studies concluded that the SWF would not substantially impact groundwater or lagoon water levels. These documents are maintained by the District and can be accessed at the District's office or online at https://www.cambriacsd.org/biological-studies-for-the-water-reclamation-facility.

Technical studies completed since 2017 showed that the original studies were overly conservative in their estimates of the rate and duration of WRF operation. They assumed that well 9P7 would pump at 710 gallons per minute (gpm) and the recycled water injection well would inject at 485 gpm continuously for 18 months (95 and 65 acre-feet per month [AF/mo], respectively). After refining the groundwater flow model and updating the operational assumptions, more recent simulations found the following (Todd Groundwater, 2022; included as Appendix A):

The constraining factor for CCSD wellfield production is the water-level gradient between the wellfield (well SS-4) and the percolation pond area (well 9P2).

The amount of WRF operation needed to maintain a positive gradient between the wellfield and percolation pond area ranges from 15-40 AF/mo, depending on the month of year and antecedent conditions. These volumes would be obtained by operating the WRF at 400 gpm of injection 28-74 percent of the time.

The gradient responds within 2 weeks to changes in WRF operation, allowing real-time biweekly adjustments to WRF flows to maintain the target gradient.

WRF operation is needed only in very dry years, typically starting around August for a year with a very early start to the dry season (creek flow ceasing in March or April). Operation can be discontinued as soon as flow resumes in San Simeon Creek the following winter because the creek recharge rapidly refills the groundwater basin. This means the WRF would usually operate for a period of only 5-7 months at a time.

Drawdown of lagoon or creek pool elevations can be prevented by adjusting the rate of mitigation water discharge from the WRF to San Simeon Creek at the upstream end of the lagoon.

Based on simulations of a range of scenarios, a set of recommended WRF operating rules was developed that included when to start and stop WRF operation, monitoring of water levels and flows, and triggers for adjusting the amounts of injection and mitigation discharge (Todd Groundwater, 2022). Those recommendations were similar to but more detailed than corresponding recommendations in the original AMP prepared by Michael Baker International. The operational recommendations were refined in an updated Project Description and are integrated with recommendations for water quality and biological monitoring in this updated AMP.

Existing CCSD Facilities

The CCSD constructed the EWSP during 2014. As designed, the Project used several existing CCSD facilities: the San Simeon well field, percolation ponds that receive treated effluent from CCSD's wastewater treatment plant, and a treated wastewater effluent holding basin (Van Gordon Reservoir). The locations of each of these existing facilities are shown in Figure 2.

The San Simeon well field is located at the eastern part of the Project site, approximately one mile inland from the ocean. The well field contains three municipal wells (SS-1, SS-2, and SS-3) used to extract groundwater from the groundwater basin beneath the valley floor, and an underground potable water supply pipeline that generally parallels the northern and western site boundaries. The pipeline transports potable water from the well field to Cambria, approximately 2.5 miles to the south. In addition to the three CCSD municipal water wells (SS-1, SS-2, and SS-3), there are four other water supply wells located within the Project site:

Well 9P1: A former domestic well that once served a ranch house and is no longer in use.

Well 9P2: An idle former irrigation well near well 9P7 that is used for monitoring water levels and calculating the gradient between the well field and percolation pond area.

Well 9P4: An irrigation well that supplies a riparian irrigator that replaces the use of abandoned Well 9K1.

Well 9P7: A former gradient control well that is now the supply well for the WRF.

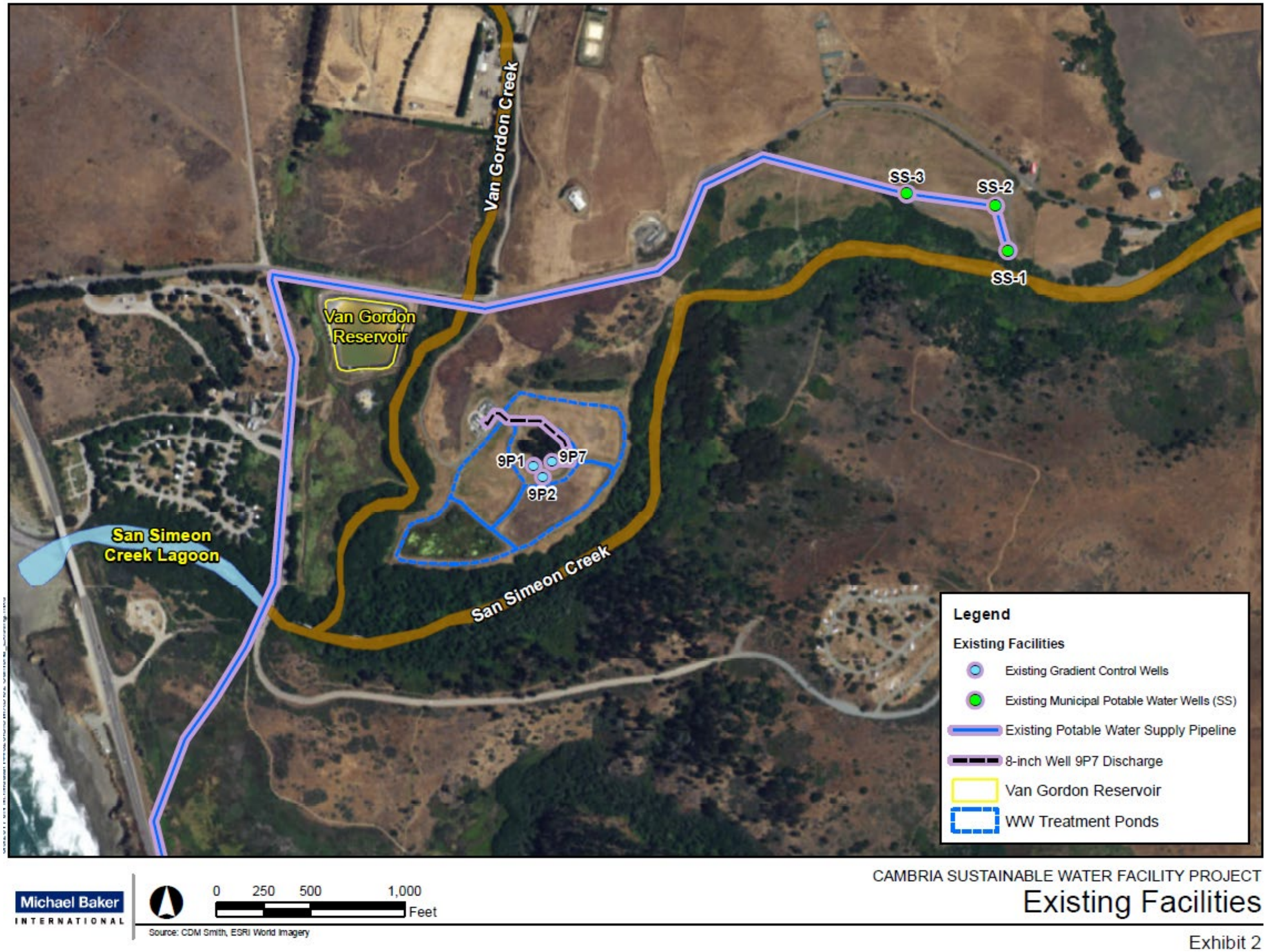


Figure 2 Infrastructure in the Well Field and Percolation Pond Areas

The effluent percolation ponds are located in the southwestern portion of the Project site and include four percolation ponds and associated treated wastewater effluent pipelines. After secondary treatment at the CCSD wastewater treatment plant (located approximately two miles south of the Project site), treated effluent is pumped to the four percolation ponds where it infiltrates through the soil into the underlying San Simeon Creek groundwater basin. Except for times when a reverse hydraulic gradient condition could occur (such as later summer to early fall, also see Section 3), this recharging of the lower San Simeon Creek aquifer helps maintain a mound in groundwater levels that creates a hydraulic barrier separating the upgradient potable groundwater supply from saline groundwater that might be present near the ocean.

Van Gordon Reservoir is an existing but unused storage basin for wastewater located at the northwest corner of the Project site. Between 1994 and 2005, the Van Gordon Reservoir served as an intermediate storage reservoir before discharge to the percolation ponds.

Emergency Water Supply Project

In addition to the use of existing CCSD facilities, the EWSP included construction of several new water facilities. **Figure 3** shows the location of the EWSP facilities in relation to the existing CCSD facilities. The new facilities included:

- An Advanced Water Treatment Plant (AWTP);
- A Recharge Injection Well (RIW);
- An evaporation pond (created by modifying the existing Van Gordon Reservoir);
- Four new monitoring wells; and
- Four new pipelines.

Figure 3 Location of the EWSP Facilities

The AWTP consists of multiple unit processes, including ultrafiltration membranes, reverse osmosis membranes, advanced oxidation, and post-treatment and disinfection facilities. A feed water pipeline transports groundwater from existing Well 9P7 to the AWTP. The treated AWTP product water is reintroduced/pumped for injection into the groundwater basin, making it available in the existing San Simeon well field. To inject product water into the basin, a new potable water recharge injection well (RIW) is located within the existing potable water well field. A new water pipeline transports the product water between the AWTP and RIW well. A separate pipeline from the AWTP provides mitigation water to the head of the San Simeon Creek lagoon area.

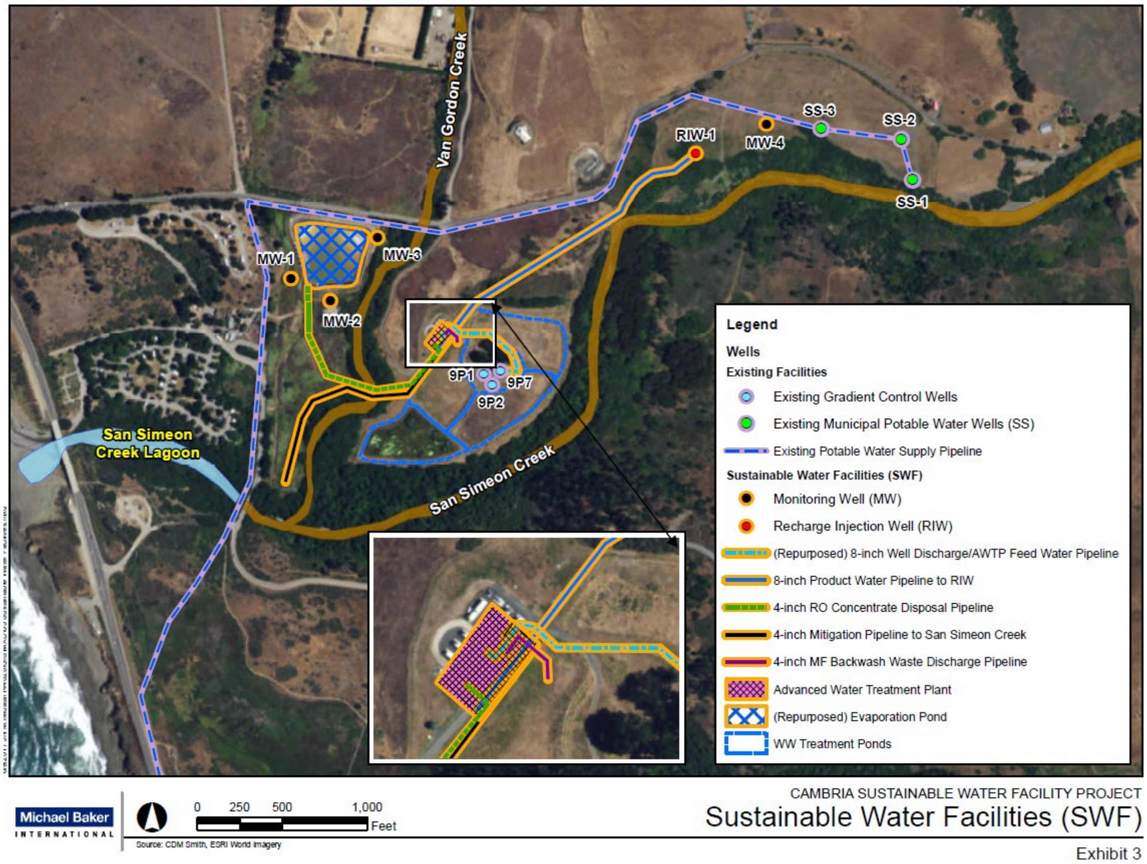


Figure 4 Sustainable Water Facility Features

The AWTP-generated waste stream (reverse osmosis concentrate) is pumped in a new pipeline from the AWTP to a lined evaporation pond (aka the modified Van Gordon Reservoir). Both natural and mechanically assisted evaporation of the waste stream occur within the evaporation pond.

Water Reclamation Facility

The District is now in the process of completing a regular Coastal Development Permit (R-CDP) for the WRF to provide greater operational flexibility and further enhance supply reliability. As part of this permitting process, the District initially submitted an application for an R-CDP on June 13, 2014. This initial application was subsequently replaced with a new R-CDP application on February 27, 2017, which was accompanied by the draft 2017 SEIR to provide CEQA information requirements. In response to input received during initial operation of the EWSP, and to further enhance reliability, the 2017 SEIR evaluated several proposed modifications to the EWSP (these modifications were known as the SWF).

The proposed SWF modifications described within the 2017 SEIR are illustrated in **Figure 5** and summarized below.

- Change in the discharge point for the AWTP RO concentrate: The AWTP RO concentrate is currently discharged into an evaporation pond (aka the Van Gordon Reservoir). The proposed modification would either redirect the RO concentrate discharge to four Baker tanks for onsite storage prior to offsite disposal or—the CCSD preferred method—would redirect the RO concentrate to a permanent zero liquid discharge (ZLD) facility, which would leave behind a semi-solid brine concentrate that would be hauled offsite for disposal. The ZLD facility was not anticipated in the 2017 SEIR but was later analyzed in a 2025 SEIR Addendum. The ZLD facility would be located next to the AWTP in the same location that a surface water treatment plant was originally contemplated.

- As currently proposed, the evaporation pond will be decommissioned, and the pond liner will be removed. The pond basin will be revegetated with native plant species. (Note: the 2017 SEIR anticipated reuse of the evaporation pond as a potable water storage basin. The 2025 SEIR Addendum evaluated the decommission and restoration of the pond.)

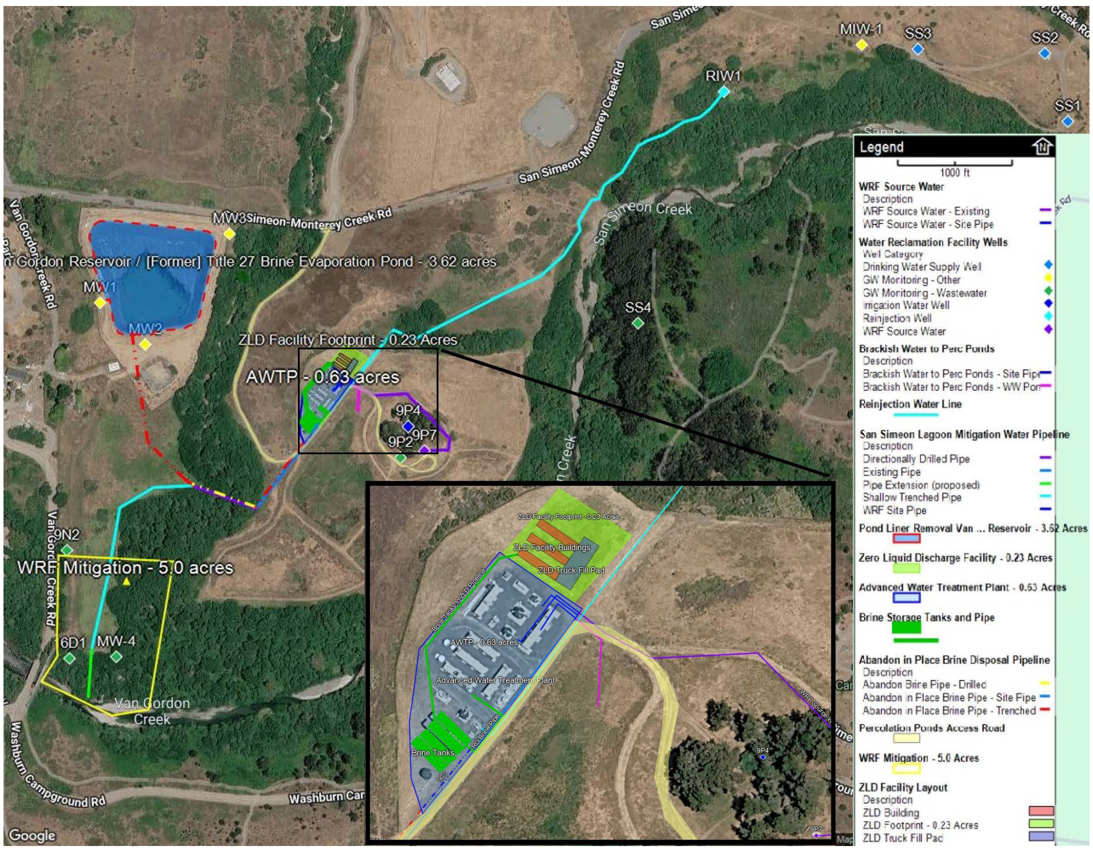


Figure 5 SWF Modifications

- Project modifications could include extending the lagoon water supply pipeline to a new discharge point further south at the bank of San Simeon Creek. At this new discharge point, Armorflex lining (articulating concrete blocks) would be installed to protect the creek bank but would allow for the continued growth of riparian vegetation.
- In dry years when CCSD declares a water shortage stage 4, 5, or 6, operation of the WRF would begin around August and continue until San Simeon Creek flows resume the following winter (typically December or January). Operating and maintaining the WRF equipment requires onsite full-time staff, although the AWTP is designed to operate with minimal operator intervention. The WRF would be staffed Monday through Friday, 12-24 hours per day, with two employees per shift for two to three

consecutive shifts. WRF output would be in the range of 15-40 AF/mo as needed to maintain a positive water-level gradient from the wellfield to the percolation pond area.

- If CCSD opts to operate the WRF in more normal years (water shortage stage 3 or less and flow at Palmer Flats <2 cfs), the duration of WRF operation in hours per day, days per week, and total weeks of operation would be correspondingly smaller. The WRF equipment is not designed for variable flow rates, so the volumes produced would be adjusted by varying the operating duration.
- Removal of the mechanical spray evaporators and decommissioning of the evaporation pond have already occurred. Removal of the pond liner, planting of native vegetation in the pond basin, and installation of RO concentrate storage (Baker tanks) or a ZLD facility are anticipated to occur within one year of approval of all necessary regulatory agency permits. Construction of the proposed modifications is subject to obtaining permits and available CCSD funding.
- Permitting agencies for completion of the proposed modification would likely include San Luis Obispo County, California Department of Fish and Wildlife (CDFW), U.S. Fish and Wildlife Service (USFWS), Central Coast Regional Water Quality Control Board (RWQCB), California Coastal Commission (CCC), and the U.S. Army Corps of Engineers (USACE)

1. Environmental Setting

The following information presents the existing environmental conditions at the Project site. This information will be used for conducting the Project's environmental analyses and will serve as the environmental baseline for hydrological and biological monitoring. This section describes the physical and biological environmental conditions in the vicinity of the Project when the WRF is not operating.

Soils

Based on the U.S. Department of Agriculture Soil Survey, the Project site and survey area are underlain by the following soil units shown on **Figure 6**: Beaches, Capistrano sandy loam (rolling), Concepcion loam (5 to 9 percent slopes), Lodo clay loam (5 to 15 percent slopes), Los Osos loam (5 to 9 percent slopes), Los Osos loam (30 to 50 percent slopes), Los Osos-Diablo complex (15 to 30 percent slopes), Marimel sandy-clay loam (occasionally flooded), Riverwash, and Salinas silty clay loam (0 to 2 percent slopes).

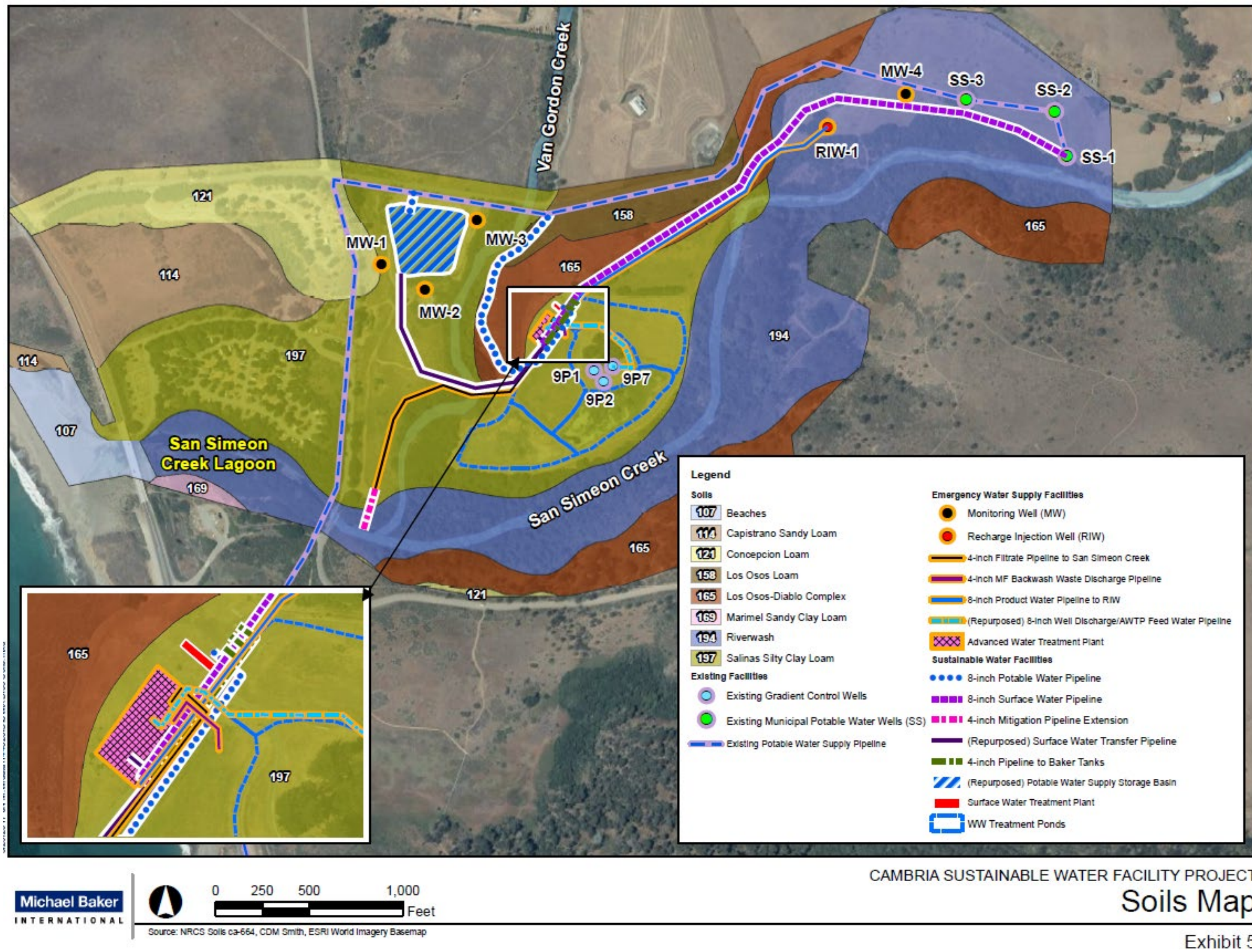


Figure 6 Soils Map

Vegetation

Eight primary plant communities and land use types were identified within the Project site, with distributions shown on the Vegetation map in **Figure 7**. This initial mapping effort was completed by Michael Baker International in support of the SWF project in 2017. The primary plant communities identified in 2017 within the project area were Central Coast Arroyo Willow Riparian Forest, Monterey Pine Stand/Monterey Pine Forest, Coyote Brush Scrub, California Bulrush Marsh, Annual Grassland, Wild Oats Scrub, Upland Mustards, and Eucalyptus Stand. It appears that some of these plant communities, such as Coyote Brush Scrub and Upland Mustards, were "lumped" together under a Ruderal heading on **Figure 7**. It also appears that the 2017 mapping effort combined the California Bulrush Marsh within the Central Coast Arroyo Willow Riparian Forest plant community since that vegetation type is not delineated on **Figure 7**. In addition, there are a landscaped campground, percolation ponds, and other project elements included under the Ruderal and Disturbed map units. San Simeon Creek, Van Gordon Creek, and the San Simeon Creek lagoon and Lagoon/Estuary are also shown on the Vegetation Map. **Table 1** lists the acreage of each plant community or noted features within the CCSD project site defined in 2017, as well as the percentage that each encompasses within the Project site. The plant communities are described in further detail below.

Figure 7 Vegetation Map

Table 1 Plant Communities

Plant Community	Acreage	Percentage
Central Coast Arroyo Willow Riparian Forest	61.1	31.0%
Monterey Pine Stand	0.8	0.4%
Monterey Pine Forest	23.3	11.8%
Coyote Brush Scrub	6.6	3.3%
California Bulrush Marsh	0.2	0.1%
Annual Grassland	31.8	16.1%
Wild Oats Grassland	6.5	3.3%
Upland Mustards	27.9	14.1%
Eucalyptus Stand	5.9	3.0%
Landscaped Campground	8.5	4.3%
Percolation Pond	9.0	4.6%
Lagoon/Estuary	2.2	1.1%
Total	183.8	100%

Central Coast Arroyo Willow Riparian Forest

A Central Coast Arroyo Willow Riparian Forest borders both San Simeon Creek and Van Gordon Creek. It is characterized by a dense, low, closed-canopy forest dominated by arroyo willow (Salix lasiolepis), western sycamore (Platanus racemosa), eucalyptus (Eucalyptus sp.), and cape ivy (Delairea odorata). It typically occurs in areas that are moist to saturated sandy or gravelly soil. Many plant types in this habitat are phreatophytic (with roots that reach the water table) and thus potentially affected by changes in groundwater levels.

Monterey Pine Stand/Monterey Pine Forest

There are two small stands of Monterey pine (Pinus radiata) located within the Project site. One stand is located in the center of the percolation ponds, adjacent to Well 9P7. The canopy cover in this area is composed entirely of Monterey pines, with the understory composed mostly of ripgut brome (Bromus diandrus) and wild oats (Avena fatua). A second stand of Monterey pine is located on the south side of San Simeon Creek. This vegetation community is supported by soil moisture supplied by rainfall and is not affected by groundwater levels.

Coyote Brush Scrub

Coyote brush scrub is scattered throughout the Project site but is concentrated in patches primarily south of the vicinity of the intersection of Van Gordon Creek Road with San Simeon Creek Road around the brine evaporation pond. It is also present north of the percolation ponds, to the east of the San Simeon Creek Campground within Hearst San Simeon State Park, and on the south side of San Simeon Creek Lagoon east of State Route 1 (SR 1). It is dominated by coyote brush (Baccharis pilularis) and is intermixed with black mustard (Brassica nigra) and non-native grasses. This vegetation community is supported by soil moisture supplied by rainfall and is not affected by groundwater levels.

California Bulrush Marsh

California bulrush marsh is located immediately east of Highway 1 on the south side of San Simeon Creek lagoon. It consists of a narrow channel dominated by dense California bulrush (Schoenoplectus californicus). The upland slopes are covered in coyote brush scrub. This channel is a tributary to the San Simeon Creek lagoon.

Annual Grassland

Annual grasslands are located in the northeastern portion of the Project site between San Simeon Creek Road and San Simeon Creek, as well as south of San Simeon Creek. This community is dominated largely by canary grass (Phalaris aquatica), wild oat, ripgut brome, dandelions (Taraxacum officinale), coyote brush, and other herbaceous vegetation. This vegetation community is supported by soil moisture supplied by rainfall and is not affected by groundwater levels.

Wild Oats Grassland

Wild oats grassland is primarily located along the upper edges of and between the percolation ponds. It is dominated almost exclusively by thick stands of wild oats, but is intermixed with light coverage of ripgut brome, short-podded mustard (Hirschfeldia incana), and canary grass. This vegetation community is supported by soil moisture supplied by rainfall and is not affected by groundwater levels.

Upland Mustards

Upland mustard communities are located primarily in the center of the Project site, both east and west of Van Gordon Creek and north of the percolation ponds. This community intermixes with coyote brush scrub. It is dominated by thick, tall stands of black mustard with low-growing grasses (canary grass and bromes), milk thistle (Silybum marianum), dandelion, poison hemlock (Conium maculatum), and giant horse tail (Equisetum telmateia ssp. braunii). This vegetation community is supported by soil moisture supplied by rainfall and is not affected by groundwater levels.

Eucalyptus Stand

Small eucalyptus stands are located on the eastern side of the Project site on the south/eastern shore of San Simeon Creek. These are predominantly characterized by tall eucalyptus trees that have invaded the Central Coast Arroyo Willow Riparian Forested areas. Some eucalyptus species are facultative phreatophytes that use groundwater when available.

Landscaped Campground

The landscaped campground (San Simeon Creek Campground) is located west of the Project site, west of Van Gordon Creek Road, and north of San Simeon Creek lagoon. (The AMP monitoring will avoid entering the campground area unless otherwise approved by State Parks. It is described here to complete a discussion on the areas adjacent to and outside of the WRF Project site.) The landscaped campground area is vegetated with non-native ornamental grasses and contains larger trees and shrubs, including cypress (Cupressus sp.), western sycamore, and toyon (Heteromeles arbutifolia).

Percolation Ponds

There are four percolation ponds located in the center of the Project site, northeast of the confluence of Van Gordon and San Simeon Creeks. While the upland edges of these are dominated by wild oat grasslands, the bottoms are periodically flooded for water treatment and therefore undergo dynamic changes, sometimes holding dense vegetation, sometimes bare and dry, and sometimes inundated with water depending on the current flooding schedule.

Lagoon/Estuary

San Simeon Creek lagoon/estuary extends from the Pacific Ocean inland approximately 2,100 feet to around the boundary between the Project site and the State Beach campground. West of Highway 1, the banks are entirely bare beach sand. Inland of Highway 1, the north and south banks are mostly lined with Central Coast arroyo willow riparian forest. When the sandbar is closed (typically late spring through fall or winter), this habitat is characterized as a lagoon. When it is open (typically fall or winter through early spring), it is characterized as an estuary where saltwater and freshwater merge. In some years, the sandbar may not open at all, and the lagoon persists all year.

Wildlife

The project site is in a rural setting, located between open space and recreational uses on lands owned by the California Department of Parks and Recreation and surrounding agricultural and range lands. San Simeon Creek Road is lightly traveled by residents, connecting rural and ranching areas to the east along the San Simeon Creek valley and the foothills of the Santa Lucia Range with Highway 1. The plant communities described above have the potential to support a diverse assemblage of wildlife species. Studies within the Van Gordon Creek and Simeon Creek corridors have confirmed that select areas of the project site support the following federally listed and sensitive wildlife species.

Amphibians

San Simeon Creek and its lagoon provide suitable breeding, foraging, and refuge habitat for the federally threatened California red-legged frog (*Rana draytonii*). During the winter months when Van Gordon Creek contains water, this part of the project site could also provide a suitable movement habitat for the red-legged frog.

Reptiles

The creek corridors within the Project Site also provide suitable habitat for western pond turtle (*Emys marmorata*), a California species of special concern, and two-striped garter snake (*Thamnophis hammondii*).

Birds

The Project site supports a variety of bird species, including both resident and migratory species. Representative species that have been observed on the site during biological studies included mallard (*Anas platyrhynchos*), turkey vulture (*Cathartes aura*), California gull (*Larus californicus*), Pacific-slope flycatcher (*Empidonax difficilis*), chestnut-backed chickadee (*Poecile rufescens*), bushtit (*Psaltriparus minimus*), cedar waxwing (*Bombycilla cedrorum*), song sparrow (*Melospiza melodia*), red-winged blackbird (*Agelaius phoeniceus*), and house finch (*Haemorhous mexicanus*). The Project site and surrounding area also have the potential to support special- status raptors such as ferruginous hawk (*Buteo regalis*) on a seasonal basis, northern harrier (*Circus cyaneus*), and prairie falcon (*Falco mexicanus*).

Mammals

The plant communities within the Project site are anticipated to provide suitable habitat for a number of common mammalian species acclimated to heavy disturbance, including California ground squirrel (*Otospermophilus beecheyi*), Botta's pocket gopher (*Thomomys bottae*), California vole (*Microtis californicus*), deer mouse (*Peromyscus maniculatus*), raccoon (*Procyon lotor*), cottontail rabbits (*Sylvilagus audubonii*), and opossum (*Didelphis virginiana*). Other larger mammals such as black-tailed deer (*Odocoileus hemionus columbianus*), mountain lion (*Puma concolor*), and the American badger (*Taxidea taxus*), as well as a variety of bats, could occur in the surrounding area. On occasion, these species could move through the Project site, even considering the surrounding fencing.

Fish

San Simeon Creek, Van Gordon Creek, San Simeon Creek lagoon, and their tributaries provide habitat for fish. Threespine stickleback (*Gasterosteus aculeatus*), the federally endangered tidewater goby (TWG, *Eucyclogobius newberryi*), and the federally threatened South-Central California Coast steelhead trout (*Oncorhynchus mykiss irideus*) have been observed during biological studies of San Simeon Creek and the lagoon.

Hydrology

The percolation pond area and CCSD's municipal wellfield are located along San Simeon Creek, 0.5 and 1.0 miles upstream of the Pacific Ocean, respectively. The 41-square-mile watershed of San Simeon Creek generates an average of 15,200 acre-feet per year (AFY) of runoff, or roughly 30 times the annual volume of groundwater pumping at the wellfield. Van Gordon Creek drains a much smaller watershed and enters San Simeon Creek at the west edge of the percolation pond area, near the upstream end of San Simeon Creek lagoon. The valley floor is a relatively flat floodplain 900-1,500 feet wide, flanked by steep hillsides that rise 200 to 800 feet above the valley floor. A lagoon (i.e., San Simeon Creek lagoon) forms during the dry season and extends approximately 2,100 feet inland from the seasonal sandbar at the confluence with the Pacific Ocean. Lagoon inflow consists of groundwater discharge and occasional waves that overwash the sandbar, resulting in fresh to brackish water in the lagoon. Outflow is by seepage through the sandbar to the ocean.

Groundwater

The lowermost 3.5 miles of San Simeon Creek flow across a narrow, shallow alluvial groundwater basin up to 120 feet thick along its centerline. The basin is 900-1,500 feet wide near the wellfield and percolation pond area. The wellfield consists of three wells (SS-1, SS-2, and SS-3) that produced 247-409 AFY annually (average = 344 AFY) for municipal supply during 2015-2024. The principal source of groundwater recharge is percolation from San Simeon Creek, which typically flows from December to June. In dry years, flow in the Project area can cease as early as March. During the dry season, groundwater levels and storage gradually decline due to pumping at CCSD's wellfield and agricultural wells in the basin. When stream flow resumes in winter, San Simeon Creek typically fully replenishes groundwater storage within 2-3 weeks.

In exceptionally dry years with a very long dry season or incomplete groundwater replenishment, the wellfield cannot produce its normal amount without creating a reverse gradient between the percolation pond area and the wellfield. The normal gradient is down the valley (from the wellfield toward the percolation pond area), and a reverse gradient creates a risk that percolated wastewater will flow toward the municipal supply wells. The Regional Water Quality Control Board permit for operating the percolation ponds prohibits the occurrence of a reverse gradient. The EWSP was constructed on an emergency basis during a sequence of dry years in 2013-2015. By extracting and treating groundwater beneath the percolation ponds and injecting it into a well between the wellfield and the percolation pond area, the EWSP (and WRF) creates a local groundwater mound that prevents a reverse gradient from forming and allows the municipal wells to pump at their normal rates.

Groundwater in the San Simeon Creek basin is considered underflow of San Simeon Creek, and CCSD's well field pumping complies with the terms of an appropriative water right issued by the State Water Resources Control Board that limits annual production to 799 AFY.

Surface Water

San Simeon Creek is a seasonally intermittent stream that typically flows in the Project area from approximately December to June. Streamflow records are available for water years 1971-1995 at Palmer Flats, the upstream end of the groundwater basin. San Luis Obispo County currently operates a stage-only gage at CCSD's well field. Without a rating curve to convert stage to flow, the gage is primarily useful to record the season of live flow in the Project area. Van Gordon Creek is an ephemeral stream that enters San Simeon Creek from the north several hundred feet upstream of the lagoon. Its flows are not gaged.

Vegetation along San Simeon Creek is primarily a Central Coast Arroyo Willow Riparian Forest community as described in Section 2.2 above. A wetland delineation was completed to determine specific acreages of potentially jurisdictional areas (Michael Baker International, 2017).

2. Potential Impacts

The WRF benefits the community by making more efficient use of existing water supplies. This is accomplished by controlling the hydraulic gradient between the well field and the percolation pond area by means of indirect potable reuse. To avoid potential contamination of potable groundwater at the well field, the difference in groundwater level between the well field and the percolation pond area is monitored. Under normal conditions, there is a positive gradient from the well field toward the percolation pond area. During very dry conditions, this positive gradient can reverse due to continued lowering of the groundwater level under the well field during the dry season. When a reverse gradient is detected, CCSD historically began pumping well 9P7 to lower groundwater levels near the percolation ponds and thus reestablish a positive gradient. The water was discharged into Van Gordon Creek, where it flowed to San Simeon Creek and the lagoon. This water was lost to the lagoon and ocean and was no longer available for the water supply.

The WRF will establish a positive gradient and simultaneously augment groundwater availability at the well field through indirect potable reuse. Water extracted from well 9P7 at the percolation pond area will be treated to drinking water quality and reinjected back into the basin between the well field and percolation pond area at well RIW-1. Groundwater modeling completed for the project design indicated that approximately 60 percent of the injected water flows toward the well field and supplements production at potable wells SS1 and SS2. The remaining 40 percent of reinjected water flows toward the percolation pond area, where it either seeps into the lagoon or is reextracted by well 9P7 (CDM Smith, 2014).

In addition to providing more efficient control of the hydraulic gradient and providing reuse of an otherwise wasted resource, the WRF will discharge approximately 100 gpm of microfiltration-treated water from well 9P7 (with no change in mineral composition) into the upstream end of San Simeon Creek lagoon to maintain groundwater levels when the WRF is operating. Based upon detailed hydrogeological analyses and modeling, CDM Smith (2014) concluded that significant impacts to groundwater levels and surface water flows are not expected as a result of WRF operation. Subsequent simulations using a refined model and more realistic WRF operating assumptions similarly found that water levels in creek pools and the lagoon would not be adversely impacted by WRF operation because target levels can be maintained by adjusting the amount of WRF discharge as “mitigation water” to the creek (Todd Groundwater, 2022; included as Appendix A).

The primary purpose of this Adaptive Management Plan is to determine whether simulated effects are correct by monitoring hydrological and biological variables before and during WRF operation. These monitoring programs and reporting requirements are discussed more comprehensively below.

Emergency Water Supply Project

Groundwater, surface water, and biological monitoring were conducted during preliminary EWSP operations in 2015. Data gathered during these limited operations found that groundwater levels and surface flows were not significantly different from those observed under drought conditions when the EWSP was not operating. Further, no observations indicated that groundwater levels and surface flows were below historical minimum levels. No impacts to tidewater goby, steelhead trout, or California red-legged frog were observed during 2015 EWSP operations. An assessment of habitat conditions and of the extant populations of California red-legged frog and tidewater goby showed high-quality habitat and stable breeding populations. Steelhead trout were not observed in San Simeon Creek or San Simeon Creek Lagoon in 2015, but those surveys did not include seining or netting. It is important to note that habitat conditions were considered to be high quality, and steelhead do occupy San Simeon Creek and lagoon in most seasons and years (D.W. Alley & Assoc., 2006; KMA 2024-2026).

Water Reclamation Facility

Based on field studies for the EWSP and other studies completed for the project, various modifications to the WRF were identified to further avoid and reduce potential environmental impacts resulting from future operations. These are listed in the description of the WRF in the "Background" section, above, and were described more completely in the 2025 SEIR. The modifications included decommissioning the evaporation pond and mechanical spray evaporators and moving the surface discharge into San Simeon Creek further downstream towards the San Simeon Creek Lagoon.

The WRF does not involve significant development of additional impervious surface areas (such as roadways, rooftops, and parking lots) in previously undisturbed areas that would substantially increase runoff or substantially alter drainage patterns within the Project site or alter the course of San Simeon or Van Gordon Creeks. As shown in Figure 4, the existing and new water facilities are outside of the two creek corridors and upstream of San Simeon Creek lagoon, with the exception of the filtrate pipeline, which may be extended to relocate the discharge point further south to the San Simeon Creek bank. This surface water discharge to the San Simeon Creek lagoon is a permitted activity through the RWQCB Order No. R3-2100-0223. This permit allows the SWF to discharge 100 gpm of microfiltration product water to the creek at the head of the lagoon as long as the discharge complies with permit requirements, based on the determination that this discharge is a low-threat discharge. Low-threat discharges are discharges that contain minimal amounts of pollutants and pose little or no threat to water quality and the environment. The surface discharge structure for the lagoon water would be located on the San Simeon Creek bank to provide more efficient delivery of water to the creek, thereby maintaining water levels in the lagoon and supporting biological resources. Armorflex lining would be used at the discharge point to protect the creek bank from erosion and allow for the continued growth of riparian vegetation.

Habitat

The Project site, where the WRF and other project elements are located, is within upland habitats that have been degraded from historic farming activities. While the Project area supports instream and riparian habitats associated with Van Gordon Creek, San Simeon Creek, and the lagoon, these drainage features would not be directly impacted by the project. All associated riparian and wetland habitats are expected to remain intact and only be influenced by natural fluctuations in groundwater and surface water levels associated with seasonal or climatic changes. WRF implementation is not expected to reduce the extent of naturally occurring habitats that do or potentially support regulated biological resources.

Species

Based on habitat requirements for specific species, availability and quality of habitats needed by special status (or sensitive) species, and known distribution in and around the WRF Project site, it was determined that the following listed or sensitive species that occur or have a high potential to occur in the Project area would not be adversely affected by Project implementation.

California Red-legged Frog

The California red-legged frog is a year-round resident in San Simeon Creek, San Simeon Creek lagoon's upper reach, and the adjacent riparian habitats. Past and current studies conducted in support of the WRF project have identified a stable breeding population in the lower reach of San Simeon Creek, including on the Project site. This species is also present further upstream, where more perennial conditions exist. The entire Project area is located within the California red-legged frog Critical Habitat Unit SLO-2, but not all of the project site provides Primary Constituent Elements for the species. Upland areas on the site that are developed or dominated by dense non-native plants are of lower quality for this species, but could still provide movement opportunities during the winter-spring rain season. As noted in the WRF Project Description, the discharge of the reverse osmosis concentrate into an evaporation pond (Van Gordon Reservoir) has been discontinued/decommissioned since December 2016, thereby eliminating an artificial water body that could inadvertently attract frogs. As part of Project modifications, the concentrate would instead be discharged to four Baker tanks or to a ZLD facility prior to offsite disposal. As noted above, two rounds of groundwater modeling concluded that groundwater levels and surface water flows will not be adversely affected, and no impacts to California red-legged frog habitat are expected to occur (CDM Smith, 2014; Todd Groundwater, 2022). Monitoring protocols and operational measures developed for the project will be in place as a backup to ensure impacts to this species and its suitable habitat do not occur when the WRF is in operation.

Tidewater Goby

The tidewater goby is a year-round resident of San Simeon Creek lagoon, and this area is designated Critical Habitat Unit SLO-5 by NOAA Fisheries. Tidewater gobies have been observed in the lagoon and lower San Simeon Creek corridor during a number of surveys conducted in support of the WRF project. As detailed above, previous modeling studies concluded that groundwater levels and surface water flows will not be adversely affected, and no impacts to tidewater goby habitat are expected to occur (CDM Smith, 2014; Todd Groundwater, 2022).

Steelhead (South-Central California Coast Distinct Population Segment)

Steelhead trout in San Simeon Creek are federally listed as threatened and are designated by the CDFW as a California species of special concern. The population in the Project vicinity ranges from Santa Cruz County south to the Santa Maria River. Typical freshwater steelhead habitat consists of gravel-bottomed, fast-flowing, well-oxygenated rivers and streams. The life cycle of this species is such that adult steelhead return to San Simeon Creek from the ocean in winter and early spring to spawn upstream. As the dry season returns and the lower four miles of the creek begin to dry into isolated pools, young steelhead fry will either move into deep pools upstream or move downstream into the lagoon to mature while the sandbar is closed. Juveniles will typically spend between one and three years maturing in a freshwater or estuarine environment before migrating out to sea. This species has been historically recorded to occur within San Simeon Creek and lagoon, and Van Gordon Creek. However, Van Gordon Creek is more of an ephemeral stream in the project area and does not support long-lived pools sufficient to support this fish. San Simeon Creek and Van Gordon Creek are part of the steelhead-designated Critical Habitat unit that is located within the Estero Bay Hydrologic Unit. Steelhead have often been observed in San Simeon Creek lagoon, including just upstream of the State Parks property boundary (D.W. Alley & Assoc., 2006; KMA, 2024-2026). As noted above, detailed hydrogeological analyses and modeling concluded that groundwater levels and surface water flows will not be adversely affected, and that no impacts on steelhead habitat are expected (CDM Smith, 2014; Todd Groundwater, 2022).

Two-striped Garter Snake

The two-striped garter snake is designated by the CDFW as a California species of special concern. It is primarily an aquatic species and is typically found in or near permanent or semi-permanent water, including creeks, pools, and stock ponds. Surrounding vegetation is typically made up of chaparral, riparian woodland, and grassland. There is a suitable habitat for this species in San Simeon Creek, but it has not been observed in the Project area during repeated surveys conducted in support of the WRF. As noted above, detailed hydrogeological analyses and modeling concluded that groundwater levels and surface water flows will not be adversely affected and no impacts to steelhead habitat are expected to occur (CDM Smith, 2014; Todd Groundwater, 2022).

Western Pond Turtle

The western pond turtle is designated by the CDFW as a California species of special concern. It typically inhabits slow-moving streams, ponds, and marshes with exposed banks, logs, and other suitable locations for basking. Western pond turtle has been documented in San Simeon Creek and lagoon during past and ongoing surveys (Cleveland Biological, 2025; KMA, 2026). Suitable habitat is located within these two areas, particularly in the downstream reaches of San Simeon Creek, where the creek substrate gives way from rocks to sandy or muddy bottoms. As noted above, detailed hydrogeological analyses and modeling concluded that groundwater levels and surface water flows will not be adversely affected, and no impacts to suitable pond turtle habitat are expected to occur (CDM Smith, 2014; Todd Groundwater, 2022).

3. Monitoring Program

Prior detailed hydrogeological analyses and modeling concluded that groundwater levels and surface water flows would not be adversely affected by the Project, and no impacts to habitats are expected to occur (CDM Smith, 2014; Todd Groundwater, 2022). Notwithstanding, given the complexity of the San Simeon Creek system and to further ensure that no impacts to habitat are occurring, this Adaptive Management Plan (AMP) includes the following groundwater, surface water, and biological monitoring programs that will be implemented before and during WRF operation. Locations mentioned in the monitoring program are shown in **Figure 8** as refined and documented in subsequent monitoring efforts by Cleveland Biological and KMA (2026).

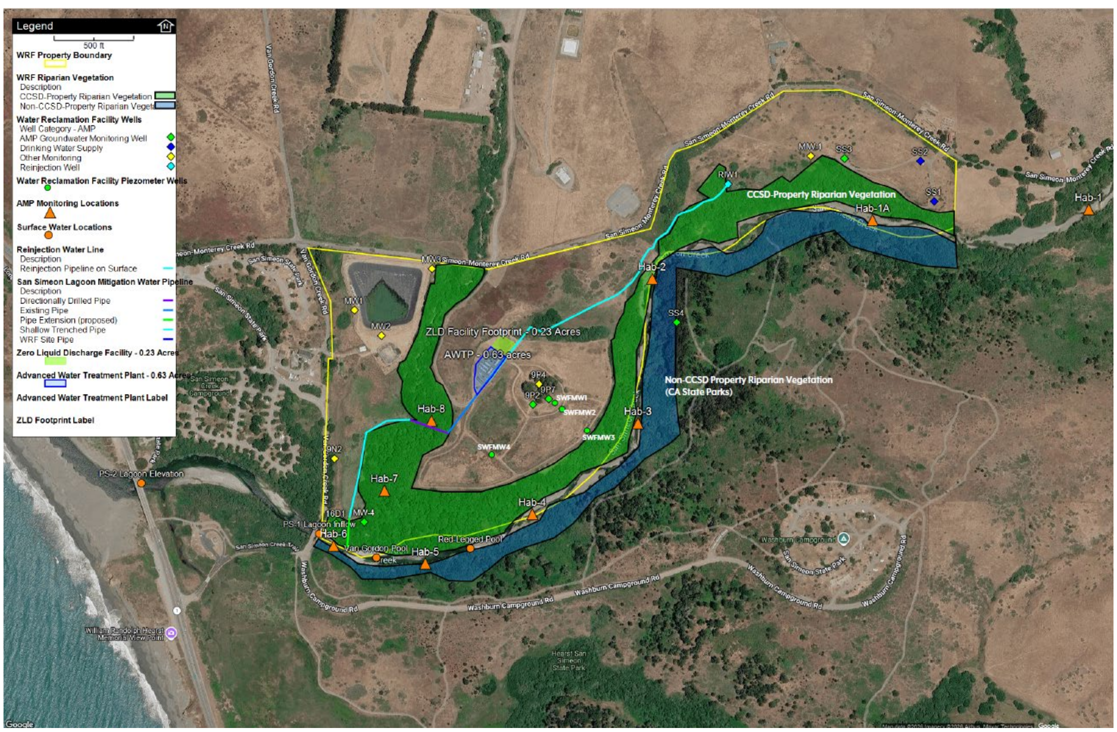


Figure 8 Monitoring Locations

Establishing Baseline Conditions

Groundwater and lagoon water levels follow a normal seasonal pattern. The San Simeon Creek groundwater basin can be conceptualized as a small pot that is filled by a large faucet (San Simeon Creek percolation). In all but the driest of years, the basin is completely refilled by creek percolation during the winter-spring flow season. The lagoon elevation reflects a balance between groundwater inflow rate and beach berm width during the dry season. This baseline pattern varies somewhat from year to year based on current hydrologic conditions. Some hydrologic variables have been monitored for many years, and the range of baseline variability can be quantified. These include pumping at the well field, percolation at the wastewater ponds, and water levels in wells near the Project area. Other variables have a more limited historical record. These include biological variables such as plant and animal species presence, abundance, and health. Some groundwater and lagoon water quality data are available and provide a limited picture of baseline conditions. Monitoring for the AMP includes additional baseline data collected prior to operations as well as measurements when the WRF is operating, with the objective of discerning whether any observed hydrological or biological variations are caused by WRF operation.

Baseline conditions will be represented by the range of seasonal variations in flows, water levels, and biological variables in prior years without WRF operation (where available) and trends during the months leading up to WRF operation.

Operational Flows

The need for WRF operation can be anticipated months in advance. Water produced by the WRF is much more expensive than native groundwater pumped at the well field, so WRF operation will be limited to dry years, particularly years when streamflow at the upper end of the groundwater basin ceases early (less than 2 cfs at Palmer Flats) or the basin has not been completely refilled by March. In those years, CCSD's water shortage criterion will likely be at Stage 4, 5, or 6 as defined in **Table 2**.

Table 2 Criteria Triggering Water Shortage Stages 4, 5, and 6

Water Shortage Criterion	Stage 4	Stage 5	Stage 6
Dry season start date	April or later	March or earlier	March or earlier
Rainfall since October 1 (% of normal)	41-55%	26-40%	≤25%
San Simeon Well Field Water levels			
Elevation (feet NAVD88)	14.1-16.0 ft	12.1-14.0 ft	≤12.0 ft
Percent of normal	71-80%	61-70%	≤60%
WBE/WBW well levels			
Elevation (feet NAVD88)	4.1-4.5 ft	3.4-3.9 ft	≤3.4 (WBE)
			≤3.3 (WBW)
Percent of normal	71-80%	61-70%	≤60%
9P2/SS4 gradient			
Water level difference (feet)	2.2-2.4 ft	1.9-2.1 ft	≤1.8 ft
% of normal	71-80%	61-70%	≤60%

If San Simeon Creek flow at Palmer Flats drops below 2 cubic feet per second (cfs) by May 1, or if observed rainfall, groundwater elevations, or the 9P2/SS-4 gradient reach any of the Stage 4, 5, or 6 thresholds identified in Table 2, CCSD shall initiate the WRF pre-operation phase, including the applicable pre-operation monitoring, regardless of whether a water shortage stage has been formally declared. In dry years when WRF operation is likely, CCSD will begin the monitoring steps for operational flows listed in **Table 3**.

Table 3 Monitoring Program for Operational Flows in WRF Operating Years

Start Date for Monitoring Phase	Starting at Least 2 Months Before WRF Operation	SS-4 to 9P2 Gradient Will Decline to 0.75 ft within 3 Weeks	Comments
WRF Status	**Off**	**On**	
Water Levels			
16D1	Biweekly	Continuous	To compare with historical record as means of detecting impact. Tidal influence is the reason for continuous monitoring (every 15-30 minutes with data logger).
MW4	Biweekly	Continuous	This well near 16D1 may be tidally influenced. Continuous measurements by data logger are needed to detect tidal fluctuations so they can be subtracted from the measurement record to reveal any 9P7 pumping drawdown.
SS-3, SS-4	Biweekly	Biweekly	SS-3 will be idle when WRF is injecting, so it will have relatively reliable static water levels. SS-4 is used to calculate the gradient that is the primary criterion for WRF operation.
9P2 and four piezometers in percolation pond area	Biweekly	Continuous	Recording water levels every 15-30 minutes with data loggers when WRF turns on will confirm the spread of drawdown from 9P7 and whether it reaches San Simeon Creek. This monitoring is needed only during the first year of sustained WRF operation.
San Simeon Creek pools (e.g. Van Gordon and red-legged)	Biweekly	Continuous	Install staff plates and water level data loggers n the pools at the start of monitoring. Remove prior to the next high flow season. This monitoring is needed only during the first year of sustained WRF operation unless pool conditions or WRF operation are significantly different from the first year of WRF operation.
Lagoon	Continuous	Continuous	If permission is granted by State Parks, CCSD will install a pressure transducer with data logger in the lagoon to monitor water level every 20 minutes, beginning in spring of any year when WRF operation is likely and continuing until WRF operation ceases.

Water Levels

Groundwater elevation has been monitored monthly to semi-monthly at wells SS-1, SS-2, SS-3, SS-4, 9P2, 9N2, 16D1, and MW-4 since at least the early 2000s. CCSD has long used the average water levels in wells SS-1, SS-2, and SS-3 to compare current conditions at the well field with the historical range of conditions. That range is indicated by the plots of monthly water levels during 1998-2017 in **Figure 9**. The water level pattern in every year is a gradual decline starting when stream flow ceases (April to August) and continuing through the fall until water levels abruptly recover when stream flow resumes (November to February). The range of variability among years provides a baseline for evaluating the impacts of WRF operation.

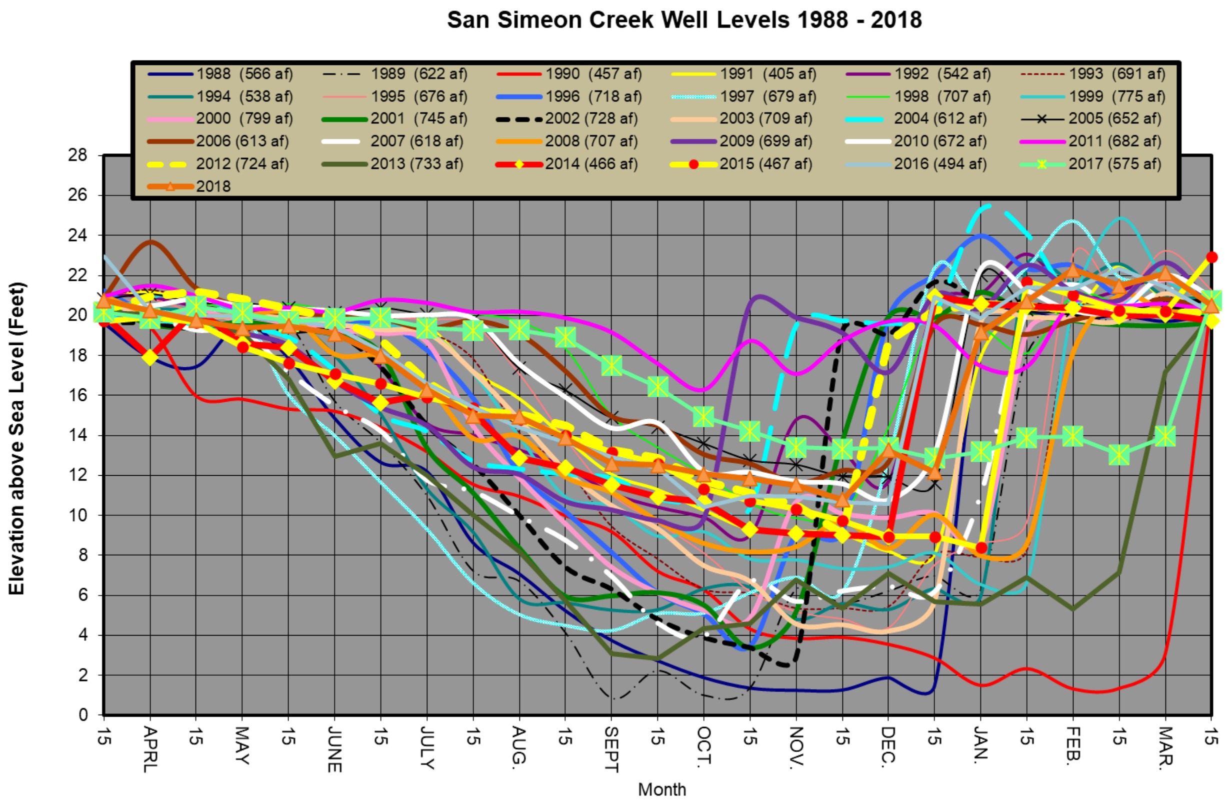


Figure 9 Historical Seasonal Water Levels at CCSD Well Fields

Note: each point represents the average water level for wells SS-1, SS-2, and SS-3.

This monitoring program will be supplemented with additional locations and more frequent measurements during years when the WRF is operating (as described under "Operational Flows" above). **Table 4** lists the specifics of the water level monitoring program in WRF operating years:

Table 4 Monitoring Program for Water Levels in WRF Operating Years

Start Date for Monitoring Phase	Starting at Least 2 Months Before WRF Operation[1]	SS-4 to 9P2 Gradient Will Decline to 0.75 ft within 3 Weeks	Comments
WRF Status	**Off**	**On**	
Water Levels			
16D1	Biweekly	Continuous	To compare with historical record as means of detecting impact. Tidal influence is the reason for continuous monitoring (every 15-30 minutes with data logger).
MW4	Biweekly	Continuous	This well near 16D1 may be tidally influenced. Continuous measurements by data logger are needed to detect tidal fluctuations so they can be subtracted from the measurement record to reveal any 9P7 pumping drawdown.
SS-3, SS-4	Biweekly	Biweekly	SS-3 will be idle when WRF is injecting, so it will have relatively reliable static water levels. SS-4 is used to calculate the gradient that is the primary criterion for WRF operation.
9P2 and four piezometers in percolation pond area	Biweekly	Continuous	Recording water levels every 15-30 minutes with data loggers when WRF turns on will confirm the spread of drawdown from 9P7 and whether it reaches San Simeon Creek. This monitoring is needed only during the first year of sustained WRF operation.
San Simeon Creek pools (e.g. Van Gordon and red-legged)	Biweekly	Continuous	Install staff plates and water level data loggers n the pools at the start of monitoring. Remove prior to the next high flow season. This monitoring is needed only during the first year of sustained WRF operation unless pool conditions or WRF operation are significantly different from the first year of WRF operation.
Lagoon	Continuous	Continuous	Obtain data from Central Coast Wetlands Group, or deploy a separate water level data logger. This monitoring is needed only during the first year of sustained WRF operation unless lagoon conditions or WRF operation are significantly different from the first year of WRF operation.

Continuous measurements mean measurements recorded every 15-20 minutes using a pressure transducer and data logger (such as a HOBO© water level logger). This frequency of measurement is needed where water levels are affected by ocean tides (the lagoon and wells 16D1 and MW-4) or where frequent measurement is needed for drawdown analysis around well 9P7 (well 9P2 and monitoring wells SWFMW1, SWFMW2, SWFMW3, and SWFMW4 in the percolation pond area).

Surface Water

Surface water flow is an integral component of providing suitable habitat for aquatic species. While tidewater goby and California red-legged frog require still water or minimal water flow to survive, steelhead trout requires water flow during most of its life stages, including adult migration, spawning, juvenile growth, overwintering, and juvenile migration (Smith undated). Flow in San Simeon Creek and Van Gordon Creek will be zero during WRF operation, because operation is not necessary when the creeks are flowing. The only location where flow would be present is where groundwater seeps into the upstream end of the lagoon, near the campground bridge.

Water Quality

CCSD's wastewater treatment and percolation operations operate under a permit from the Central Coast Regional Water Quality Control Board. In December 2025, the individual permit was changed to enrollment in a General Order specifying Waste Discharge Requirements Discharges from Domestic Wastewater Systems with Flows Greater than 100,000 Gallons per Day (R3-2020-0020). The monitoring and reporting program for the new permit includes monthly to quarterly monitoring of treated effluent discharged to the percolation ponds and in nearby wells SS3, SS4, 9P7, 16Dl, MW-4, and 9N2. Constituents that are monitored include nitrate/nitrogen, total dissolved solids (TDS), sodium, chloride, sulfate, boron, pH, electrical conductivity, dissolved oxygen, and oxidation-reduction potential. The recent enrollment of the Project's mitigation water into the RWQCB's General NPDES Permit for low-threat discharges requires that the 25-month rolling median TDS concentration be less than 500 mg/L in effluent percolated in the ponds with a single-sample maximum of 1,000 mg/L The same criteria are applied to downgradient wells, including well 16D1 next to the upper end of San Simeon Creek lagoon. The 25-month rolling median total nitrogen concentration must be less than 10 mg/L in the effluent. It is not specified for downgradient wells.

The quality of groundwater that seeps into the lagoon will be the same during WRF operation as it has been for many years under percolation pond operation. It consists of a mix of percolated pond water and native groundwater. **Table 5** summarizes water quality in the ponds and downgradient wells 16D1 and MW-4 near the lagoon in 2025 and compares them with water quality objectives in the Central Coast Basin Plan. The two wells are 42 feet deep and thus representative of shallow groundwater seeping into the lagoon. The water quality objectives for groundwater are the same as the maximum contaminant levels for drinking water. The general water quality objectives for inland estuarine and saline surface waters (EST and SAL beneficial uses) do not include objectives for TDS, sodium, chloride or nitrogen. Also, no specific objectives are presented for San Simeon Creek lagoon.

Table 5 Water Quality at the Percolation Ponds and Downgradient Wells in 2024-2026

Water Quality Constituent	Concentrations in milligrams per liter (mg/L)				
	Effluent to Percolation Ponds	WRF Creek Augmentation Well 9P7	Downgradient wells 16D1 and MW-4	Drinking water MCL	Surface water BMO
Total dissolved solids	832	410	798	500/1,000	not specified
Sodium	193	22	87	not specified	not specified
Chloride	204	23	141	250/500	not specified
Total nitrogen (as N)	9.2	0.4	<1	10	not specified

Notes:
MCL = maximum contaminant level for nitrate as nitrogen or recommended/upper secondary maximum contaminant level for TDS and chloride; BMO = basin management objective for estuaries;
WRF = water reclamation facility; ND = below detection limit
All entres are averages of available data for 2024-2026.

A comparison of concentrations in percolation pond water, well 9P7 groundwater, and downgradient well water reveals two general patterns. First, downgradient water (in wells 16D1 and MW4) has lower concentrations than percolation pond water, demonstrating that percolation is diluted by mixing with ambient groundwater before seeping into the lagoon. Second, well 9P7 groundwater—which is the source of water discharged to San Simeon Creek at the head of the lagoon during periods of WRF operation—has lower concentrations than are present in the downgradient wells. This means that concentrations in water entering the lagoon during periods of WRF operation will be lower than concentrations under existing conditions when the WRF is not operating.

Previous and current monitoring requirements for CCSD's wastewater operations have not included water quality monitoring of the lagoon. However, data are available from previous studies of the San Simeon Creek, Santa Rosa Creek, and Arroyo de la Cruz lagoons (D.W. Alley & Associates, 2006; Todd Groundwater, 2018). Those studies found highly variable water temperatures, salinities, and dissolved oxygen levels across all of those lagoons. The Arroyo de la Cruz study installed a local weather station and found that diurnal, multi-day, and seasonal patterns in water levels correlated with solar radiation, air temperature, wind speed, and relative humidity. In contrast, groundwater seepage into lagoons has a relatively constant temperature. At most, it would produce a small region of relatively stable thermal conditions near the upstream ends of the lagoons. Both studies found that saline water lenses occasionally present at the deepest part of the lagoon would become relatively warm due to a lack of mixing with the overlying fresh water. The warm and cool waters were separated by only 1-2 meters of water depth.

The salinity regimes of the three lagoons were found to be dominated by waves overwashing the beach berm and introducing seawater into the lagoon. The Arroyo de la Cruz study deployed water quality data loggers just below the lagoon surface and just above the lagoon bottom in a deep area near the beach berm and found that wave overwash events raised the electrical conductivity near the bottom of the lagoon from approximately 350 microsiemens per centimeter (µS/cm) to approximately 30,000 µS/cm, or roughly half the salt concentration of seawater. This saline water formed a layer at the bottom of the lagoon that seeped through the beach berm back to the ocean over a period of approximately one week. Notably, water near the lagoon surface experienced much smaller salinity peaks that dissipated much more quickly. D.W. Alley & Associates (2006) found similar salinity patterns in San Simeon and Santa Rosa Creek lagoons. Salinity at the lagoon surface was almost always low (0.5-0.8 parts per thousand [ppt]). At the bottom of the lagoon (1-2 m deeper), salinity soared to 5,000-35,000 ppt after waves overwashed the beach berm and often remained for several weeks. These results indicate that coastal lagoons experience a very large range of salinity in a complex spatiotemporal pattern. In all of the lagoons studied, high salinity was restricted to local lenses at the bottom of the lagoon, which means that fish could simply move upward in the water column to access fresher water.

The water quality data loggers deployed for the Arroyo de la Cruz study found markedly different DO patterns between the surface and bottom of the lagoon, even though the sensors were separated vertically by only 4 feet. The surface DO regime followed the classic diurnal pattern: high DO during the day from algal photosynthesis and low DO at night from algal respiration. DO at the bottom of the lagoon followed a tidal cycle, dropping to 0 mg/L at high tide and rebounding to 6-8 mg/L at low tide. This pattern appeared to result from microbial decomposition of organic matter accumulated on the lagoon bottom, which consumed oxygen rapidly. During high tides, the ocean level was approximately as high as the water level in the lagoon, and seepage through the sand berm ceased in the absence of a water-level difference between the lagoon and ocean. This allowed the DO at the bottom of the lagoon to drop to zero. As the ocean level dropped toward low tide, seepage through the sand berm resumed and moved the low-DO water out of the lagoon into the sand berm and ultimately the ocean. Meanwhile, DO at the lagoon surface fluctuated from 2-4 mg/L before dawn to 6-8 mg/L in the afternoon. D.W. Alley & Associates (2006) found similar patterns in San Simeon and Santa Rosa Creek lagoons. At the lagoon surface, the minimum DO concentration (at dawn) was generally 2.5-3.5 mg/L, while concurrent DO at the lagoon bottom was commonly 0-0.5 mg/L. A key result of both studies is that DO did not drop to lethal levels throughout the lagoons at any time. As with salinity, the data revealed a complex spatial-temporal distribution of DO in the lagoon. It appeared that fish would always be able to move to regions with adequately high DO when the lagoon bottom became anoxic.

Nitrate concentrations were not measured for the San Simeon and Santa Rosa Creek lagoon studies. The trickle of groundwater seeping into the far upper end of the Arroyo de la Cruz lagoon was sampled at five locations and found to have less than 1 mg-N/L of nitrate (as nitrogen). This is not surprising. On its way into the lagoon, groundwater is near the land surface, where it is within reach of plant roots that rapidly take up available nitrogen. The upstream end of San Simeon Creek lagoon is bordered by riparian vegetation similar to the vegetation along the Arroyo de la Cruz lagoon, and it is reasonable to assume that nitrogen is similarly removed. Wastewater percolation at the ponds along San Simeon Creek does not add a large nitrogen load to groundwater, as evidenced by the low nitrogen concentrations in shallow wells between the percolation ponds and lagoon (Table 6).

Overall, the water quality findings from previous lagoon studies demonstrate that the water quality variables most important to fish—temperature, salinity, and DO—are controlled by factors other than groundwater inflow. The quality of percolated wastewater and shallow groundwater seeping into the lagoon does not adversely impact those lagoon water quality parameters and would not change when the WRF is operating. Water from well 9P7 has lower TDS, sodium, and chloride than shallow groundwater that normally seeps into the lagoon, and nitrogen concentrations are equally low (Table 6). Thus, the discharge from 9P7 into the upper end of the lagoon during WRF operation periods would not degrade lagoon water quality.

Although no adverse impacts on lagoon water quality are expected to result from WRF operation, water quality monitoring at the upper end of the lagoon, a nearby well, and the WRF discharge into the lagoon will be conducted to verify this conclusion. CCSD's current NPDES WDR permit for the treated wastewater effluent discharged from the wastewater treatment plant requires monthly monitoring of nitrate and total nitrogen in effluent percolated at the ponds and one year of quarterly monitoring of TDS and chloride in nearby wells, including 9P7, 9N2, 16D1, and MW-4. The WRF's NPDES low-threat-to-water-quality discharge permit for the San Simeon Lagoon mitigation water also includes sampling requirements for nitrate and total nitrogen. These existing WDR and NPDES monitoring requirements are distinct from and will continue independently of the supplemental monitoring proposed under the AMP. The AMP monitoring program will provide additional data to evaluate potential effects associated with WRF operation, as described in Table 6, which identifies the supplemental monitoring locations and parameters to be sampled.

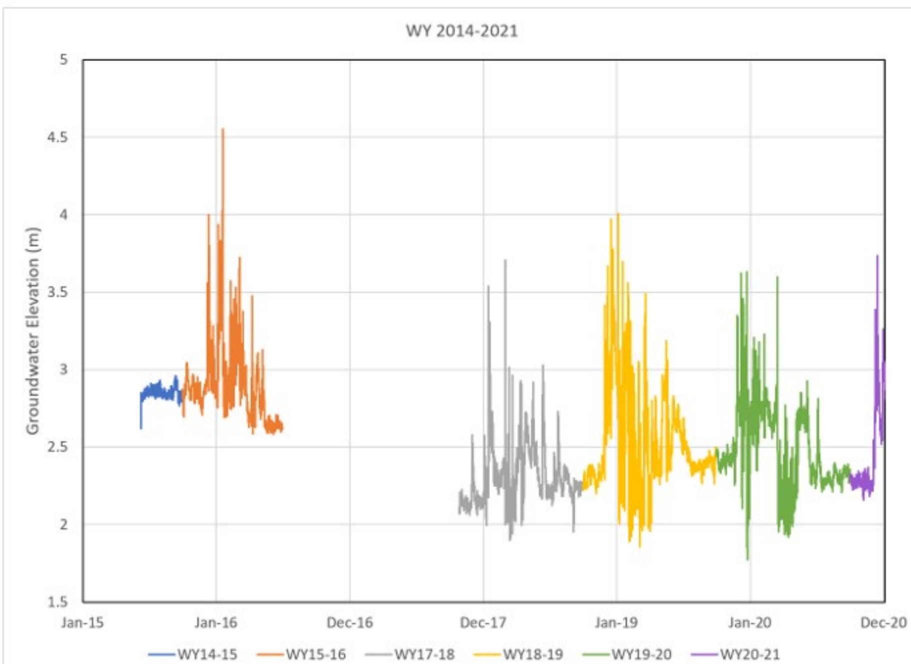
The TDS threshold triggering an adaptive response is an increase in TDS at the upper end of the lagoon that is more than 200 mg/L higher than the value measured the same year before WRF startup and not associated with a wave over-wash event. The likely response action will be to increase the WRF creek discharge, because the TDS of that discharge (water from well 9P7) is typically around 400 mg/L, so it would tend to dilute the salinity of other lagoon inflows to the lagoon.

The nitrate threshold triggering an adaptive response is a concentration greater than 0.8 mg/L in the WRF discharge to the creek. CCSD cannot directly or immediately modify the nitrate concentration in groundwater seeping into the creek and lagoon, but it can decrease the nitrate concentration in the WRF discharge, which comingles with the groundwater that enters the lagoon. If the median concentration of nitrate in discharge water in the three most recent biweekly samples is greater than 0.8 mg/L as N, then nitrogen removal will be implemented to bring the nitrate concentration to below 0.8 mg/L.

Table 6 Monitoring Program for Water Quality in WRF Operating Years

Start Date for Monitoring Phase	Starting at Least 2 Months Before WRF Operation	SS-4 to 9P2 Gradient Will Decline to 0.75 ft within 3 Weeks	Comments
WRF Status	**Off**	**On**	
Water Quality			
Upper end of San Simeon Creek lagoon	Twice (in spring and early summer)	Every 2 weeks during the first sustained WRF operating season.	Electrical conductivity, TDS, nitrate.
WRF discharge to San Simeon Creek	n.a.	Every 2 weeks during the first sustained WRF operating season.	Electrical conductivity, TDS, nitrate. Sample at the point of discharge to the creek when the discharge is occurring.
Well MW-4	Twice (in spring and early summer)	Every 2 weeks during the first sustained WRF operating season.	Electrical conductivity, TDS, nitrate. MW-4 is a monitoring well located and designed to represent groundwater entering the upper end of the lagoon.

Sampling frequency may subsequently be reduced following the TAC/agency review process already described later in the AMP.



The water level fluctuates 5-7 feet over short time periods, which will invariably cause corresponding fluctuations in lagoon width—all entirely unrelated to WRF operation.

- Maximum depth varies from year to year based on erosion/deposition during the previous winter stream flow season and the configuration of the beach berm. D.W. Alley & Assoc (2006) documented a 1-meter contrast in depth due to these processes between 2004 and 2005, as shown in this figure from the report:

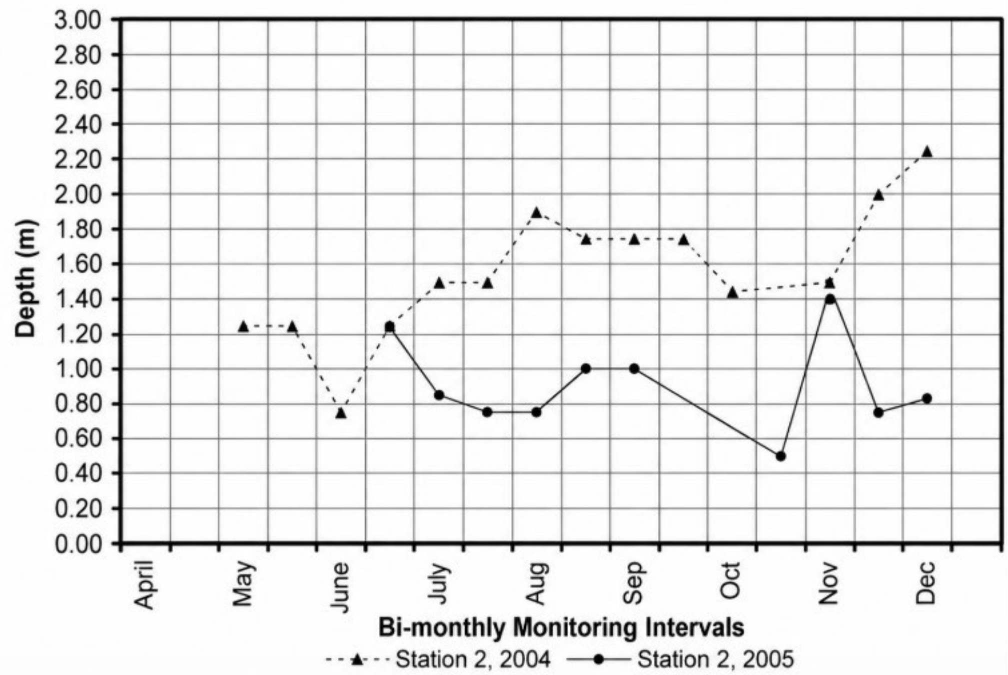
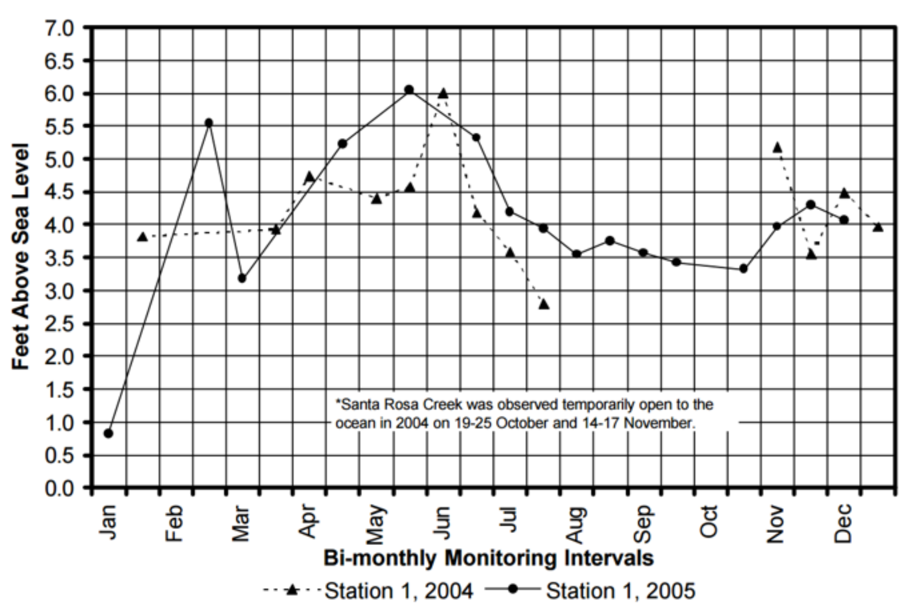


Figure 46. San Simeon Lagoon Depth during the Period of Sandbar Closure, Station 2, 2004-2005.

The WRF could conceivably affect lagoon elevation by affecting inflow, but it could not independently affect lagoon depth, which is controlled entirely by tides, wave overwash, and the aforementioned geomorphic processes.

Figure 31. Santa Rosa Lagoon Surface Elevation, Station 1, 2004-2005.*



Riparian Habitat

The AMP originally envisioned collecting baseline data for one year prior to WRF operation to determine the interaction between groundwater and surface water, and how this interaction maintains in-stream and riparian habitat. The goal is to determine a threshold or range of monitoring values that, if exceeded, would indicate a potential significant effect of WRF operations on aquatic and riparian habitats in San Simeon and Van Gordon Creeks. To date, AMP monitoring has occurred since 2015, greatly exceeding the one-year baseline monitoring period. Over this time, baseline data have shown considerable variation in streamflow and duration of seasonal pools due to natural fluctuations in surface water levels resulting from variability in seasonal precipitation, as well as annual variability or detectability in special-status species populations (Cleveland Biological, LLC 2022; KMA, 2024-2026).

Before WRF operations begin, baseline monitoring data collected for the AMP will be analyzed to establish ranges of observable metrics to track during WRF operations. Due to the variability with intermittent stream systems in the arid west, these data will be evaluated along with observations made at ecological reference sites upstream and downstream from CCSD property to assess potential impacts with WRF operations. Field measurements described in this plan, and review of historic and current aerial imagery, including the potential use of other technologies such as LiDAR, will help track changes with the extent of riparian habitat and stream channel morphology in the project area. Defined baseline ranges will be reviewed with the TAC prior to initial WRF operation and incorporation into the AMP. Exceedance of the acceptable ranges during regular monitoring during WRF operation would trigger notification of the TAC, County, and Coastal Commission, as well as additional investigation to determine potential causation. Adaptive management measures would be implemented in coordination with the TAC if it were determined to be associated with WRF operation.

In addition to tracking changes in groundwater and surface water within the Project area, the AMP will focus on monitoring the extent and viability of riparian habitat associated with Van Gordon Creek, San Simeon Creek, and San Simeon Creek lagoon at designated sample or data observation points, including qualitative description of flow, substrate type, aquatic species observed, riparian habitat condition, visible disturbances to stream bank or channel morphology, and fixed photo points. This includes measurements of wetted width and depth of pools in the creek upstream of the lagoon, and of lagoon levels and inflow (see Tables 4 and 5 above). In addition, riparian vegetation along the reaches of San Simeon and Van Gordon Creeks adjacent to the percolation pond area will be monitored for evidence of drought stress. These measurements will, in turn, help assess the habitat's suitability for supporting listed species known to occur in the Project vicinity.

A. According to annual studies commissioned by the CCSD between 1991 and 2005, tidewater goby has been observed to be generally more tolerant of adverse ambient conditions. Tidewater goby can spawn at salinities ranging from 5 to 10 parts per thousand (ppt) and can survive in temperatures ranging from 18 up to 27° Celsius (C) and only 1 part per million (ppm) of dissolved oxygen (DO).
B. Steelhead trout require more restrictive aquatic conditions in order to survive. Optimal conditions for steelhead trout in San Simeon Creek are believed to be salinity of less than 10 ppt, water temperatures below 22°C, and dissolved oxygen of greater than 5 ppm.
C. California red-legged frog lays eggs in water that is usually less than 16°C, with a maximum salinity tolerance of 9 ppt for adults and 6 ppt for embryos (Cook 1997).

Species

Tidewater goby, steelhead trout, and California red-legged frog are aquatic species known to occur in lower San Simeon Creek and Lagoon. From 1992 to 2006, the CCSD commissioned in-house surveys for tidewater goby and steelhead in lower San Simeon Creek and San Simeon Creek Lagoon. Tidewater goby was surveyed semiannually, while steelhead was surveyed annually. Baseline monitoring for the AMP, including California red-legged frog protocol-level surveys, has been completed over the last ten years, which documented high-quality habitat for these species in San Simeon Creek. In addition, past studies conducted by biologists at the USGS Piedras Blancas Research Station also documented the presence of these species in the greater project area.

AMP implementation will continue to conduct habitat assessment surveys prior to and following Project implementation. Surveys for these species are also expected to occur on a periodic basis by academic researchers and biologists with state and federal agencies to continue building a database of species presence in San Simeon Creek. As part of this AMP, visual surveys would occur for these target species, including supplemental surveys as warranted for the Tidewater goby and California red-legged frog following current regulatory guidance.

4. Impact Evaluation and Adaptation

Detecting Effects of WRF Operation

Data from the monitoring program will be evaluated in a two-step process. First, groundwater levels, pond and lagoon water levels, flows, riparian health, and species populations will be evaluated after WRF operation commences to determine whether any of these variables fall outside the normal range of variability observed in baseline data. Second, if conditions are outside the baseline range, all factors that might contribute to the anomaly will be evaluated to ascertain whether WRF operation is the likely cause. These factors include wellfield pumping, 9P7 pumping, injection into the RIW well, wastewater percolation at the ponds, agricultural pumping, and discharge from the WRF to the upper end of the lagoon. If there is a reasonable possibility that WRF operation is impacting flows, levels, and habitat, discharge from the WRF to the lagoon will be increased, or other pumping rates adjusted to decrease potential WRF impacts. This section details the impact evaluation methodology and is followed by a description of the set of response measures.

The following steps will be implemented to detect any effects of WRF operation on riparian vegetation, San Simeon Creek pools, San Simeon Creek lagoon, and aquatic resources:

1. Every 2 weeks after the WRF starts operating in any year, update time series plots of current year monitoring data for the following variables:
    a. Water levels in monitoring wells SWFMW1 through SWFMW4
    b. Water levels in monitoring wells 9P2, 9N2, 16D1 and MW-4 in the percolation pond area
    c. Water levels in pools in San Simeon Creek (Red Legged Pool and Van Gordon Pool)
    d. Inflow to the San Simeon Creek lagoon was measured near the head of the lagoon
    e. Lagoon water level
2. After each survey of riparian vegetation health or fish abundance in pools and the lagoon, compare the results with historical baseline surveys and surveys conducted earlier that year, prior to WRF startup.
3. Evaluate the plots fr signs of riparian vegetation water stress, abnormal seasonal declines in aquatic species abundance, desiccated egg masses, or water levels or flows declining more rapidly than occurred in baseline data. For reference, **Figure 10** shows the range of seasonal water-level declines in well 16D1 near the upstream end of the lagoon. **Figure 11** similarly shows seasonal water depths in two San Simeon Creek pools during 2016-2018. **Figure 12** shows historical dry season San Simeon Creek lagoon elevations during 2015-2020. Notably, the base elevation of the lagoon shifts from year to year,

presumably due to differences in the width of the beach berm. Also, temporary spikes in water level commonly result from wave overwash events.

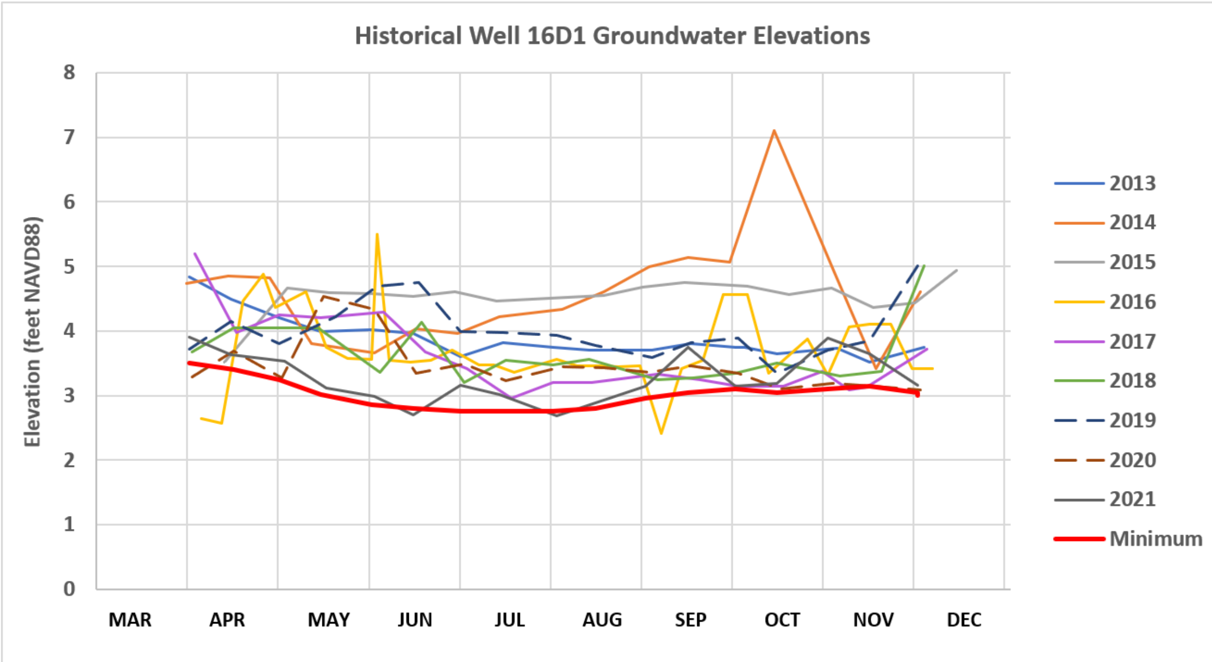


Figure 10 Seasonal Water-Level Trends in Well 16D1

Dry-season water level trends in well 16D1 vary considerably from year to year. The expected effect of WRF operation would be a lowering of water levels relative to that year's trend. A comparison of June-to-August water-level trends to August-to-October trends in each of the historical years shown in the Figure found that the most negative change in trend under baseline conditions was -0.0067 feet per day. Accordingly, adaptive mitigation will be implemented in WRF operating years if the water-level trend since 9P7 began pumping is more than -0.0067 ft/d different from the trend during the 2 months prior to 9P7 pumping. See "Responding to Adverse Effects of WRF Operation" below.

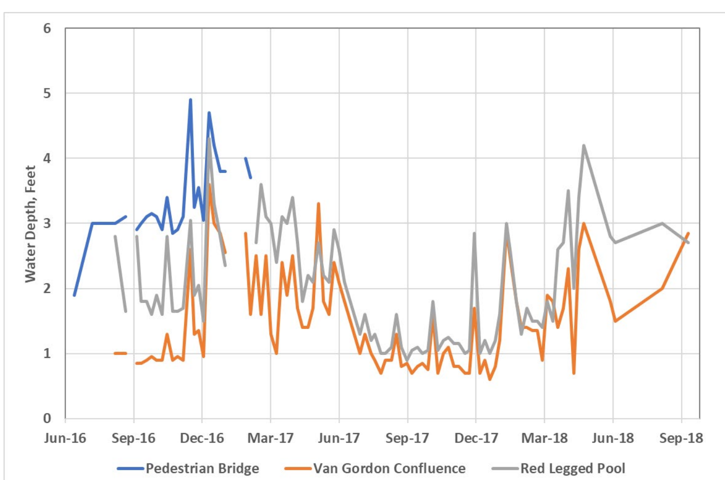
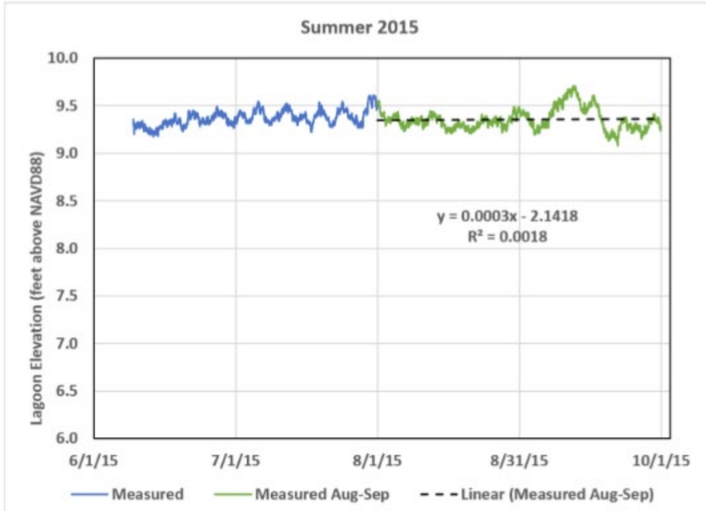
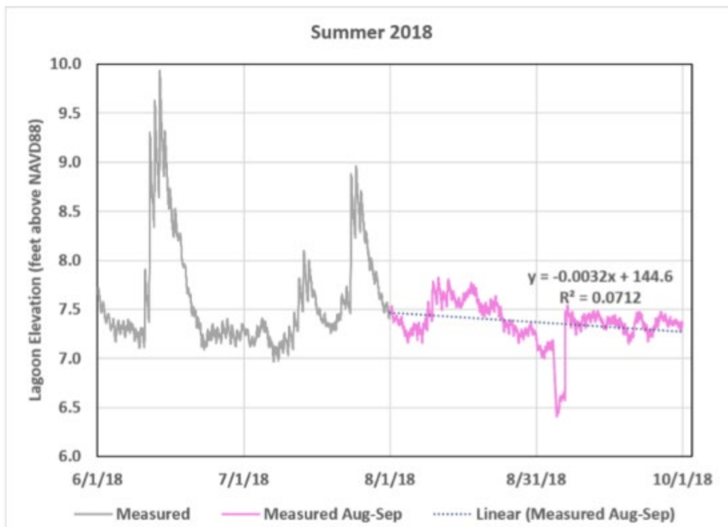
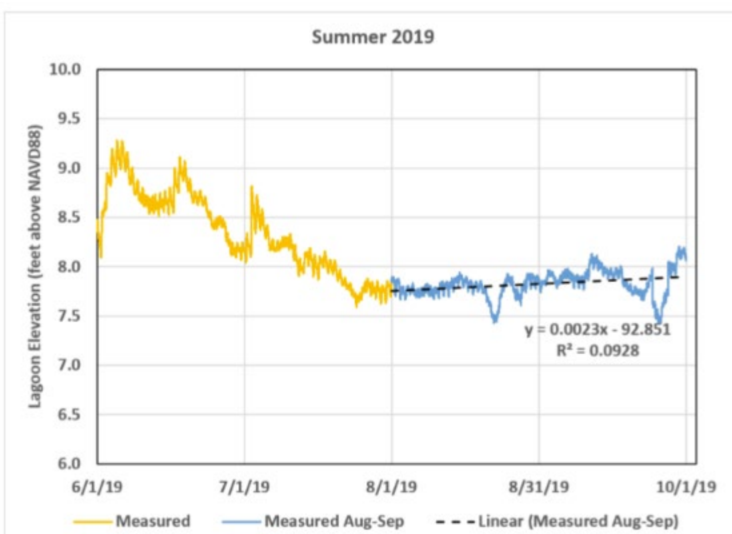


Figure 11 Seasonal Water Depths in San Simeon Creek Pools, 2016-2018

In both years, pool depth remained essentially constant during July-December. Accordingly, adaptive mitigation will be implemented in WRF operating years if the pool depth since the date when 9P7 began pumping decreases at a rate of 0.0041 ft/d or more (corresponding to 0.5 ft over 4 months). See “Responding to Adverse Effects of WRF Operation”, below.







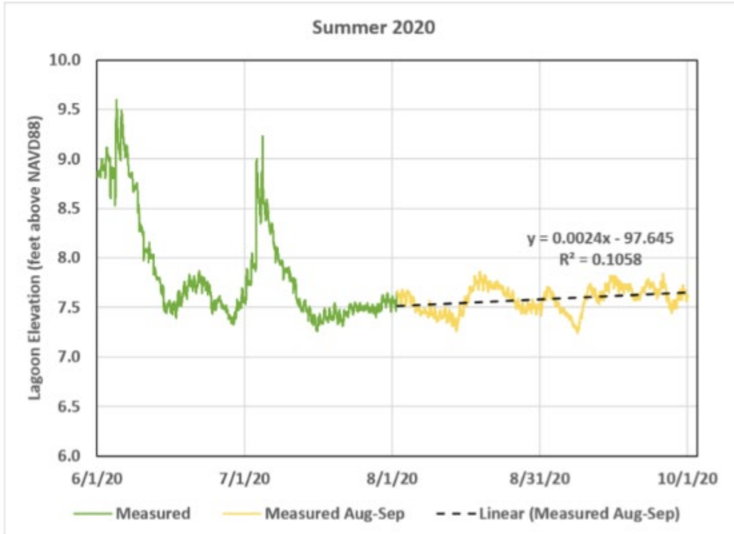


Figure 12 Lagoon Water Elevation in Summer-Fall 2015-2020

Figure 12 shows historical dry season San Simeon Creek lagoon elevations during 2015-2020. Notably, the base elevation of the lagoon shifts from year to year, presumably due to stream erosion and deposition processes the preceding winter and differences in the width of the beach berm. Also, temporary spikes in water level commonly result from wave overwash events and last for a number of days. Finally, lagoon elevation fluctuates twice daily in response to tides. In contrast, the expected effect of reduced lagoon inflow due to pumping at well 9P7 would be a small, gradual decline in lagoon elevation. Accordingly, the threshold for implementing an adaptive response is a statistical test of the slope of lagoon elevation since the WRF was turned on. WRF operation in dry years would likely start around August, and the hydrographs in Figure 12 show a linear regression trend line of lagoon elevation during August-September of each year. The slopes ranged from -0.0032 ft/d to +0.0024 ft/d. The test procedure that will be implemented every 2 weeks is to calculate the slope of lagoon elevation since the date well 9P7 started pumping. If the slope is more negative than -0.0032 ft/d but the value is influenced by a recent, sudden drop in elevation, the test will be repeated in 2 weeks. This will avoid reacting to "false positives". In all four years, there were dates when the regression slope since August 1 was more negative than -0.0032 (specifically, 9/3/2015, 9/2/2018, 8/22/2019, and 9/8/2020). In all four cases, however, the slope calculated 2 weeks later had recovered to a positive value. If the negative slope does not appear to be influenced by a temporary downturn, adaptive management will be implemented (see "Responding to Adverse Effects of WRF Operation", below). If the slope is still too negative 2 weeks later, additional response will be implemented, such as increasing the discharge to the creek by another 20 gpm, and so forth. Finally, if the slope of lagoon elevation since the date well 9P7 started pumping is more positive than +0.0024 ft/d, the discharge to the creek will be reduced by 20 gpm.

Responding to Adverse Effects of WRF Operation

Increase the Rate of Creek Discharge

If patterns in the potentially causal factors indicate that WRF operation is causing the abnormally low groundwater or pool/lagoon levels or lagoon inflow, then increase the time-averaged rate of WRF discharge to San Simeon Creek by 20 gpm. This will require increasing the amount of 9P7 pumping. However, increasing the creek discharge will benefit pool and lagoon levels and inflow faster than pumping at 9P7 can reduce them, due to the hydraulics of groundwater flow. Water level drawdown from 9P7 spreads in all directions, not just toward the pools and lagoon. Also, the additional pumping is supplied in part by depletion of temporary storage in the aquifer. In contrast, the creek discharge is focused directly on the impact area and is not subject to losses.

Change the Location of the Creek Discharge

If patterns in the potentially causal factors indicate that WRF operation is causing drought stress in riparian vegetation, move the creek discharge to a location upstream of the impacted vegetation and increase the time-averaged discharge rate by 20 gpm. If the 20-gpm increase in discharge does not improve conditions by the next biweekly data evaluation event, the discharge will be increased by another 20 gpm. An additional interim measure that may be implemented if drought stress is particularly sudden or severe is to irrigate areas of impacted vegetation using water-cannon sprinklers supplied by well 9P7 until the depth to the water table and vegetation health have recovered.

Decrease the Rate of Recycled Water Injection

In the unlikely event that pumping at well 9P7 appears to be a problem that cannot be avoided by increasing or relocating the creek discharge, decrease the amount of 9P7 pumping while maintaining the rate of creek discharge. In practice, this would mean reducing the output of the WRF product water and the rate of injection into the RIW. This can be implemented in 5 AF/mo increments until impacts are no longer evident.

5. Adaptive Management Process

The adaptive management process consists of four steps or phases:

- Monitoring to establish baseline conditions
- Monitoring, data evaluation, and adaptation during WRF operation
- Reporting
- Updating the AMP

Each step is described below.

Monitoring to Establish Baseline Conditions

Measuring operational, water level, flow, and biological variables prior to WRF operation provides data needed to characterize the natural variability of those factors. Substantial amounts of baseline data have already been collected to serve this purpose, as described in Section 2, "Environmental Setting."

Monitoring, Data Evaluation, and Adaptation during WRF Operation

Monitoring WRF operations and other concurrent pumping, water level, stream flow, and biological variables frequently during periods of WRF operation will indicate whether any variables are trending toward abnormal conditions outside the historical range. This monitoring is primarily needed during the first year of sustained WRF operation. Reduced monitoring will be sufficient in subsequent WRF operating years as long as WRF operation and ambient hydrologic conditions are similar to those during the first year. This is because drawdown from well 9P7 will be the same as in the first year if the pumping rate remains the same, and the quality of the water in the creek discharge will likely be the same as well.

Quantitative Trigger Framework

Monitoring results will be evaluated using the quantitative thresholds in Table 7. The thresholds are organized as early-warning triggers and action triggers. An early-warning trigger initiates prompt data review and confirmation; it does not, by itself, establish that WRF operation caused the observed condition. An action trigger requires an operational response when the available information indicates a reasonable possibility that WRF operation caused or materially contributed to the condition. CCSD may implement protective action before completing confirmation or causal evaluation when warranted by the severity or rate of change observed.

Table 7 Early-Warning and Action Triggers and Required Initial Responses

Indicator/location	Early-warning trigger	Action trigger	Required initial response
Well 16D1 groundwater trend	Post-startup slope approaches the approved action value or materially departs from the two-month pre-operation trend.	Post-startup slope differs from the two-month pre-operation trend by more than -0.0067 ft/day.	Validate logger and pumping records; review comparison wells and non-WRF pumping; implement mitigation if a WRF contribution is reasonably possible.
San Simeon Creek pool depth	Decline is detected over two consecutive biweekly evaluations but remains below the action rate.	Pool depth declines at a rate of 0.0041 ft/day or more after 9P7 pumping begins (equivalent to 0.5 feet over four months).	Confirm measurements and evaluate hydrologic causes; increase or relocate creek discharge if a WRF contribution is reasonably possible
San Simeon Creek Lagoon elevation	Post-startup slope is approaching -0.0032 ft/day.	The slope since startup is more negative than -0.0032 ft/day and is not explained by a temporary tidal, overwash, berm, or instrument-related fluctuation. Confirmation may occur at the next biweekly evaluation if the decline appears temporary.	Review tidal, overwash, berm, weather, and pumping data; increase creek discharge by 20 gpm if a WRF contribution is reasonably possible; reevaluate biweekly.
Water quality: EC/TDS and nitrate at 9P7, MW-4, and the upper lagoon	(1) TDS concentrations at the upper lagoon sampling site are increasing and approaching 200 mg/L above pre-startup values; or (2) the concentration of nitrogen (N) in the WRF discharge to the creek is increasing toward 0.8 mg/L.	If TDS at the upper lagoon sampling site is more than 200 mg/L greater than the concentration measured immediately within 7 days prior to WRF startup, or if N in the WRF discharge exceeds 0.8 mg/L, resample. If the repeat sample continues to show an elevated concentration, implement an adaptive response. A confirmed exceedance of the applicable site-specific EC/TDS or nitrate threshold at MW-4 or the upper lagoon that is reasonably attributable to WRF operation shall also require an adaptive response.	Investigate the source and spatial pattern; increase creek discharge by 20 gpm if a WRF contribution to increased TDS is reasonably possible; implement nitrogen removal to lower N in the discharge water to less than 0.8 mg/L; notify applicable agencies; and intensify monitoring until recovery.

Implementation note: *Before the first operating year, the AMP appendix shall identify the calculated site-specific upper prediction limits and the modeled/pre-operation drawdown envelope, including the dataset, period of record, statistical method, and treatment of nondetects and outliers.*

Water-Quality Threshold Calculation

Before WRF operation begins, CCSD shall calculate a site-specific upper prediction limit for EC/TDS and nitrate at each applicable monitoring location using the available pre-operation dataset. A 95-percent upper prediction limit shall be used where the dataset is sufficient for that method. If the dataset is insufficient or does not meet the assumptions of the selected method, the 95th percentile of the validated baseline dataset shall be used provisionally. The resulting numerical values, units, period of record, and calculation method shall be documented in an AMP appendix and provided to the TAC, County, Coastal Commission, and Regional Water Quality Control Board before operation.

For constituents subject to an applicable permit limit, Basin Plan objective, or other enforceable water-quality criterion, the more protective of the applicable criterion and the site-specific baseline threshold shall govern the early-warning evaluation. A confirmed exceedance of the applicable site-specific EC/TDS or nitrate threshold for which there is a reasonable possibility that WRF operation caused or materially contributed to the condition shall constitute an action trigger and require an adaptive response. Compliance determinations remain governed by the applicable permit or regulatory order; the AMP thresholds are additional operational early-warning and adaptive-management tools.

Confirmation and Causal Evaluation

When an early-warning trigger is reached, CCSD shall begin the following response without waiting for the next biweekly sampling event:

1. Validate the result by checking field notes, calibration records, laboratory quality-control information, logger performance, units, datum, and transcription.
2. Collect confirmation samples or measurements as soon as practicable and generally within five business days for laboratory water-quality parameters. Continuous water-level data will be evaluated at the next scheduled biweekly review, or sooner when the condition is severe or rapidly worsening.
3. Compare the affected location with pre-operation conditions, concurrent results at well 9P7 and appropriate reference or comparison locations, well-field and agricultural pumping, percolation-pond operations, RIW injection, creek discharge, tides, wave overwash, rainfall, temperature, and other reasonably available causal factors.
4. Determine whether there is a reasonable possibility that WRF operation caused or materially contributed to the condition. Conclusive proof is not required before CCSD implements a protective interim response.

Tiered Adaptive Responses

If an action trigger is reached and WRF contribution is reasonably possible, CCSD shall implement one or more of the following measures in the order appropriate to the affected resource. CCSD may proceed directly to a higher tier when the condition is severe, rapidly worsening, or presents a potential threat to beneficial uses or sensitive species.

Tier	When used	Measures	Follow-up
1 — Verify and contain	Early-warning trigger or uncertain cause	Validate data; confirmation sampling; inspect equipment; increase monitoring; preserve samples and operational records.	Complete promptly and document in the biweekly evaluation.

2 — Initial operational adjustment	Confirmed action trigger with a reasonable possibility of WRF contribution	Increase creek discharge by 20 gpm and/or relocate the discharge; adjust RIW injection or other controllable flows; use temporary irrigation for sudden or severe vegetation stress.	Reevaluate no later than the next biweekly event and sooner where warranted.
3 — Escalated adjustment	Condition persists, worsens, or fails to respond to Tier 2	Increase creek discharge by another 20 gpm; reduce WRF product-water output and RIW injection in 5 AF/month increments while maintaining protective creek discharge; reduce 9P7 pumping.	Increase monitoring frequency and notify the TAC and agencies.
4 — Temporary suspension	Lesser measures are ineffective; the condition presents a material risk; or continued operation could cause a significant adverse effect	Temporarily suspend the affected WRF operation, including 9P7 pumping as necessary, except for activities needed to protect public health, water-supply safety, or environmental resources.	Resume only after the cause is addressed and data demonstrate recovery or an agency-approved protective operating plan is in place.

Notification, Documentation, and Effectiveness Review

If an action trigger results in an operational adjustment or temporary suspension, CCSD shall notify the TAC, County of San Luis Obispo, California Coastal Commission, and other applicable regulatory agencies as soon as practicable. The notice shall identify the trigger, supporting data, quality-control review, preliminary causal evaluation, action taken, and schedule for follow-up monitoring. Immediate protective action does not require prior TAC approval.

CCSD shall continue enhanced monitoring until the affected parameter returns within the applicable threshold or demonstrates a stable recovery trend over at least two successive evaluation events, unless a different period is approved by the applicable agency. The event, response, and effectiveness determination shall be included in the annual report. The TAC shall review the first operating year and any material trigger event and may recommend revised thresholds, monitoring frequencies, or response measures; monitoring shall not be reduced without submission of those recommendations to the County and applicable regulatory agencies.

Reporting

WRF operations will be adjusted approximately every 2 weeks during periods of WRF operation. This includes adjustments to the amount of RIW injection and the rate of creek discharge. Previous modeling demonstrated that biweekly adjustments were sufficient to maintain the target water-level gradient between the well field and percolation pond area and to prevent adverse declines in pool and lagoon water levels and lagoon inflows (Todd Groundwater, 2022).

Most monitoring will be done by CCSD staff, with biological monitoring by a CCSD consultant. Data will be compiled and interpreted biweekly for signs of impacts or changes in the water level gradient. These ranges will be defined before operations begin. Monitoring will be completed in real-time. If a biweekly data evaluation event shows a potential impact and leads to the adjustment or implementation of a mitigation measure, the analysis and response will be reported to the Technical Advisory Committee (TAC), County of San Luis Obispo, and California Coastal Commission so that members of the TAC and agencies may comment.

The TAC shall be convened by CCSD and include qualified representatives from California State Parks, the California Coastal Commission, the California Department of Fish and Wildlife, the County of San Luis

Obispo, and the Upper Salinas–Las Tablas Resource Conservation District; representatives from other regulatory agencies and technical specialists may also be invited as appropriate. CCSD shall convene with the TAC to review the monitoring results and evaluate the effectiveness and adequacy of the Adaptive Management Plan. Based on that review, the TAC shall recommend whether the monitoring program should remain unchanged, be expanded or otherwise modified, or whether sufficient data support reducing the frequency of specific monitoring activities during future operations. The TAC's findings and recommendations regarding monitoring performance and any proposed changes to the AMP—particularly those resulting from the first-year review—shall be documented and submitted to the County and applicable regulatory agencies for review before monitoring frequencies are reduced. The TAC may be reconvened thereafter when monitoring results, changed environmental conditions, proposed AMP revisions, or agency concerns warrant additional technical review.

An annual report documenting WRF operations, monitoring data, and adaptive adjustments to WRF operations will be prepared after each year of WRF operation and submitted to the County of San Luis Obispo, Coastal Commission, and RWQCB. The CDFW, USACE, and NMFS will also be allowed to review the reports.

To the maximum extent practicable, CCSD shall coordinate with the Technical Advisory Committee ("TAC"), Executive Director and County Planning Director regarding monitoring results and in season adaptive management responses. To the extent annual monitoring identifies an adverse impact as defined below, CCSD shall submit proposed adaptive management measures to the TAC, the Executive Director and County Planning Director for review and comment at least thirty (30) days before implementation, where practicable. CCSD shall consider all timely comments received and shall implement adaptive management measures consistent with the AMP and the recommendations of the TAC. Prior approval from the Executive Director or County Planning Director shall not be required unless the proposed measures would materially modify the approved project or amend the AMP.

For purposes of this provision, an "adverse impact" shall mean: (i) an exceedance of an applicable water quality objective, permit limit, or regulatory standard; (ii) degradation in groundwater, surface water, or lagoon water quality that is reasonably attributable to WRF operations and meets or exceeds the action thresholds identified in the Adaptive Management Plan ("AMP"); or (iii) a measurable reduction in riparian habitat extent, riparian habitat health, or sensitive species habitat that exceeds the action thresholds identified in the AMP and is reasonably attributable to WRF operations.

Notwithstanding the foregoing, during a duly declared Stage 5 or Stage 6 water shortage condition under CCSD's Water Shortage Contingency Plan, operation of the WRF may continue provided that: (a) monitoring demonstrates compliance with applicable permit limits and water quality objectives; and (b) the TAC has identified and recommended remedial measures reasonably designed to avoid or minimize adverse impacts. In such circumstances, implementation of the remedial measures identified by the TAC shall constitute compliance with this provision unless and until monitoring demonstrates that such measures are ineffective in preventing an adverse impact as defined herein.

Updating the AMP

This AMP was originally prepared in 2017 and was updated and revised in 2026 to refine the program. Future technical studies and experience operating the WRF might reveal a need to modify WRF operations, the monitoring program, or adaptive measures. The AMP will be updated at a sufficient frequency to incorporate these modifications when the need arises.

6. Conclusions

In wet, normal, and slightly dry years, percolation from San Simeon Creek completely refills the groundwater basin, and WRF operation is not needed. Stream flow near the well field and percolation pond area ceases for months in summer and fall, during which time riparian vegetation remains supplied by a gradually declining water table. Groundwater seepage into San Simeon Creek near the upper end of the lagoon also provides a small amount of lagoon inflow. The lagoon forms during the dry season when wave action overpowers stream flow and creates a sand berm damming the lower end of the creek. Because groundwater recharge from winter streamflow resets the hydrologic system in almost all years, and WRF operation will likely occur in only a few years, there is no potential for long-term (multi-year) trends associated with WRF operation.

Percolation of treated municipal effluent in the percolation ponds augments the natural availability of groundwater, helping to support a shallow water table in riparian areas and inflow to the lagoon. Groundwater quality downgradient of the percolation ponds reflects a mix of native groundwater and percolated effluent. Concentrations of major water quality parameters are generally low.

The WRF would introduce three changes to the hydrologic system, and together they are not expected to adversely impact the creek, lagoon, and associated biota. First, pumping at well 9P7 in the percolation pond area would be the source of water for injection and for discharge to San Simeon Creek. That pumping would create a local cone of depression in the water table, potentially impacting riparian vegetation or reducing groundwater seepage into the lagoon. Second, injecting WRF product water into the recycled water injection well would create a water-table mound between CCSD's municipal well field and the percolation pond area. Third, water from well 9P7 (following microfiltration) would be discharged to San Simeon Creek near the upstream end of the lagoon at a time-averaged rate of approximately 100 gpm to offset any potential effects of 9P7 pumping on shallow groundwater levels or lagoon inflow. The benefits of this discharge on levels and flow will stay ahead of the drawdown impacts of 9P7 pumping because the former is focused at the location of potential impact, while the latter is distributed over a broad area.

Detailed, frequent monitoring of operational flows, water levels, water quality, and biota will be implemented before and during WRF operation to confirm whether impacts are occurring. In the unlikely event of adverse impacts, a set of adaptive response measures has been developed to eliminate them. The menu includes increased WRF discharge to San Simeon Creek and lagoon, temporary irrigation of drought-stressed riparian vegetation, and reduction in pumping at well 9P7.

The quality of water discharged from the WRF to San Simeon Creek (well 9P7 groundwater) is better than the quality of shallow groundwater that presently seeps into the creek and lagoon. Therefore, there is no obvious mechanism by which WRF operation could adversely impact water quality in creek pools or the lagoon. Previous detailed studies of water quality in San Simeon Creek, Santa Rosa Creek, and Arroyo de la Cruz lagoons found that temperature, salinity, and dissolved oxygen were all highly variable in space and time and controlled by factors other than groundwater seepage into the lagoons.

Many years of baseline data are available for pumping at the CCSD well field, percolation at the wastewater ponds, water levels in wells in the well field and percolation pond areas, and several water quality constituents for effluent and groundwater. Baseline biological data are also available, including detailed monitoring of the lagoon and creek pools in 2004-2005 and 2015-2026. Populations of key management species (steelhead, tidewater goby, red-legged frog, western pond turtle) are naturally quite variable due to factors unrelated to percolation pond or WRF operations. Additional baseline biological monitoring would occur immediately prior to WRF operations to help ensure that impacts to aquatic and riparian habitats do not occur from the project.

The monitoring program in this AMP focuses on the rapid detection of any impacts of WRF operation on water levels, lagoon inflow, or biota. Biweekly comparison of monitored variables within baseline ranges and trends will be used to trigger adjustments in discharge to the creek and recycled water injection. Previous modeling indicated that biweekly adjustments in relatively small increments can successfully maintain the target water-level gradient between the well field and the percolation pond area and prevent abnormally low water levels in creek pools and the lagoon. The AMP was designed to provide on-the-ground data collection and analysis to confirm the modeling is correct. If the 20-gpm increase in discharge does not improve conditions by the next biweekly data evaluation event, the discharge will be increased by another 20 gpm.

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Appendices

Appendix A: Water Reclamation Facility Groundwater Modeling Report (Todd Groundwater, 2022)

TODD GROUNDWATER

March 22, 2022

MEMORANDUM

To: Cambria Community Services District

From: Gus Yates, Senior Hydrologist

Re: Simulated Effects of Water Reclamation Facility Operation

BACKGROUND

The Water Reclamation Facility (WRF) purifies brackish groundwater extracted from the coastal part of the San Simeon Creek groundwater basin and processes it through microfiltration and reverse osmosis. After treatment, the water is injected back into the basin at a well farther up the San Simeon Creek Valley, where it augments groundwater available to three municipal wells that comprise the primary water supply for the community of Cambria. Cambria Community Services District (CCSD) constructed the WRF in 2014 under severe drought conditions, pursuant to an expedited emergency permitting procedure. At that time, the facility was called the Emergency Water Facility or Sustainable Water Facility. The locations of the WRF, extraction well, injection well, municipal wells and other hydrologic features are shown in **Figure 1**.

The WRF operated intermittently for 4 months in early 2015, 4 months at the end of 2015, and briefly at the end of 2016, injecting a total of approximately 89 AF of purified water into the basin. Health regulations required that the subsurface travel time from the injection wells to the nearest municipal supply well be at least two months. Groundwater modeling was done to identify an injection well location and injection rate that would meet that requirement.

The WRF has been idle since 2016, but CCSD is seeking to convert the emergency permit to a regular Coastal Development Permit. Although lagoon impact issues were discussed in previous environmental compliance documents (CCSD, 2016; CDM Smith, 2015), some regulatory agencies have lingering concerns that WRF operation could adversely impact habitat for several sensitive species that inhabit the lagoon and perennial pools along San Simeon Creek upstream of the lagoon (California Coastal Commission, 2016; California Department of Fish and Wildlife, 2016).

CCSD plans to operate the WRF in drought years. The 2020 urban water management plan (WSC, 2021) includes a water shortage contingency plan that defines six stages of increasing drought severity and describes associated management actions that would be taken to reduce demand and augment supply. Assuming the District obtains the regular permit to operate outside of emergencies, WRF operation is contemplated for the three most severe water shortage stages (Stages 4, 5 and 6).

The San Simeon Creek groundwater basin extends along San Simeon Creek valley from the Pacific Ocean about 5 miles upstream to Palmer Flats. The width of the alluvial deposits that comprise the basin is generally 800-1,500 feet, and the depth to bedrock along the center of the valley decreases from slightly over 100 feet at the coast to about 80 feet at Palmer Flats (Yates and Van Konynenburg, 1998). A thick sequence of fine-grained estuarine deposits separates the basin fill into upper and lower aquifers downstream of Van Gordon Creek, which enters the San Simeon Creek valley about 0.5 mile upstream of the ocean.

San Simeon Creek drains a watershed of 26 square miles. In normal years, base flow is continuously present during the winter wet season, gradually receding to zero in late spring or early summer. The dry season is defined as starting on the day flow at the upstream end of the basin (Palmer Flats) recedes to 0 cfs, and it continues until stream flow resumes the following winter (typically around December). Because percolation from San Simeon Creek supplies most of the recharge to the basin, water shortage conditions can result from an unusually long dry season or from a winter with so little stream flow that the basin is not completely refilled prior to the next dry season. Both of these conditions were incorporated into the scenario simulations.

MODEL ACTIVATION AND VERIFICATION

In 2014, CDM Smith developed a numerical groundwater flow model of the San Simeon Creek groundwater basin for the purpose of simulating subsurface travel time of water from the WRF injection well to the nearest potable supply well (CDM Smith, 2014). The investigators modified an existing model for that purpose, decreasing the grid spacing and increasing the number of layers from three to eighteen. The model was recalibrated to measured water levels for 2002-2003. A groundwater tracer study was subsequently completed (CDM Smith, 2017). It confirmed the accuracy of the modeling and recommended a maximum injection rate of 400 gallons per minute (gpm). The modeling study presented some results related to simulated lagoon water levels and ocean boundary outflow, but the primary focus was on subsurface travel time.

For the present effort, the model was shifted from one proprietary modeling software platform (GMS) to another (Groundwater Vistas). Model layering was modified slightly, and inputs were changed to simulate March 2013 through December 2014 using semi-monthly stress periods. That two-year period was a drought and was selected to ensure that the model was calibrated to be accurate for dry-year scenarios, which are the focus of CCSD water supply planning. Model calibration involved adjustments to several variables. Layer thicknesses were adjusted to prevent excessive numbers of cells from going dry during the simulations. The CDM Smith model had eighteen 5-foot-thick layers, and the upper layers tend to become unsaturated when simulated water levels decline. The MODFLOW-NWT solver simulates unsaturated flow but becomes unstable if large numbers of cells convert from saturated to unsaturated. This was particularly problematic near the upper end of the basin, which experiences large fluctuations in water levels as groundwater drains down-valley during the dry season then refills as soon as stream flow resumes. Most of the basin thickness in that region was assigned to model layer 1 to minimize unsaturation. Other variables adjusted during calibration included hydraulic conductivity, storativity and stream bed elevations.

Figure 2 shows hydrographs comparing measured and simulated groundwater levels at nine wells used for calibration. The figure also shows a hydrograph of the simulated groundwater gradient between well SS-4 and well 9P2. The generally good fit between the simulated and measured hydrographs at the nine wells was confirmed by statistical analysis of pairs of simulated and measured data points. **Figure 3** shows a scatterplot of measured versus simulated water levels for the 362 available water level measurements. The plot is clustered tightly around the 1:1 line, which represents a perfect match. The scaled root-mean-squared error was 3.6 percent, which is low and indicates acceptable model calibration.

WRF OPERATIONAL SCENARIOS

The primary objective of the modeling was to determine whether WRF operation would substantially diminish surface or groundwater inflow to the lagoon and/or lower reach of San Simeon Creek, which might have adverse biological impacts. A secondary objective was to identify the amounts of WRF operation needed under various drought conditions to meet water supply needs.

The overall WRF-groundwater system is complex, with many variables that interact. The diagram in **Figure 4** shows the components of the system. These include well 9P7 (the WRF supply well), the microfiltration component of the WRF, a lagoon discharge to San Simeon Creek that occurs while 9P7 is pumping, percolation of microfiltration backflush water at the percolation ponds, treatment of the remaining microfiltration water by reverse osmosis followed by injection at well RIW1, pumping of groundwater at CCSD's municipal wells (SS-1, SS-2 and SS-3), and percolation of treated wastewater at the ponds. Within the natural part of the system, seepage can occur in either direction between San Simeon Creek and groundwater and between the lagoon and groundwater. During the dry season, lagoon water seeps through the beach berm to reach the ocean. The basin extends offshore, and deeper layers are presumed to be in hydraulic connection with the ocean at some unknown offshore distance. Consequently, groundwater flow at the coastline can be seaward or landward, depending on the difference between onshore and offshore water levels. A change in any of the flows in this system affects all other flows.

The WRF is expensive to operate and would only be turned on in dry years when the supply of native groundwater might not be sufficient to meet CCSD water demand. CCSD plans to operate the WRF in water shortage Stages 5 and 6 and possibly in Stage 4. Those are the three most severe water shortage stages. To represent hydrologic conditions likely to be associated with those stages, the two years of the simulation period for scenario analysis represented two types of drought: a long dry season and a winter with incomplete basin recharge. These were implemented by adjusting the amount of San Simeon Creek inflow at the upstream end of the basin. **Figure 5** shows the assumed semi-monthly inflows for normal, Stage 4 and Stage 6 scenarios.

Some aspects of the model were held constant for all scenarios. These global assumptions included:

- Annual CCSD water demand in normal years is 700 AFY.
- Water shortage stages are associated with increasing amounts of water conservation. For Stage 4, conservation is assumed to decrease annual water demand by 40 percent, and for Stage 6 by 50 percent, per the water shortage contingency plan documented in the District's 2020 urban water management plan (WSC, 2021).
- The monthly distribution of water demand follows the average for 2013-2019. Monthly amounts range from 6.8 percent of the annual total in February to 10 percent in July. This reflects customer water use behavior during a drought.
- Pumping from the Santa Rosa Creek basin (located south of the San Simeon Creek basin) equals 20 percent of the CCSD water demand (after conservation) on an annual basis. The Santa Rosa pumping quota is distributed uniformly during June through October.
- Municipal wastewater percolation equals 92 percent of total CCSD water use on an annual basis and is uniform throughout the year. This was the percentage during 2014-2015, and it reflects customer water use patterns under drought conditions.
- All wastewater percolation is at Pond A (the most westerly pond).
- All water produced by WRF supply well 9P7 is processed through microfiltration.
- Microfiltration is 94.1 percent efficient. That is, 5.9 percent of the inflow is used to backflush the filters and is sent to the wastewater ponds for percolation.
- A constant flow of microfiltration product water is discharged to San Simeon Creek just upstream of the lagoon whenever well 9P7 is actively pumping. This flow could be adjusted independently of the reverse osmosis and RIW1 injection rates to prevent lagoon elevations and inflow from declining while the WRF is operating. Rates of 100-140 gpm were used in the simulations. These were assumed to be constant for each simulation, although in practice the lagoon discharge could be adjusted monthly as needed.
- Well 9P7 is assumed to have a pumping rate of 581 gpm, which was the measured discharge rate. Because the volume of WRF product water injected at well RIW1 varies by month and by scenario, the monthly hours of operation of well 9P7 also vary, and hence so does the monthly volume of lagoon discharge.

- Water produced by well 9P7 that is not used for backflushing the microfiltration filters or for lagoon discharge is processed through reverse osmosis. The reverse osmosis process has an efficiency of 92.1 percent (the remaining 7.9 percent is a brine that is trucked out of the basin for disposal). The reverse osmosis and advanced oxidation product water is injected at well RIW1.
- For a target amount of injection at well RIW1 in any semi-monthly stress period, the fraction of total time that 9P7 is pumping is imputed based on the recovery efficiencies of microfiltration and reverse osmosis. This is also the fraction of time the lagoon discharge is occurring. It is calculated based on the capacity of well 9P7 and the instantaneous lagoon discharge according to the following formula:
- $X = \frac{\left\{\frac{RIW}{RO\mathrm{eff} \cdot MF\mathrm{eff}}\right\}}{\left\{9P7\mathrm{cap} - \left(\frac{Lag}{MF\mathrm{eff}}\right)\right\}}$
- Where,
- X is the fraction of time 9P7 and the discharge are occurring
- RIW is the target WRF product water injection volume for the stress period (AF)
- RO_{eff} is the recovery efficiency of the reverse osmosis process (fraction)
- MF_{eff} is the recovery efficiency of the microfiltration process (fraction)
- $9P7_{cap}$ is the pumping capacity of well 9P7 if it operated continuously for the entire stress period (AF)
- Lag is the volume of lagoon discharge that would result if the discharge occurred continuously for the entire stress period (AF)
- Given a pumping capacity of 581 gpm for well 9P7, a lagoon discharge rate of 100 gpm, and the aforementioned efficiencies, the equation can be solved for X. The actual stress period volumes of 9P7 and lagoon discharge water equal their stress period capacities multiplied by X.
- 60 percent of water injected at RIW1 is available for extraction by municipal wells SS-1 and SS-2, and pumping of native groundwater is decreased by that amount. The remaining 40 percent of injected water flows joins native groundwater and flows west toward well 9P7 and the percolation pond area. This proportion was determined by prior modeling (CDM Smith, 2014).
- The lagoon discharge is to San Simeon Creek at the next-to-last stream cell before entering the lagoon (about 80 feet upstream of the lagoon).
- The lagoon has a fixed footprint.
- The “equivalent freshwater head” model assigns a constant head of 3.33 feet above the NAVD88 datum for all offshore cells in model layer 1. Lower model layers are assigned higher constant heads reflecting the greater density of seawater relative to fresh groundwater. Cells along the offshore end of the model grid in layers 10-12 are assigned a head of 3.84 feet, and cells along the offshore end of layers 14-18 are assigned a head of 5.40 feet. The density difference between seawater and fresh water can cause seawater to intrude a short distance into the onshore part of the aquifer, although in practice low onshore water levels due to pumping typically have a much larger effect.

- The principal management variable in the scenarios is the timing and amount of WRF operation. Other flexible input variables that were tested over a range of values were year type (water shortage stage) and the amounts of groundwater pumping for irrigation by neighboring well owners Pedotti and Warren. **Table 1** shows the combinations of assumptions regarding these variables for each of the scenarios.

SIMULATED EFFECTS OF WRF OPERATION

Hydrologic Conditions for Two Successive Dry Years

Each simulation covered a period of 22 months using semi-monthly stress periods. The simulations start in March with a full basin condition and continued through December of the following year. For model calibration, this period corresponded to March 2013-December 2014. Thus, the simulations covered two dry seasons. To simulate operational scenarios, different drought conditions were assumed for each dry season. The first one was long, with stream flow at Palmer Flats ceasing April 1 (for Stage 4 water shortage scenarios) or March 1 (for Stage 6) and not resuming until mid-January of the following year (see **Figure 5**). The second dry season was only moderately long (April 1 through December 15), but groundwater levels did not fully recover during the wet season between the two dry seasons. By trial and error, it was found that four semi-monthly stress periods with 5 cfs of San Simeon Creek inflow at Palmer Flats achieved partial basin refilling. These low flows mostly percolated out of the creek at the upstream end of the basin, with little surface flow reaching as far as the municipal well field. Water levels at the upstream end of the basin (represented by well 11B1) completely refilled for 2 weeks in late March before beginning the usual dry-season decline. Refilling decreased to about 40 percent of normal (based on water levels) at irrigation well 10M2, to about 35 percent of normal at the well field and roughly 10 percent of normal at well 9P7.

Operational Constraints

Constraints on WRF operation include infrastructure capacity, conditions in permits, and environmental impacts. None of the scenarios exceeded the capacity of well 9P7 or the microfiltration and reverse osmosis units. All of those operated less than full time in the scenarios. The dry season and annual groundwater production limits in CCSD's water rights permit were never exceeded. The limitation that most commonly constrained operation was the water-level gradient between well SS-4 and well 9P2 (see locations in **Figure 1**). To prevent the subsurface flow of percolated wastewater toward the well field, the water level in SS-4 should always be higher than the water level in 9P2. The existing permit for operating the percolation ponds allows temporary excursions to a reverse gradient, with SS-4 as much as -0.79 foot below 9P2. In practice, CCSD operates the system to avoid a water level difference less than +0.75 foot, and this was the criterion used in the scenarios.

The Coastal Commission has expressed concern regarding potential impacts of decreased inflow to the lagoon, although no quantitative threshold of significance has been defined.

The lagoon receives surface and subsurface inflow during the dry season. For the scenario analysis, the sum of the two inflows was tabulated for each stress period, and the minimum inflow during each dry season was identified. Lagoon inflow is affected by several variables including drought severity, irrigation pumping, municipal pumping and WRF operation. With regard to WRF operation, the effects of pumping at well 9P7 are partially or entirely offset by the lagoon discharge, a slight increase in percolation at the ponds, and injection at well RIW1.

Seawater intrusion is another potential constraint on system operation. If pumping and drought conditions cause groundwater levels near the coast to drop below 3.33 ft NAVD88 in upper model layers or 5.40 ft NAVD88 in lower model layers, groundwater flow across the coastline will shift from seaward to landward. The salinity of groundwater in the offshore part of the basin is not known, but eventually saline groundwater would begin arriving at onshore parts of the basin. Small amounts of landward groundwater flow during the dry season are not necessarily a concern if the water is flushed by large amounts of seaward flow during the wet season. Accordingly, scenario results were evaluated based on the ratio of seaward to landward flow on an annual basis and on the occurrence of relatively high amounts of landward flow.

Simulation of Normal Year Conditions

Under normal year conditions, CCSD water use was assumed to equal the full 700 AFY of demand, with no reduction by conservation. The dry season for San Simeon Creek flow was from June 1 to December 15 in both years of the simulation, and the basin refilled completely over the intervening wet season. The WRF was assumed not to operate.

This scenario was acceptable with respect to lagoon inflow and seawater intrusion but not with respect to the SS-4/9P2 gradient. Simulated water levels at key wells are shown in **Figure 6**, where they are compared with measured and simulated historical water levels for 2013-2014. The simulated CCSD water demand was greater than the demand during 2013-2014, but water levels declined more gradually during the start of the dry seasons due to generally wetter conditions. By December, however, the SS-4/9P2 gradient had dropped below the minimum target of +0.75 foot, reaching +0.17 foot in both years. The basin refilled abruptly when stream flow resumed and remained full throughout the wet season.

The brief downward spike in the the SS-4/9P2 gradient visible in December 2014 is present in the results for all scenarios. It is an artifact of model gridding, which causes the rapid rise in water levels at the onset of the winter flow season to reach well 9P7 before well SS-4 in the first time step of the final semi-weekly stress period. It is not meaningful from a water management standpoint.

Hydrographs of simulated lagoon water levels are shown in **Figure 7**, where they are compared with the results for other scenarios. For the normal year scenario, simulated lagoon levels were about 0.2-0.3 ft higher than for any other scenario during the first dry season. During the second dry season normal year water levels were very similar to those during the first dry season and 0.4-1.4 ft higher than those under the other scenarios. The other scenarios all included incomplete basin recharge over the winter, which lowers lagoon water levels substantially during the following dry season.

Water budgets for the scenarios were tabulated for two periods: March of year 1 through March of year 2, and April through December of year 2. The 13-month period for the first dry season was necessary because low stream recharge during winter caused water levels and gradients to continue declining through March of the second year. In other words, the winter months were functionally an extension of the year 1 dry season. The second budget analysis period covers a more normal April-December dry season for year 2. Key water budget inputs and results for all scenarios are listed in **Table 2**, with results for the first dry season shown in the upper table and results for the second dry season in the lower table. Scenarios may be compared within each dry season. Because of their different durations, results for the first dry season may not be directly comparable to results for the second dry season.

The minimum simulated lagoon inflow during the first and second dry seasons is shown in **Figure 8**, along with results for other scenarios. Minimum inflow during the first dry season under normal year conditions was slightly less than for historical 2013-2014 conditions, probably because the greater amount of CCSD pumping in the normal year scenario more than balanced the drier hydrologic conditions during 2013-2014. The opposite was true during the second year, when the larger amount of stream flow under normal year conditions more than offset the higher pumping.

Annual groundwater flow across the coastline is shown for all scenarios in **Figure 9**. All of the scenarios show a small amount of groundwater flow from offshore to onshore. This small, constant amount is probably an artifact of the equivalent freshwater head boundary condition in the model, which tends to create some vertical “short-circuiting” of groundwater flow from deep layers (where constant head = 5.40 ft) to shallow layers (where constant head = 3.33 ft). This effect could affect water levels and flow as far inland as the coastline. In any case, groundwater outflow in normal years exceeded groundwater inflow across the coastline by a factor of 24 to 29 in the two dry seasons, indicating an absence of significant intrusion.

Simulation of Stage 4 Water Shortage Conditions

Stage 4 water shortage conditions were simulated with and without WRF operation to test the specific effects of the WRF. Annual CCSD water demand was assumed to be reduced by 10 percent through conservation efforts. Simulated water levels at key wells with and without WRF operation are shown in **Figure 10**. Water levels under the stage 4 scenario without WRF operation were similar to historical 2013-2014 water levels during the first dry season but much lower during the second year due to the assumption of incomplete basin recovery in winter. The effect of WRF operation was to raise water levels from well 10M2 down to well 9P2 by 0.5-1 foot from the summer of year 1 through the end of year 2. The effect on the SS-4/9P2 gradient was more pronounced. WRF operation raises water levels at both wells, but it raises them more at SS-4, which is near injection well RIW1. The gradient responds immediately to WRF operation. In this scenario, operation at 10 acre-feet per month (AF/mo) increased the gradient by about 0.5 ft as long as the WRF was operating. Conversely, the gradient quickly drops by the same amount when the WRF is turned off.

Without WRF operation, the gradient declined below the minimum target in both years (to -0.60 and -0.45 ft, respectively). As described earlier, the brief downward spike in the gradient in December of year 2 is an artifact of modeling and not meaningful for water management. With WRF operation at 10-30 AF/mo, the minimums were close to the target in both years (+0.70 and +0.60 ft, respectively). Larger amounts of WRF operation would have increased the gradient even further. Because of the speed at which the gradient responds to WRF operation, WRF operation can be adjusted in real time to prevent the gradient from falling below the target.

An instantaneous lagoon discharge rate of 140 gpm was found to be necessary to prevent reductions in the minimum dry-season lagoon elevation and inflow. For example, with a discharge rate of 100 gpm, the minimum dry-season elevation was 0.01 to 0.05 ft lower than without WRF operation, and the minimum dry-season inflow was 0.05 to 0.09 AF/mo lower. With the 140 gpm discharge rate, minimum elevations were only 0.03 ft lower and minimum inflows were 0.02-0.03 cfs higher than without WRF operation (see **Figures 7 and 8**). The effect of WRF operation on the lagoon can be controlled by adjusting the lagoon discharge rate. The discharge has a larger effect on lagoon inflow than lagoon elevation. In practice, the width of the beach berm at the ocean end of the lagoon generally exerts the greatest influence on lagoon elevation.

Groundwater flow across the coastline under Stage 4 conditions was essentially the same with and without WRF operation. In both cases, the ratio of groundwater outflow to groundwater inflow was slightly smaller than in normal years, but the ratios remained above 20 (see **Figure 9**). Thus, seawater intrusion was not a concern for either scenario.

Simulation of Stage 6 Water Shortage Conditions

The difference between Stage 4 and Stage 6 hydrologic conditions is most apparent at the start of year 1, when San Simeon Creek inflow ceased a month earlier under Stage 6. This can be seen in the hydrographs for wells 10M2 and SS-2 in **Figure 11**. For both water shortage stages, stream flows in winter 2014 were assumed to be identical and insufficient to completely replenish groundwater storage. Thus, the simulations were very similar during year 2.

The amount of WRF operation was adjusted for the Stage 6 scenario so that the SS-4/9P2 gradient remained almost continuously above the target minimum of +0.75 foot. To avoid excessive WRF operation, the amounts of water injected at RIW1 were varied from month to month, as they could be under real-time operation. By trial and error, it was found that WRF operation at 15-30 AF/mo was needed from August of year 1 through April of year 2, with the highest rates occurring in December-January. WRF operation at 15-40 AF/mo was also needed in year 2, with the highest rates occurring in November-December. Over the course of the two years, WRF injection for Stage 6 was less than 10 percent greater than for

Stage 4 because of greater assumed water conservation and because the principal hydrologic difference was one additional month of dry season in year 1.

Stage 6 drought conditions were slightly worse than Stage 4 conditions with respect to the lagoon and ocean boundary flow. Assuming WRF operation in both cases, the minimum simulated lagoon elevation was 0.05-0.06 ft lower for Stage 6 (see **Table 2**). The minimum simulated lagoon inflow was 0.04-0.06 cfs lower and annual groundwater outflow across the coastline was 10-102 AF (2-10 percent) lower. However, simulated groundwater inflow was the same.

Simulations of Increased Irrigation Pumping

Two farming operations use groundwater from the San Simeon Creek basin, and in both cases potential future groundwater use is greater than recent historical use. Jon Pedotti farms numerous fields along the basin from just upstream of the well field to Palmer Flats. His supply wells include several of the wells used for water level monitoring: 11B1, 10A1, 10M2 and others (see **Figure 1** for locations). In the late 1980s, all of his fields were planted every year and were irrigated primarily by sprinkler or furrow methods, resulting in estimated groundwater pumping of 264 AFY (Yates and Van Konynenburg, 1998). Irrigation was converted almost entirely to drip by the early 2000s, and Mr. Pedotti presently plants only about half of his total acreage each year (Pedotti, 2021). His annual groundwater pumping in recent years is estimated to be approximately 130 AFY. At full production, it would be about 260 AFY.

Clyde Warren irrigates land in and near Van Gordon Creek from well 9P4, which is located 86 feet north of well 9P7 in the percolation pond area. Pumping from well 9P4 is metered and recorded by CCSD. His cropping has been small in recent years, and pumping averaged only 14.5 AFY during 2012-2018. However, pursuant to an agreement with CCSD reached in 2006, he is entitled to pump 183.5 AFY.

Because of the well locations, increased groundwater pumping by the two farming operations was expected to have different effects on water levels, the SS-4/9P7 gradient, lagoon inflow and ocean boundary flow. Accordingly, increased pumping was simulated separately for each farming operation.

Increased Pedotti Pumping

For this scenario, the Stage 4 + WRF scenario was modified by increasing Pedotti pumping from 130 to 260 AFY in year 1 and year 2. The irrigation season was assumed to remain the same (June through October). The timing of irrigation pumping does not substantially affect simulation results as long as it all occurs during the dry season. WRF operation was adjusted iteratively to maintain the SS-4/9P2 gradient above +0.75 foot.

Simulated water levels at key wells are shown in **Figure 12**, where they are compared with the earlier Stage 4 + WRF scenario results. The largest effect shown is at well 10M2, which is a Pedotti irrigation well. Water levels were 4-5 ft lower due to the increased irrigation pumping. The effect extended all the way down the basin but decreased in magnitude to about 1 foot at well 16D1 near the lagoon. WRF operation had to be increased substantially above the amount needed for the Stage 4 + WRF scenario to prevent the SS-4/9P2 gradient from dropping below +0.75. WRF operation was required continuously from April of year 1 through December of year 2 at rates 5-15 AF/mo greater than the rates for corresponding months of the Stage 4 + WRF scenario. Over the course of the two years, WRF production was 1.4 times greater than for the Stage 4 + WRF scenario without the increased Pedotti pumping (see **Table 2**).

This simulation included a lagoon discharge of 100 gpm, and the minimum simulated lagoon elevations were 0.13-0.17 foot lower than for the scenario without increased Pedotti pumping (see **Figure 7**). Minimum simulated lagoon inflow was reduced by 0.08-0.16 cfs. A higher rate of lagoon discharge could potentially eliminate the decreased inflow but might not fully offset the decrease in lagoon elevation. Seaward flow of groundwater across the ocean boundary in year 1 was similar to the flows for the Stage 4 + WRF and Stage 6 + WRF scenarios, but outflow was lower in inflow was higher in year 2 (see **Figure 9** and **Table 2**). Groundwater outflow was 12-17 times greater than inflow, compared to 18-29 times greater for the earlier scenarios. Seawater intrusion is a potential concern with increased Pedotti pumping.

Increased Warren Pumping

To simulate increased irrigation pumping by Clyde Warren, the Stage 4 + WRF scenario was modified to increase irrigation pumping at well 9P4 from 15 AFY to 183.5 AFY during both dry seasons. The timing of irrigation pumping was assumed to remain the same. This scenario was simulated with and without WRF operation, to determine the extent to which WRF operation compounds or counteracts the effects of Warren pumping. The assumed lagoon discharge rate was 100 gpm whenever 9P7 was operating. WRF operation was increased only as much as was needed to maintain the SS-4/9P2 gradient at or above the target minimum of +0.75 foot. Total WRF injection over the two years was similar to the total for the Stage 4 + WRF scenario.

Simulated groundwater levels for increased Warren pumping with and without WRF operation are shown in **Figure 13**. WRF operation was able to increase the minimum SS-4/9P2 gradient from +0.09 to +0.62 foot in year 1 and from +0.12 to +0.88 foot in year 2. Additional WRF operation could have achieved even larger increases. Simulated lagoon levels were the lowest of any of the simulations, continuously 0.5-1.0 ft below the Stage 4 + WRF and Stage 6 + WRF levels (see **Figure 7**). The lower lagoon elevations were caused by the large amount of irrigation pumping at well 9P4 and its location relatively close to the lagoon. In this pair of simulations, adding WRF operation did not change the minimum lagoon water level during year 1 but lowered it by 0.04 ft in year 2. This could be largely or completely offset by increasing the rate of lagoon discharge during August-September of year 2.

With Warren pumping, the minimum lagoon elevations and inflows occurred in August of both years, during the peak of the irrigation season. Minimum lagoon inflow in year 1 (with or without WRF operation) was about the same as for the Stage 4 + WRF scenario. In year 2, however, it was only about half as much (again, with or without WRF operation). The potential for seawater intrusion was also the highest of any of the scenarios. Without WRF operation, groundwater outflow at the coastline was only about 16 times greater than groundwater inflow in year 1 and about 10 times greater in year 2. The ratios were slightly smaller with WRF operation (see **Table 2** and **Figure 9**).

Figure 14 compares water levels and groundwater flow directions in shallow and deep parts of the basin in November of year 2 with WRF operation and maximum Warren irrigation pumping. The upper plot shows contours of groundwater elevation in model layer 1 (top layer) using a contour interval of 0.2 foot. The pumping depression around wells 9P2 and 9P7 due to Warren and WRF pumping is visible as closed contours. The water table mound beneath Pond A also appears as a closed contour, about midway between the wells and the lagoon. The contours bend toward the lagoon and lower end of San Simeon Creek, indicating groundwater discharge into those water bodies even at the end of the dry season in year 2. Note that the base map in the figure overstates the length of the lagoon; it does not extend above the road crossing. Farther upstream, injection at well RIW1 produces a water-level plateau in the upstream direction (toward the municipal wells) and a steep gradient in the downstream direction, toward well 9P7.

In contrast, the water level gradient in model layer 16 near the bottom of the basin is landward from the offshore ocean boundary (lower plot in **Figure 14**). Groundwater elevation decreases from 5.0 ft NAVD88 offshore (the freshwater equivalent of sea level) to 4.6 ft at well 9P7, which is the low point for water levels in that model layer. The landward gradient is very small, but it produces the small increase in landward groundwater flow evident in the water balance.

WRF is capable of achieving an acceptable SS-4/9P7 gradient in the presence of maximum Warren pumping, but it cannot prevent lagoon impacts and increased risk of seawater intrusion associated with that pumping.

CONCLUSIONS

Conclusions that can be drawn from model calibration and the scenario simulations include the following:

- The reactivated model is calibrated to measured water levels during 2013-2014 with reasonable accuracy.
- Eight weeks of 5 cfs of San Simeon Creek inflow at Palmer Flats during the wet season only partially refills the basin. Increasing 2-4 of those weeks to 10 cfs refills it.
- The occurrence of two successive years as dry as the two years in the simulation is very unlikely. Although the two dry seasons were intended to be evaluated independently, the limited stream recharge between them had the effect of

prolonging some effects of the first dry season until March of year 2. Thus, the simulations represent extreme drought conditions with respect to stream flow.

- The amount of WRF injection can be adjusted to exactly meet the target minimum SS-4/9P7 gradient. The gradient responds very quickly to starting or stopping WRF operation. This would allow the amount of WRF injection to be adjusted in real time during a dry season to keep the gradient above the minimum.
- The lagoon discharge can similarly be adjusted independently of the reverse osmosis and RIW1 injection volumes to achieve target lagoon elevations and inflows. Simulation results demonstrated that a lagoon discharge rate of 100 gpm proved to be too small to prevent slight declines in minimum dry season lagoon elevation and inflow for the Stage 4 and Stage 6 simulations, relative to the corresponding simulations without WRF operation. This is probably because the original estimate of 100 gpm assumed a continuous discharge at that rate, whereas the simulations indicated that the WRF supply well (9P7) would need to operate much less than full time to supply the necessary injection at well RIW1. When the simulations were repeated with lagoon discharge rates of 120-140 gpm, simulated minimum dry-season lagoon levels and inflow were approximately the same as in the simulations without WRF operation. The discharge has a stronger effect on lagoon inflow than lagoon elevation.
- WRF operation can compensate for failure to achieve water conservation goals at each water shortage stage. It would supply the needed make-up water and keep groundwater conditions within constraints related to the SS-4/9P2 gradient, lagoon inflow and seawater intrusion. This could offer CCSD customers a choice between cutting back even further on water use or paying for expensive WRF water.
- In the Stage 4 + WRF and Stage 6 + WRF scenarios, it was possible to meet all three criteria for acceptability by adjusting the WRF injection volumes and lagoon discharge volumes on a semi-monthly basis. The SS-4/9P2 gradient remained above +0.75 foot almost continuously, lagoon levels and inflow were not reduced, and seawater intrusion did not occur.
- Groundwater flow in upper model layers near the coast was consistently toward the lagoon and ocean in all scenarios, even at the end of the dry season. In scenarios with maximum irrigation pumping (Pedotti or Warren), groundwater flow in deep model layers became landward in the summer of year 1 and remained landward until December of year 2. The gradients were small, but the condition persisted for 16 months. That condition could potentially cause seawater intrusion.
- The amounts of WRF injection required to prevent the SS-4/9P2 gradient from dropping below +0.75 ft ranged from 145 to 220 AF for the first dry season, and 145 to 235 AF for the second dry season, depending on the scenario. The highest amounts were in the scenario with increased Pedotti irrigation pumping.

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Table 1. Summary of Scenario Input Values

Scenario Description	Water Shortage Stage	WRF Activated	Pedotti Irrigation	Warren Irrigation	Mitigation Discharge (gpm)
Normal Year	None		Recent historical	Recent historical	0
Stage 4	4		Recent historical	Recent historical	0
Stage 4 + WRF	4	✓	Recent historical	Recent historical	120
Stage 6 + WRF	6	✓	Recent historical	Recent historical	120
Stage 4 + WRF + Full Pedotti Irrigation	4	✓	Full	Recent historical	100
Stage 4 + Maximum Warren Irrigation	4		Recent historical	Maximum	0
Stage 4 + WRF + Maximum Warren Irrigation	4	✓	Recent historical	Maximum	100

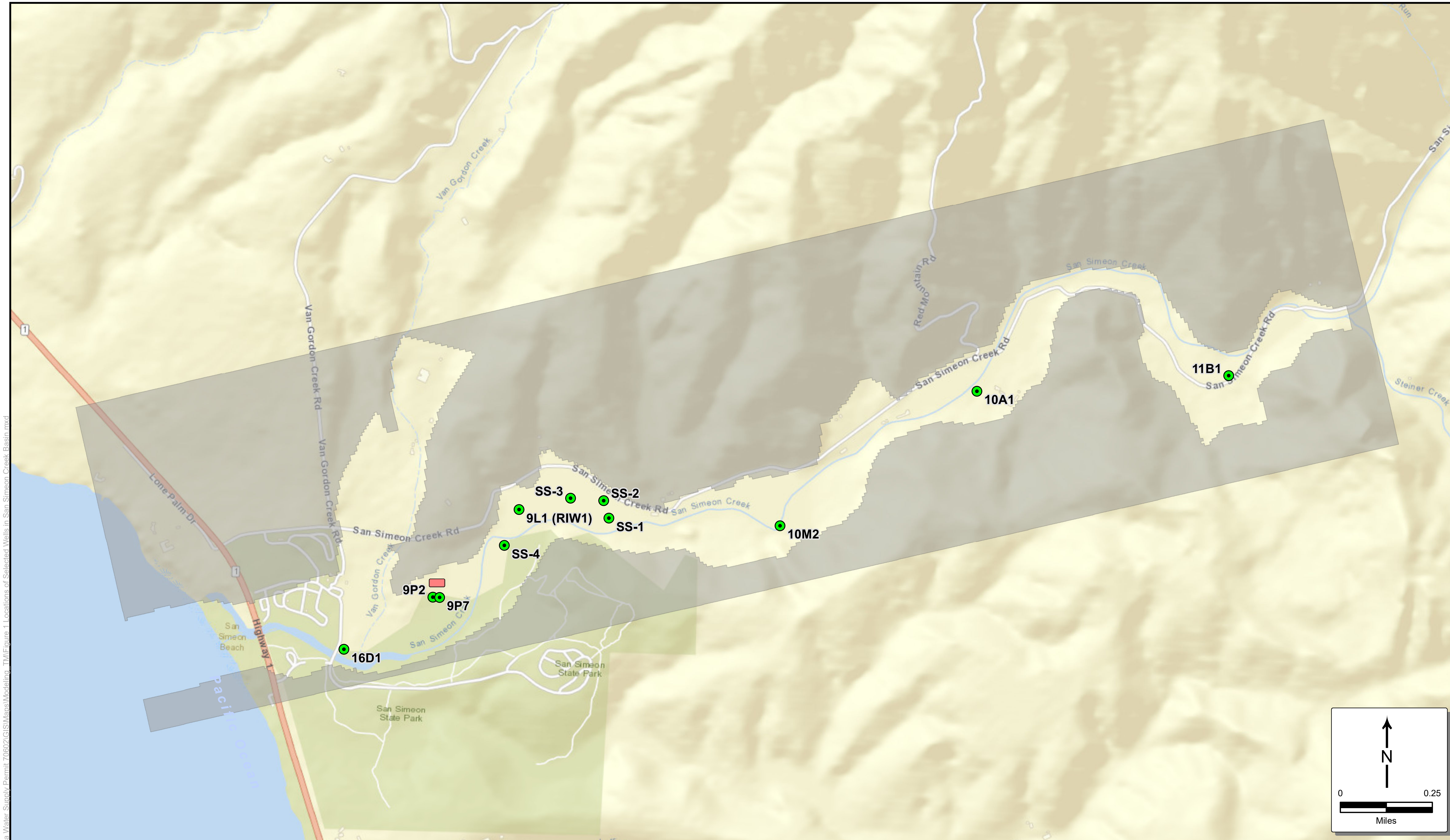
Table 2. Water Balance Results for Scenarios

March of Year 1 through March of Year 2

Scenario Description	Year Type	CCSD Water Demand after Conservation (AFY)	Date Flow Ceases at Palmer Flats	Date Flow Resumes at Palmer Flats	San Simeon Well Field Groundwater Pumping (AF)	Pond Percolation (AF)		WRF Supply Well 9P7 Pumping (AF)	RIW1 Injection (AF)	Lagoon Discharge (AF)	Pedotti Irrigation Pumping (AF)	Warren Irrigation Pumping (AF)	Minimum SS-4 to 9P2 Water Level Difference (feet)	Minimum Lagoon Elevation		Minimum Dry-Season Inflow to Lagoon (cfs)				Groundwater Flow Across Coastline (AF)	
						Municipal Wastewater	Microfiltra-tion Backflush							Month	Elevation (feet NAVD88)	Month	Creek	Ground-water	Total	To Offshore	From Offshore
Historical 2013-2014	2013-2014	753	May 29	Feb 28	740	563	0	0	0	0	99	15	+0.23	OCT 2013	4.35	MAR 2014	0.58	0.34	0.92	1,157	48
Normal	Normal	753	Jun 1	Dec 16	613	697	0	0	0	0	130	15	+0.17	DEC 2013	4.6	DEC 2013	0.45	0.38	0.83	1,497	51
Stage 4, no WRF	Stage 4	678	Apr 1	Jan 1	552	628	0	0	0	0	130	15	-0.60	MAR 2014	4.17	FEB 2014	0.21	0.29	0.50	1,040	47
Stage 4 + WRF	Stage 4	678	Apr 1	Jan 1	552	628	14	229	150	52	130	15	+.79	MAR 2014	4.14	MAR 2014	0.31	0.22	0.53	1,023	51
Stage 6 + WRF	Stage 6	602	Mar 1	Jan 16	490	558	17	276	188	56	130	15	+0.81	MAR 2014	4.08	FEB 2014	0.27	0.22	0.49	921	51
Stage 4 + WRF + Pedotti	Stage 4	678	Apr 1	Jan 1	552	628	18	312	220	55	260	15	+0.72	MAR 2014	4.01	FEB 2014	0.25	0.2	0.45	942	55
Stage 4 + Warren	Stage 4	678	Apr 1	Jan 1	552	628	0	0	0	0	130	183	-0.68	AUG 2013	4.12	AUG 2013	0.17	0.35	0.52	855	52
Stage 4 + WRF + Warren	Stage 4	678	Apr 1	Jan 1	552	628	12	206	145	36	130	183	+0.63	AUG 2013	4.12	AUG 2013	0.17	0.35	0.52	845	58

April 2014 through December of Year 2

Scenario Description	Year Type	CCSD Water Demand after Conservation (AFY)	Date Flow Ceases at Palmer Flats	Date Flow Resumes at Palmer Flats	San Simeon Well Field Groundwater Pumping (AF)	Pond Percolation (AF)		WRF Supply Well 9P7 Pumping (AF)	RIW1 Injection (AF)	Lagoon Discharge (AF)	Pedotti Irrigation Pumping (AF)	Warren Irrigation Pumping (AF)	Minimum SS-4 to 9P2 Water Level Difference (feet)	Minimum Lagoon Elevation		Minimum Dry-Season Inflow to Lagoon (cfs)				Groundwater Flow Across Coastline (AF)	
						Municipal Wastewater	Microfiltra-tion Backflush							Month	Elevation (feet NAVD88)	Month	Creek	Ground-water	Total	To Offshore	From Offshore
Historical 2013-2014	2013-2014	543	April 27	Dec 5	541	317	0	0	0	0	112	27	+0.52	NOV 2014	4.43	SEP 2014	0.3	0.4	0.7	838	36
Normal	Normal	543	Jun 1	Dec 16	403	483	0	0	0	0	130	15	+0.17	DEC 2014	4.64	DEC 2014	0.44	0.38	0.82	947	40
Stage 4, no WRF	Stage 4	489	Apr 1	Dec 16	363	435	0	0	0	0	130	15	-0.45	DEC 2014	4.26	DEC 2014	0.21	0.36	0.57	522	21
Stage 4 + WRF	Stage 4	489	Apr 1	Dec 16	363	435	15	252	165	58	130	15	+0.93	DEC 2014	4.23	DEC 2014	0.33	0.26	0.59	511	24
Stage 6 + WRF	Stage 6	435	Apr 1	Dec 16	323	386	12	214	145	44	130	15	+0.61	DEC 2014	4.18	DEC 2014	0.32	0.21	0.53	491	25
Stage 4 + WRF + Pedotti	Stage 4	489	Apr 1	Dec 16	363	435	20	336	235	59	260	15	+0.81	DEC 2014	4.06	DEC 2014	0.25	0.18	0.43	421	34
Stage 4 + Warren	Stage 4	489	Apr 1	Dec 16	363	435	0	0	0	0	130	183	-0.62	SEP 2014	3.86	AUG 2014	0.05	0.23	0.28	380	40
Stage 4 + WRF + Warren	Stage 4	489	Apr 1	Dec 16	363	435	14	241	170	43	130	183	+0.92	SEP 2014	3.82	AUG 2014	0.10	0.19	0.29	361	46



Hydrograph Wells
Water Reclamation Facility
Inactive Flow Cells

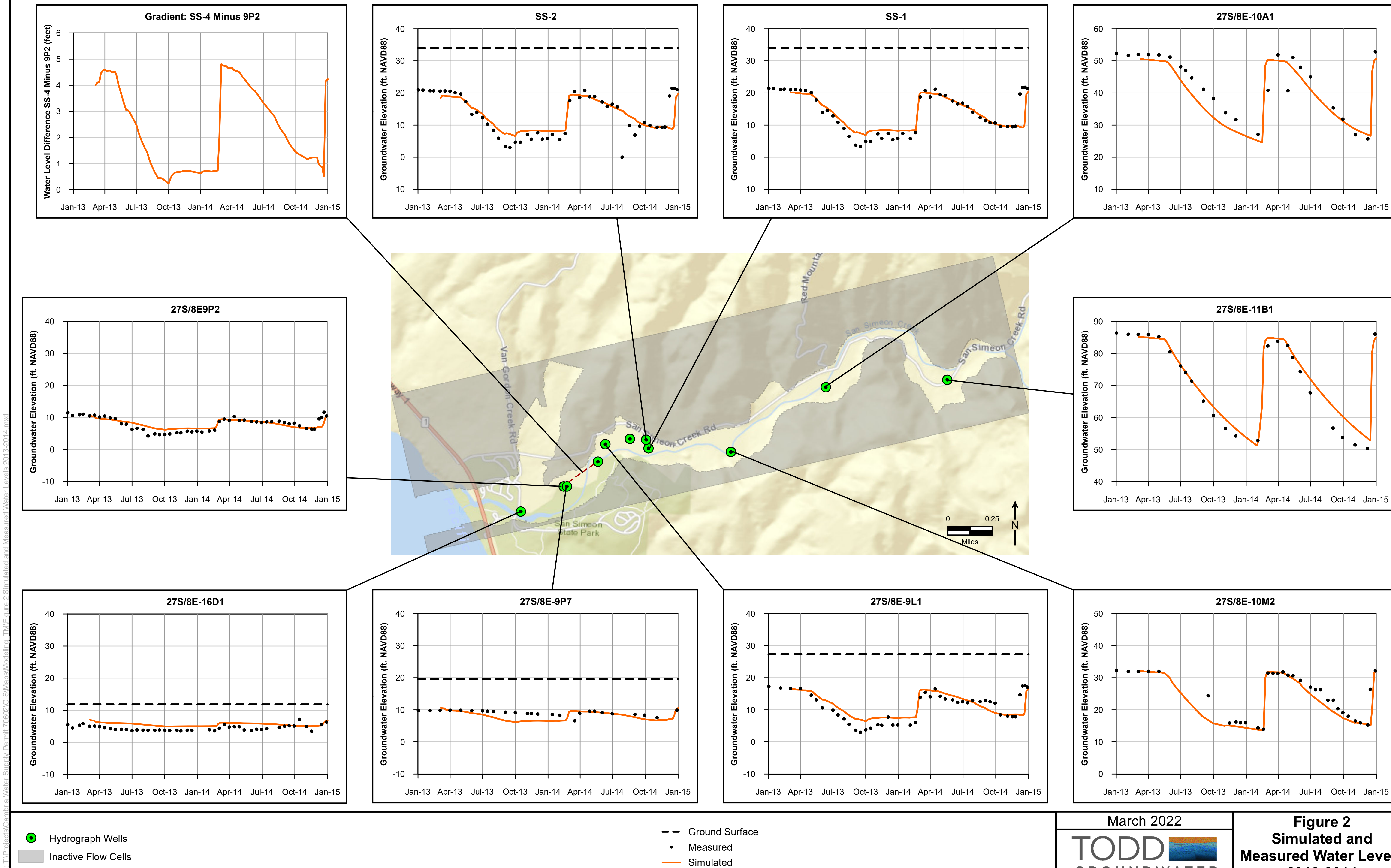
March 2022

TODD GROUNDWATER

Figure 1
Locations of Selected Wells in San Simeon Creek Basin

Path: T:\Projects\Cambria Water Supply Permit 70602\GIS\Maps\Modeling_TM\Figure 1 Locations of Selected Wells in San Simeon Creek Basin.mxd

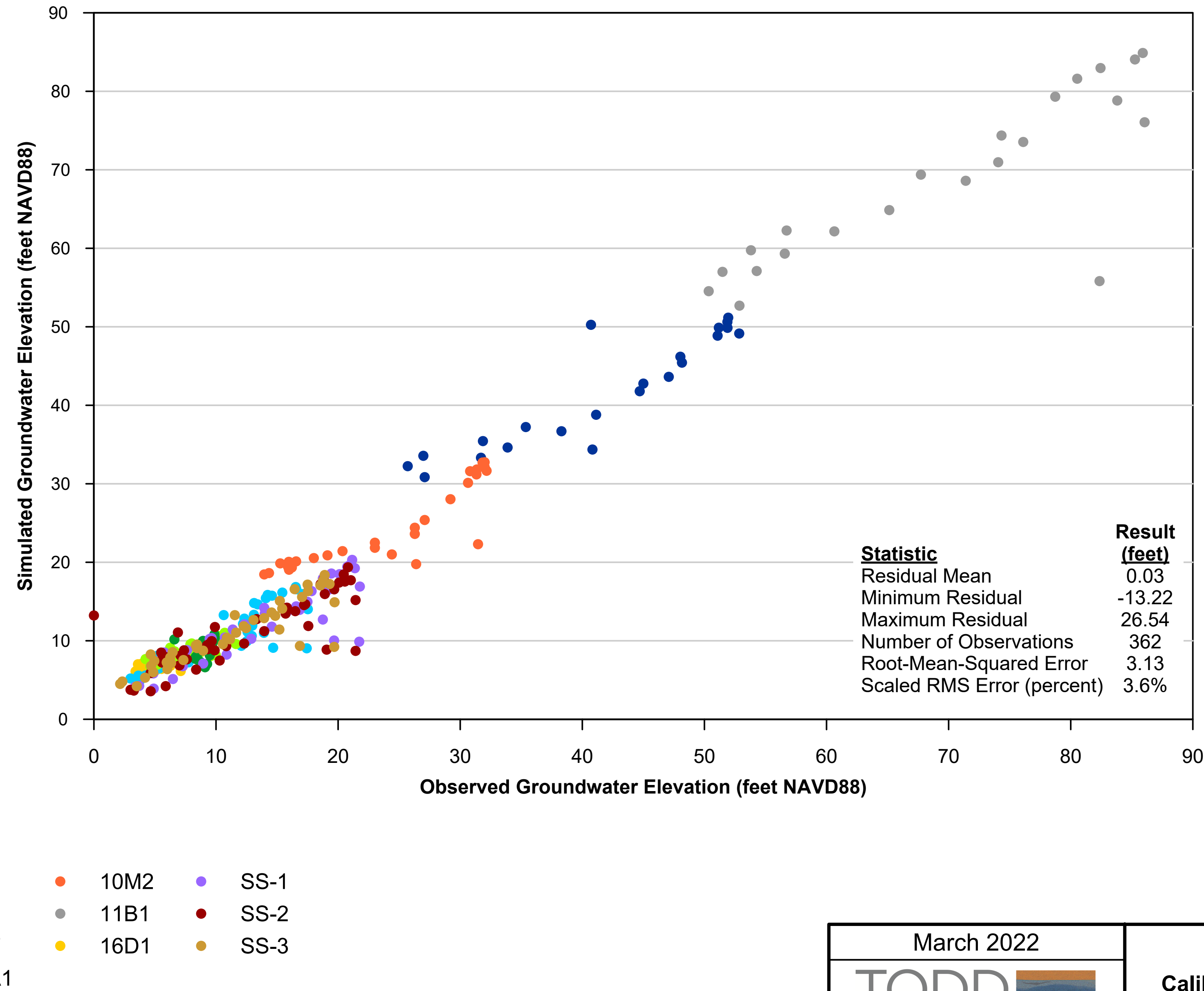
Appendix A



March 2022

TODD GROUNDWATER

Figure 2
Simulated and Measured Water Levels 2013-2014



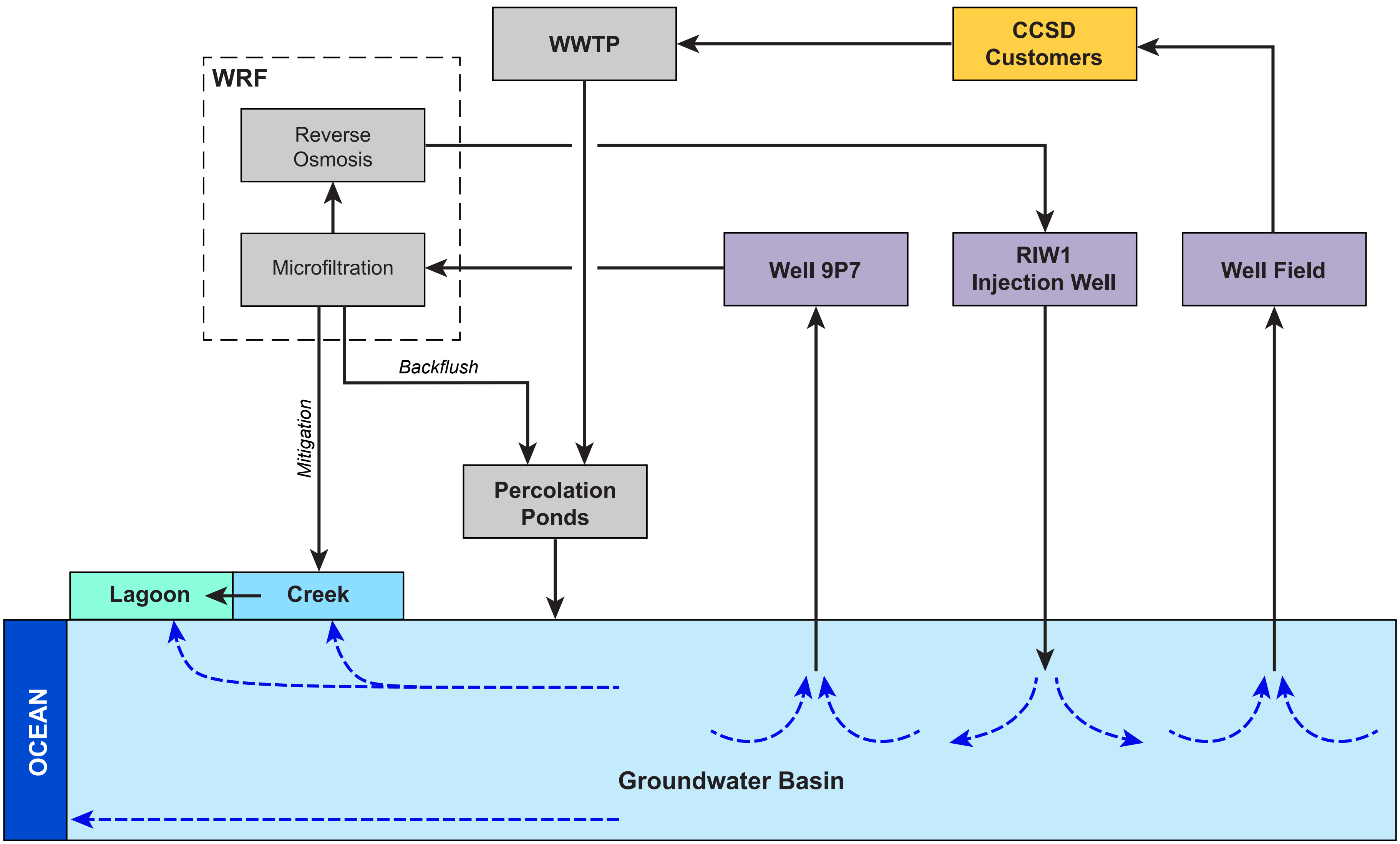
Data Source: T:\Projects\Cambria Water Supply Permit 70602\Model\Water_Levels\Target_results_Run017.xlsx Target_results_Run017

Path: T:\Projects\Cambria Water Supply Permit 70602\GRAPHICS\Figure 3 Calibration Residuals Plot and Statistics.gpj

March 2022

TODD GROUNDWATER

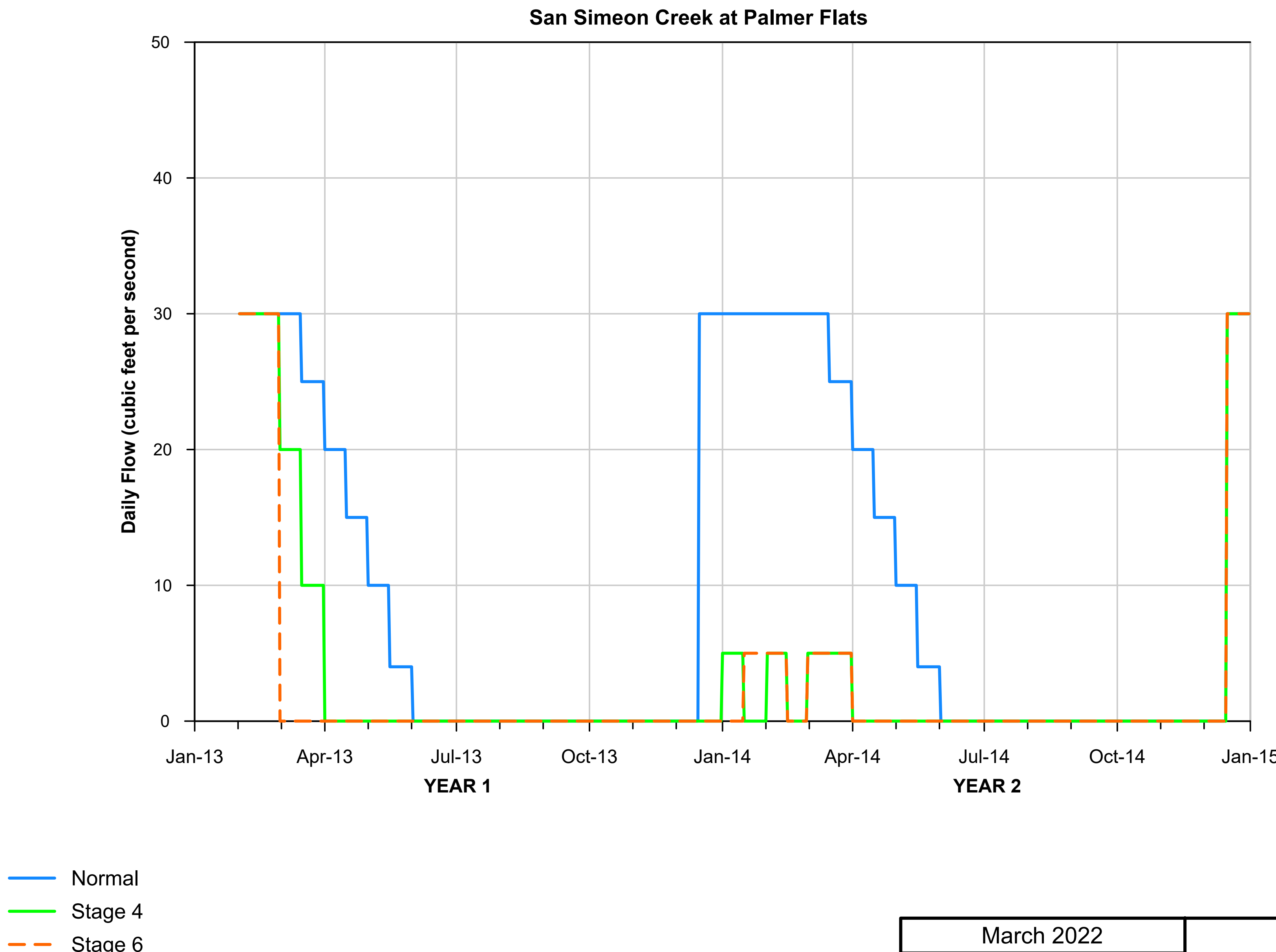
Figure 3
Calibration Residuals Plot and Statistics



March 2022

TODD GROUNDWATER

Figure 4
Diagram of WRF and Groundwater System



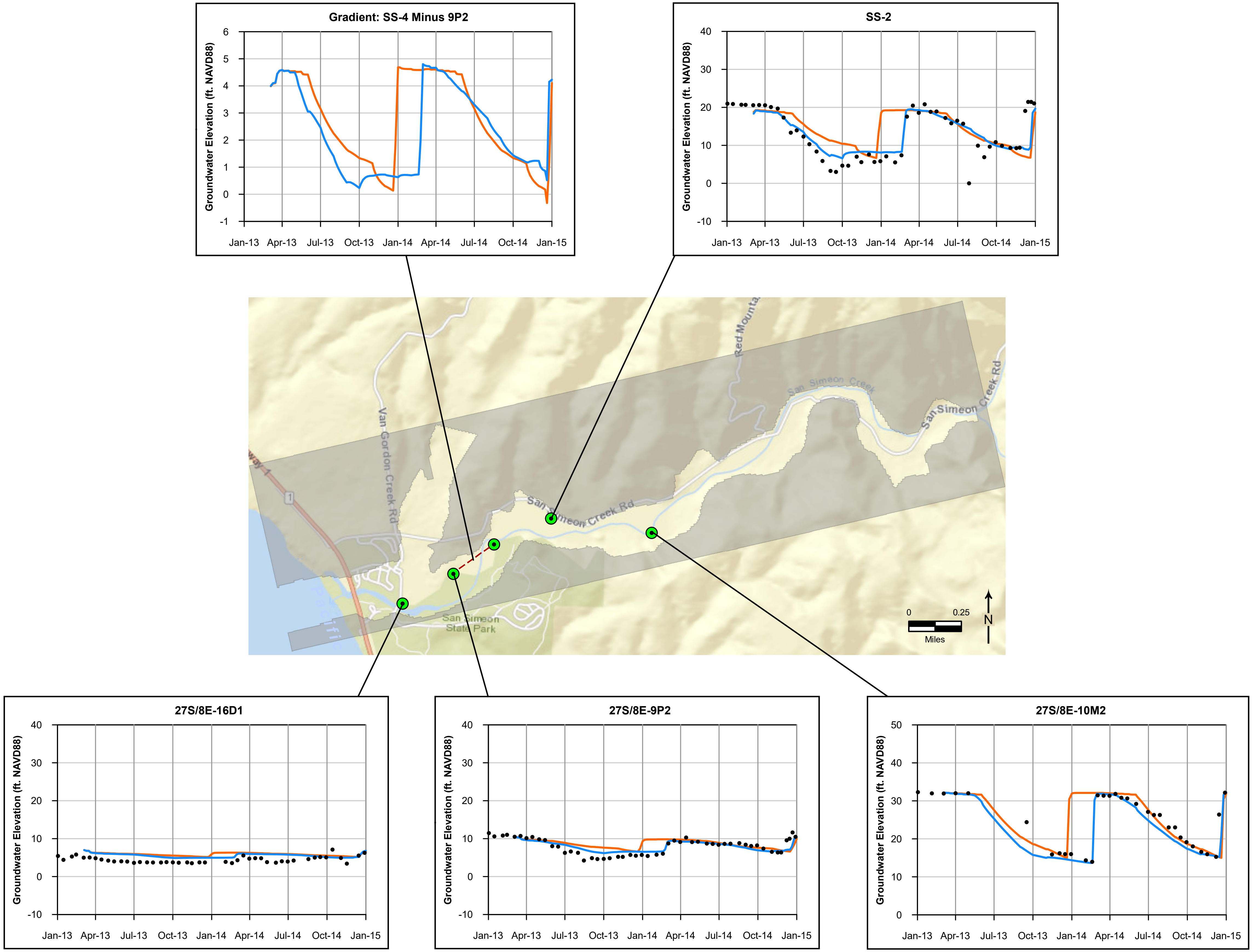
Data Source: T:\Projects\Cambria Water Supply Permit 70602\Model\SFR2\SFRprepIn_flow.xlsx SFRprepIn_flow

March 2022

TODD GROUNDWATER

Figure 5
San Simeon Creek
Inflow for Scenarios

Path: T:\Projects\Cambria Water Supply Permit 70602\GRAPHICS\Figure 5 San Simeon Creek Inflow for Scenarios.gpj



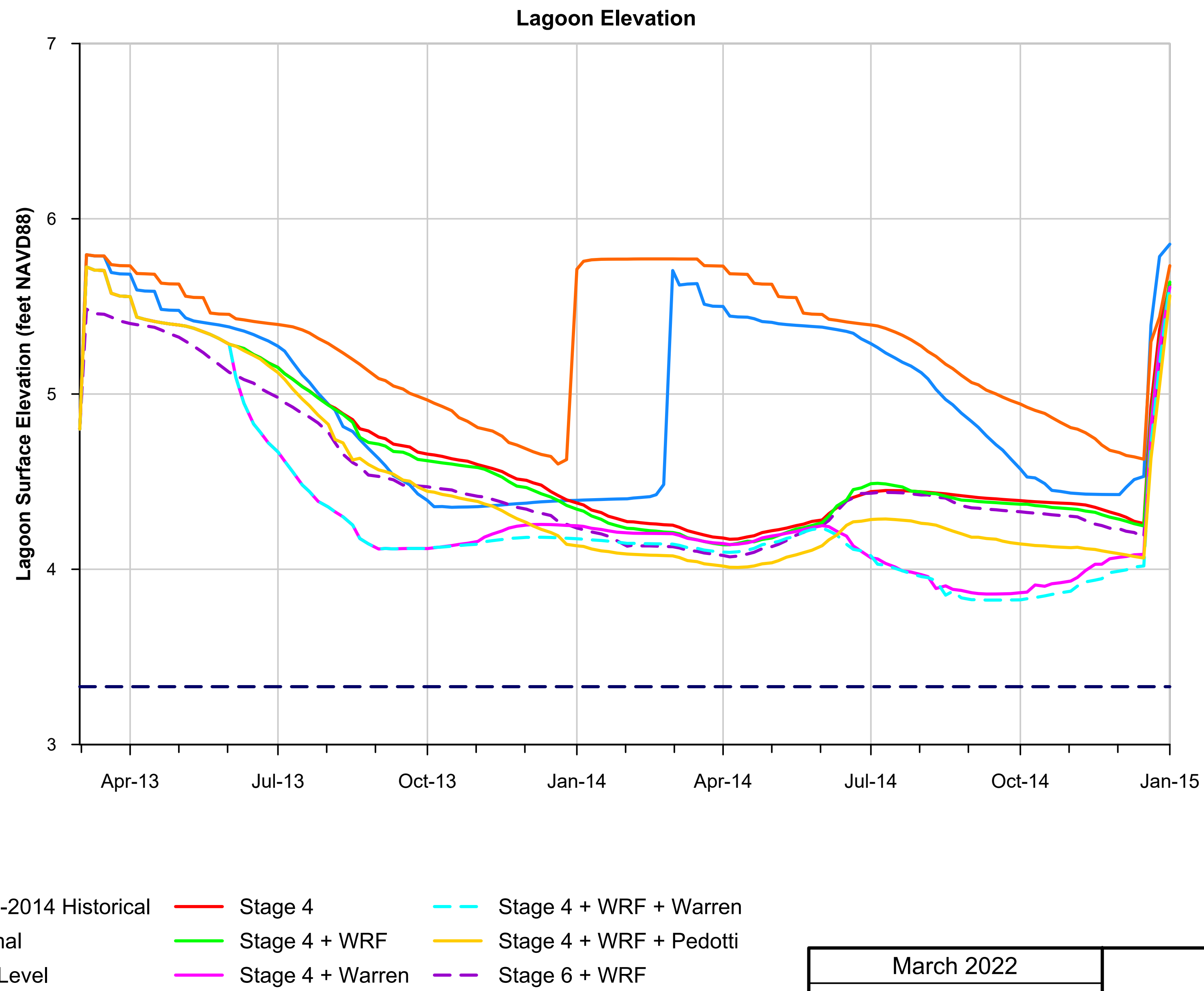
Hydrograph Wells
Inactive Flow Cells

Measured 2013-2014
Simulated 2013-2014
Normal Year

March 2022

TODD GROUNDWATER

Figure 6
Simulated Well Hydrographs - Historical and Normal Year



Data Source: T:\Projects\Cambria Water Supply Permit 70602\Model\GWV\SSCR2_gage_lak.xlsx Graph - all

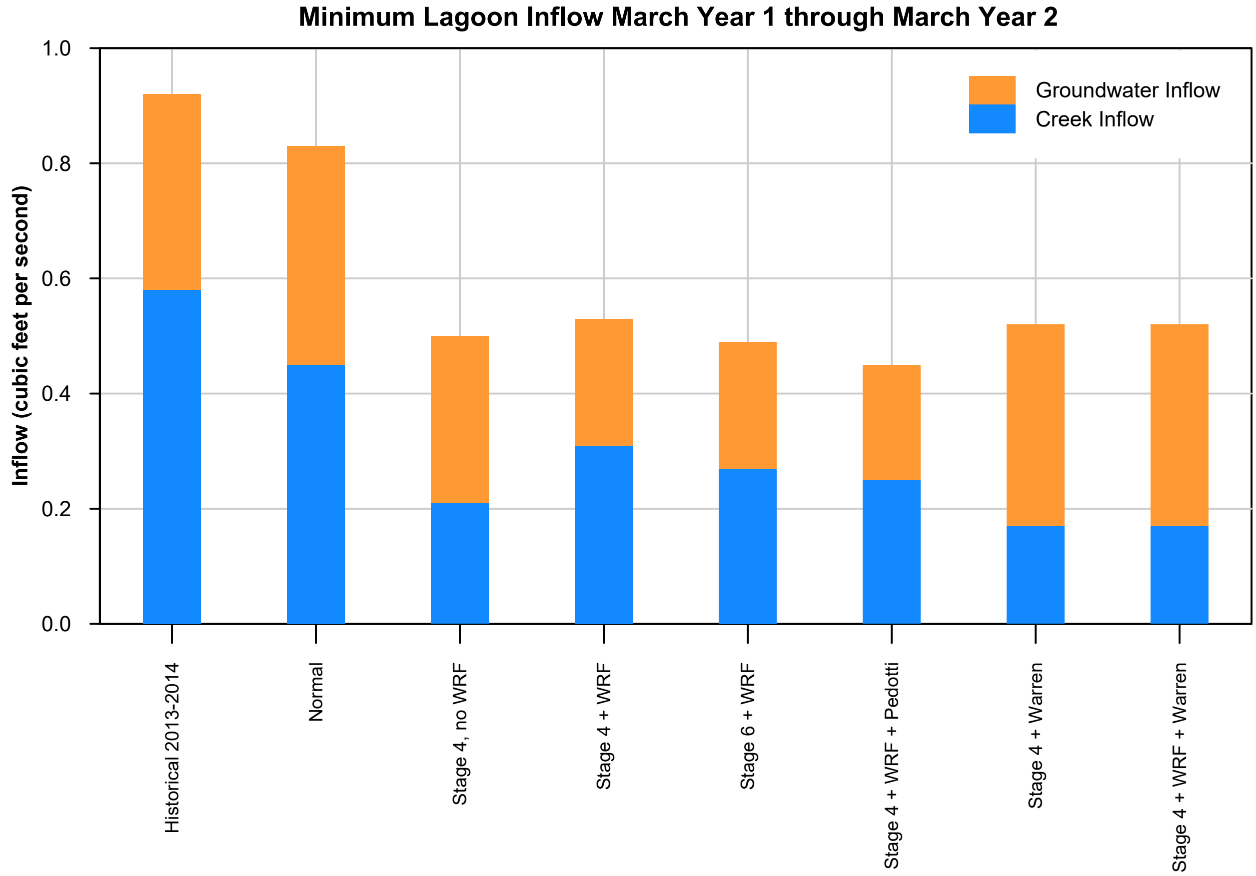
March 2022

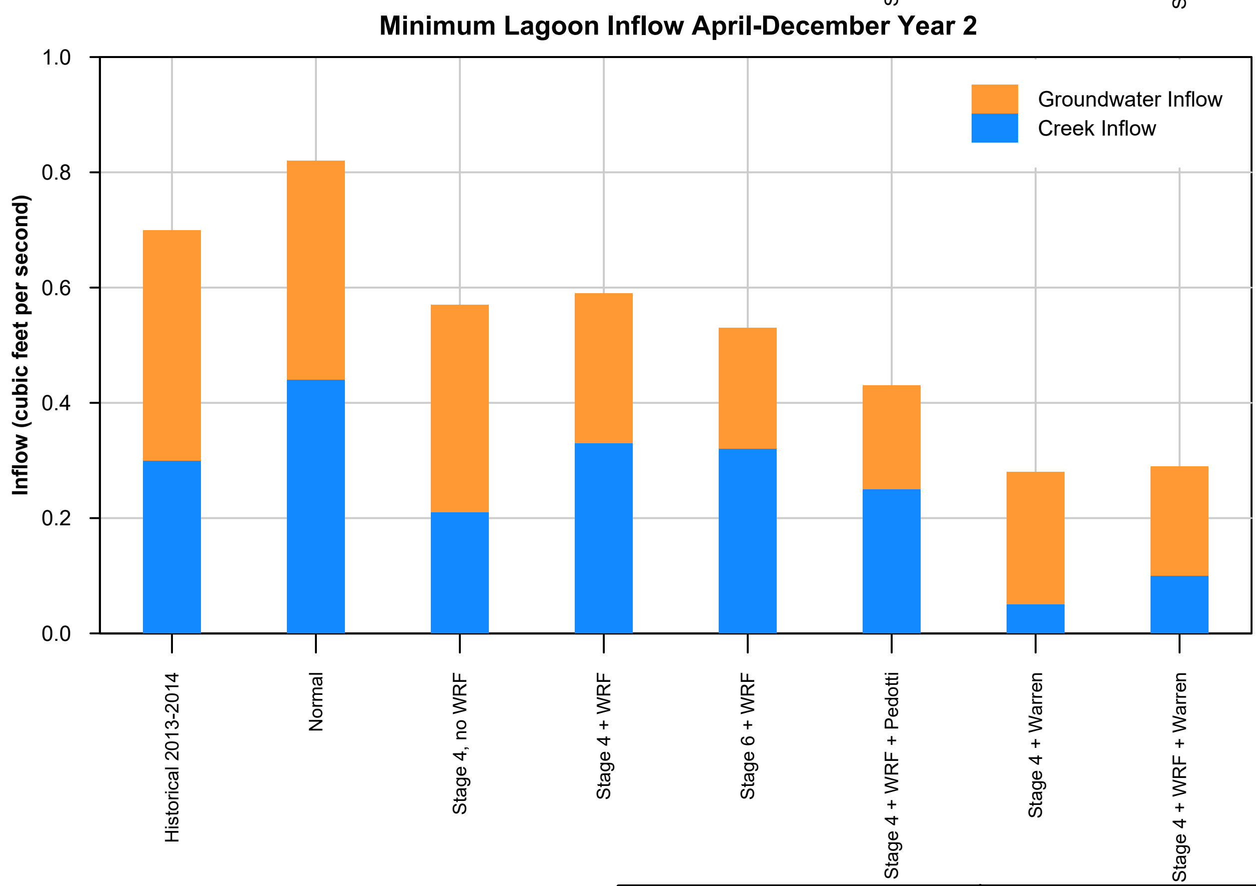
TODD GROUNDWATER

Figure 7
Simulated Lagoon Elevation

Path: T:\Projects\Cambria Water Supply Permit 70602\GRAPHICS\Figure 7 Simulated Lagoon Elevation.gpj

Appendix A





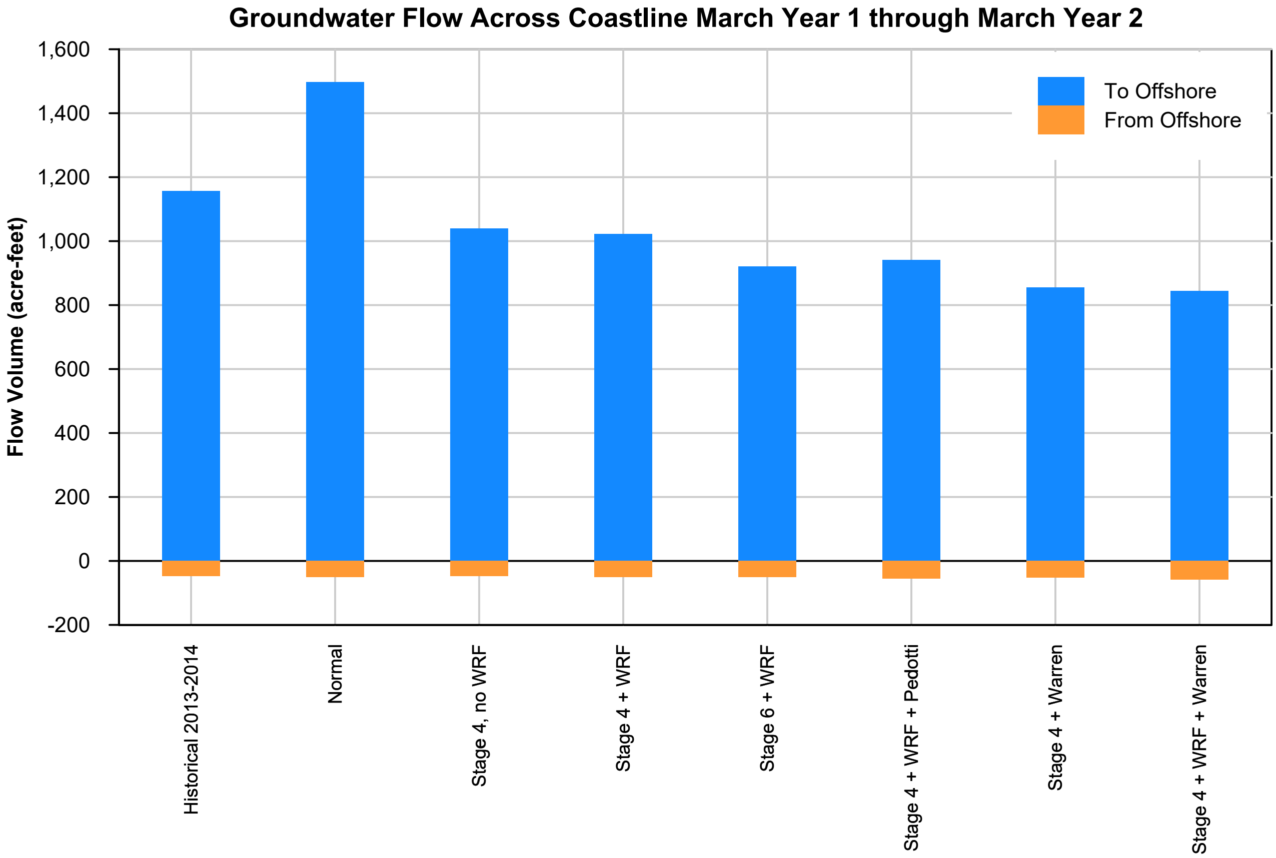
Path: T:\Projects\Cambria Water Supply Permit 70602\GRAPHICS\Figure 8 Minimum Dry Season Lagoon Inflow.gpj

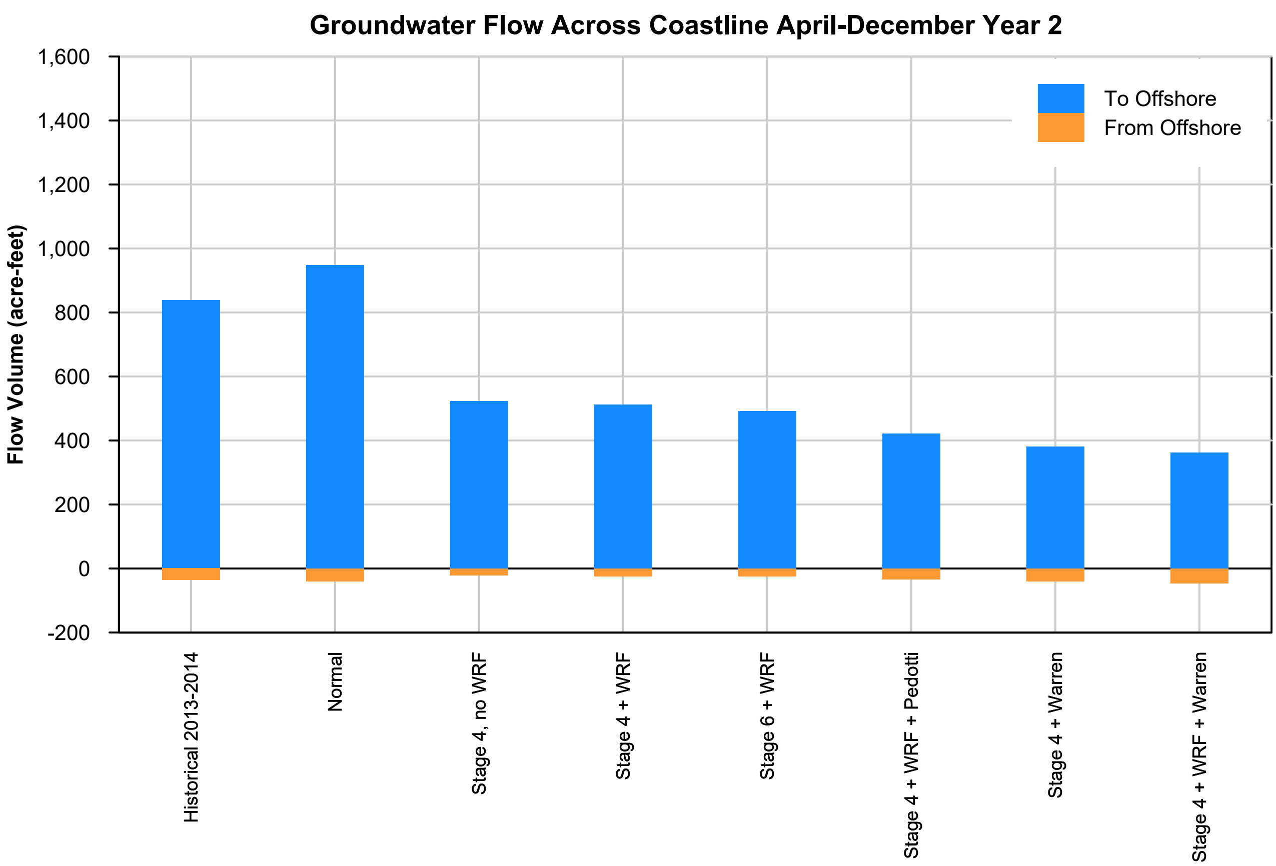
Data:
T:\Projects\Cambria Water Supply Permit 70602\Model_Modeling_log_CCSD.xlsx Scenarios

March 2022

TODD GROUNDWATER

Figure 8
Minimum Dry Season Lagoon Inflow





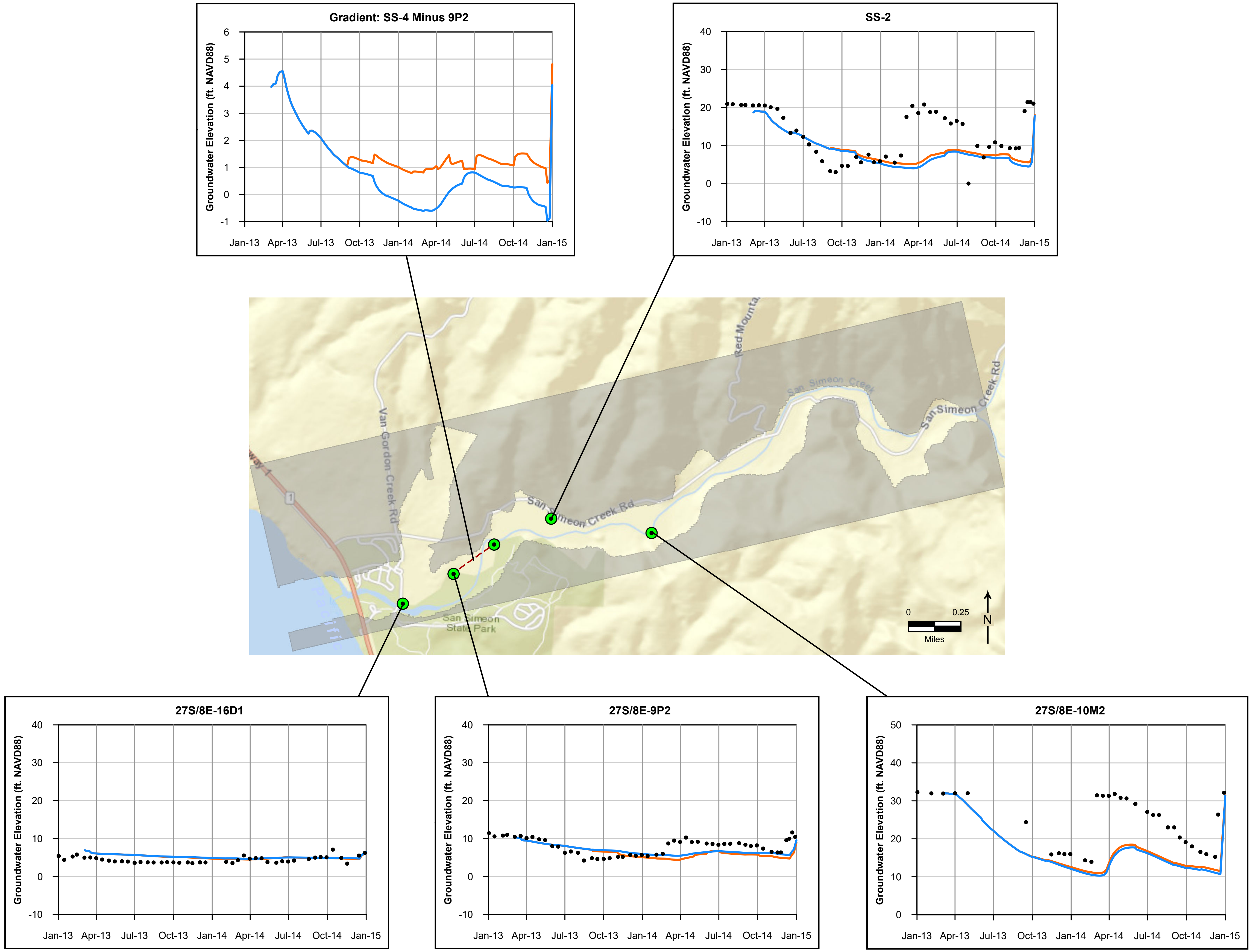
Path: T:\Projects\Cambria Water Supply Permit 70602\GRAPHICS\Figure 8 Minimum Dry Season Lagoon Inflow.gpj

Data:
T:\Projects\Cambria Water Supply Permit 70602\Model_Modeling_log_CCSD.xlsx Scenarios

March 2022

TODD GROUNDWATER

Figure 9
Groundwater Flow Across Coastline



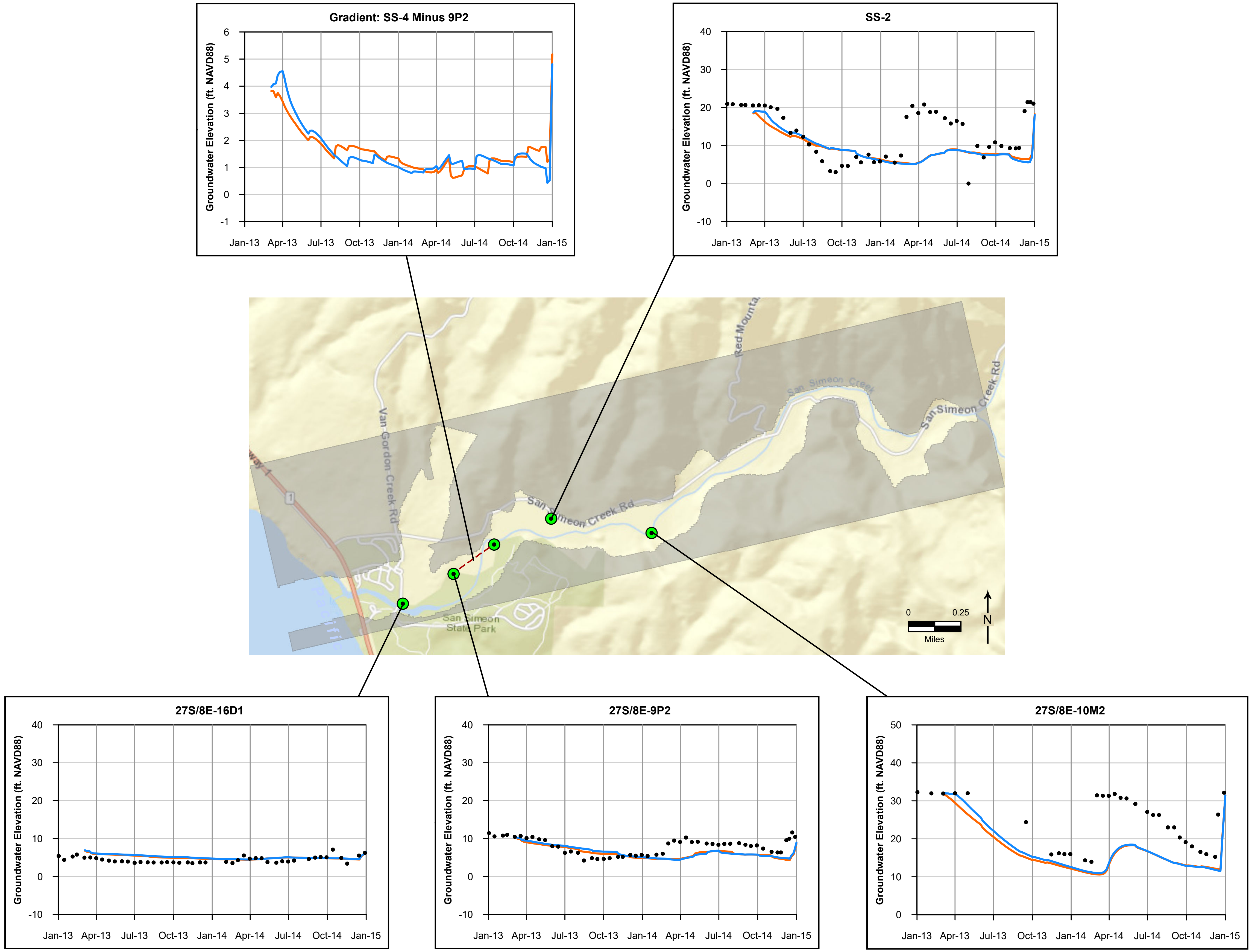
Hydrograph Wells
Inactive Flow Cells

Measured 2013-2014
Stage 4
Stage 4 + WRF

March 2022

TODD GROUNDWATER

Figure 10
Simulated Well Hydrographs - Stage 4 With and Without WRF



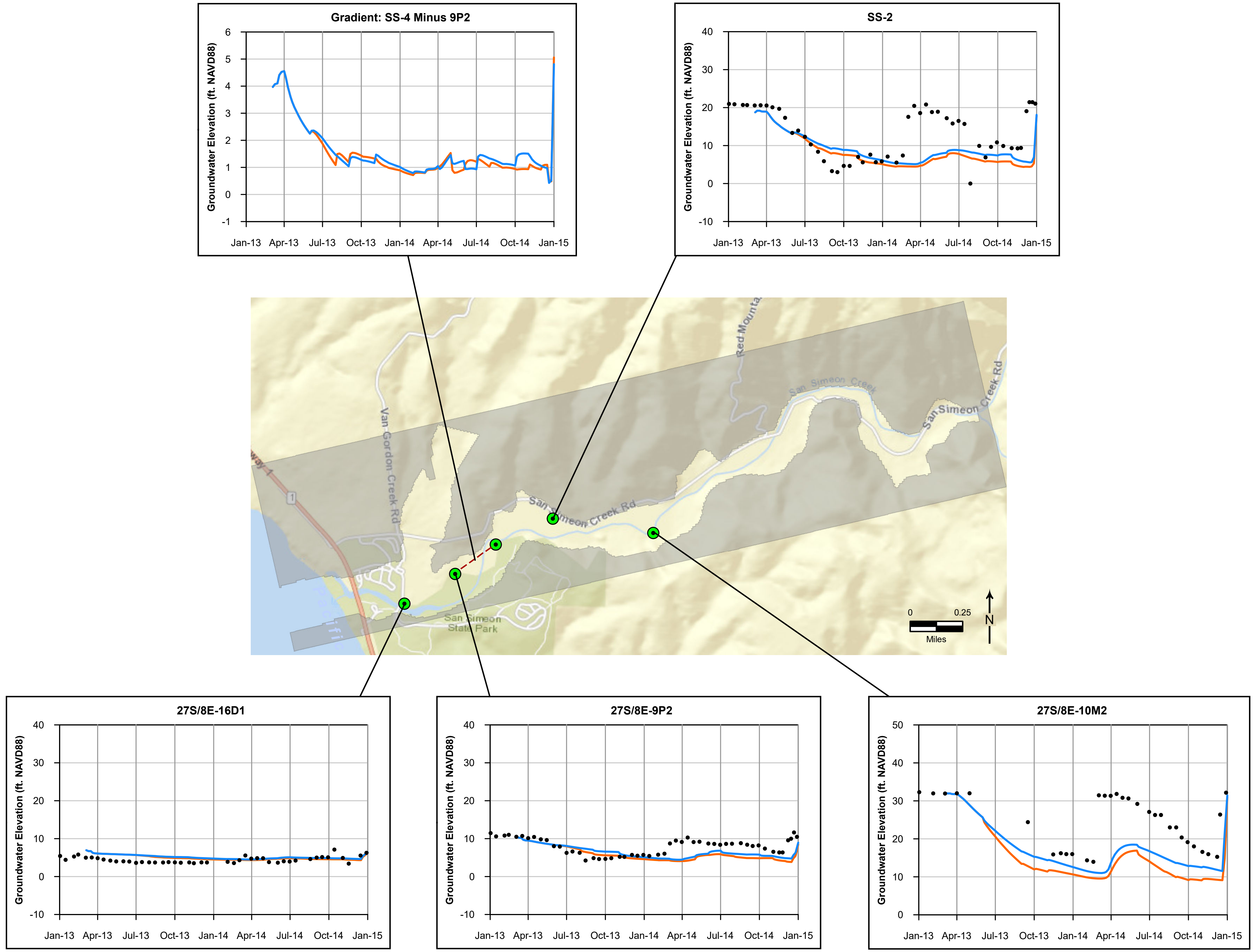
Hydrograph Wells
Inactive Flow Cells

• Measured 2013-2014
Stage 4 + WRF
Stage 6 + WRF

March 2022

TODD GROUNDWATER

Figure 11
Simulated Well Hydrographs - Stage 6 and Stage 4 with WRF



Hydrograph Wells
Inactive Flow Cells

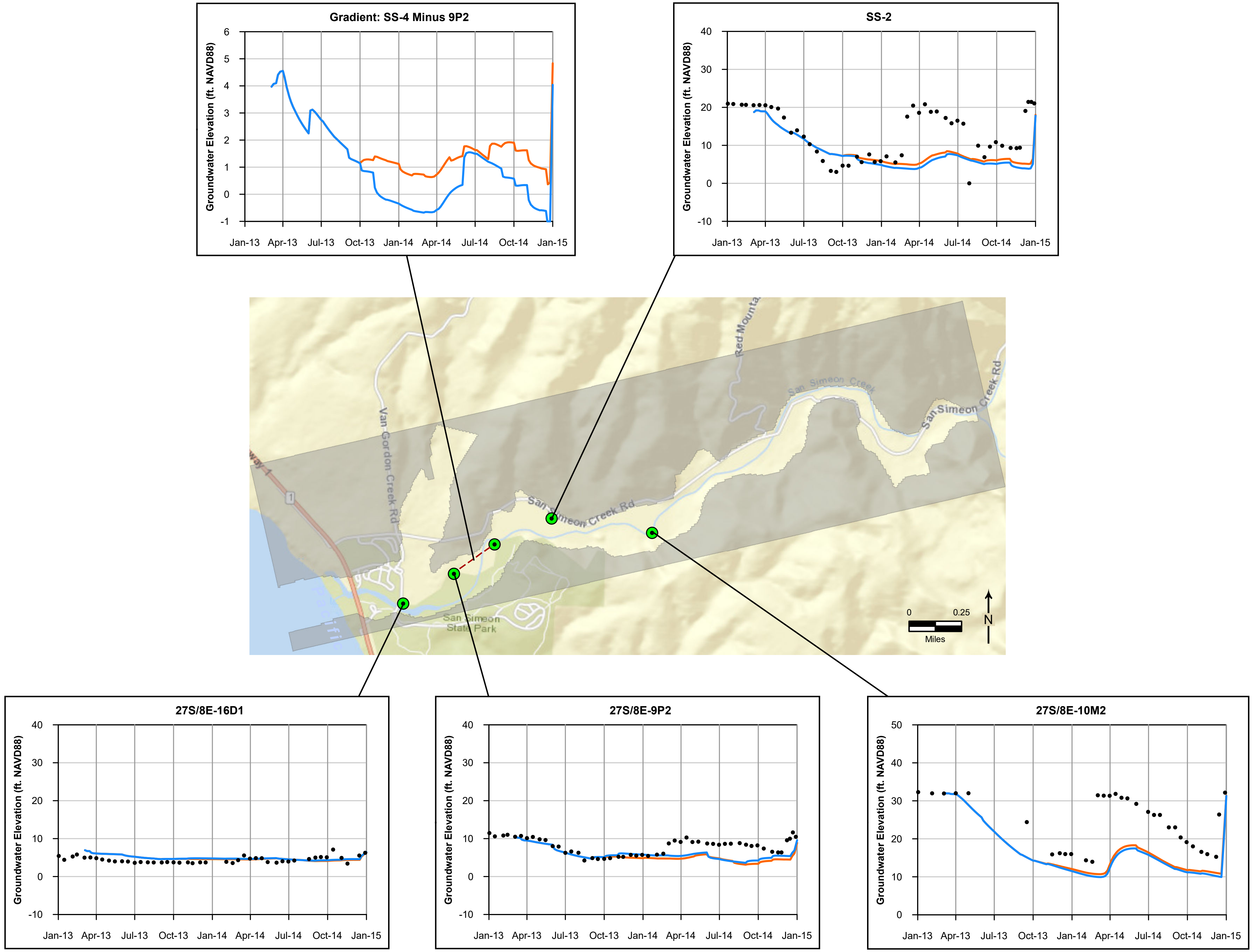
Measured 2013-2014
Stage 4 + WRF
Stage 4 + WRF + Pedotti

March 2022

TODD GROUNDWATER

Figure 12
Simulated Well Hydrographs - Stage 4 with Increased Pedotti Pumping

Path: T:\Projects\Cambria Water Supply Permit 70602\GIS\Maps\Modeling_TM\Figure 12 Simulated Well Hydrographs - Stage 4 with Increased Pedotti Pumping.mxd



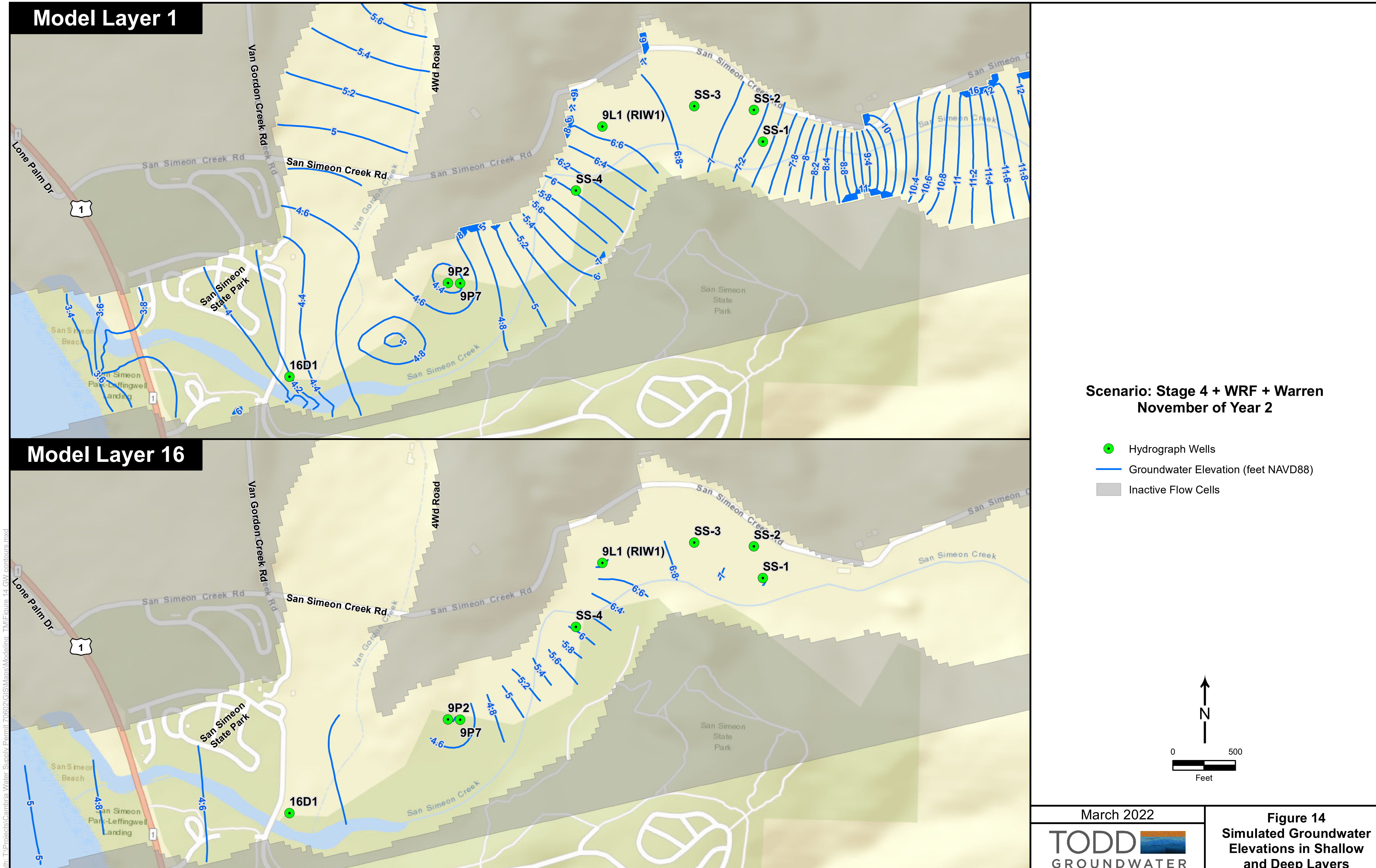
Hydrograph Wells
Inactive Flow Cells

• Measured 2013-2014
Stage 4 + Warren
Stage 4 + WRF + Warren

March 2022
TODD GROUNDWATER

Figure 13
Simulated Well Hydrographs - Stage 4 with Increased Warren Pumping

Path: T:\Projects\Cambria Water Supply Permit 70602\GIS\Maps\Modeling_TM\Figure 13 Simulated Well Hydrographs - Stage 4 with Increased Warren Pumping.mxd


Model Layer 1
Model Layer 16
Van Gordon Creek Rd
4Wd Road
San Simeon Creek Rd
Lone Palm Dr
San Simeon State Park
San Simeon Beach
San Simeon Park-Leffingwell Landing
San Simeon Creek
9L1 (RIW1)
SS-1
SS-2
SS-3
SS-4
9P2
9P7
16D1
Scenario: Stage 4 + WRF + Warren
November of Year 2
Hydrograph Wells
Groundwater Elevation (feet NAVD88)
Inactive Flow Cells
N
0
500
Feet
March 2022
TODD GROUNDWATER
Figure 14
Simulated Groundwater Elevations in Shallow and Deep Layers