



DESALINATION EXECUTABLE SOLUTION AND LOGISTICS PLAN



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APPENDIX A

2015 DESALINATION OPPORTUNITIES SUMMARY REPORT

SAN LUIS OBISPO COUNTY
DESALINATION OPPORTUNITIES SUMMARY REPORT

AUGUST 2015

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2 EXECUTIVE SUMMARY

The purpose of this report is to identify the opportunities and challenges of desalination as a water supply for San Luis Obispo County.

The communities within San Luis Obispo County are confronted with an exceptional drought, severe declines in groundwater and surface water levels, and limitations on imported water supplies. To help address existing and future water needs in the face of these issues, this report provides basic information about desalination for consideration by water purveyors, groundwater sustainability agencies, community leaders and other water resource management entities.

A regional desalination project may be an appropriate solution for San Luis Obispo County to address water supply issues when integrated with the communities' goals and strategies. However, the feasibility for a desalination project highly depends on the various needs by water managers, decision makers and the general public. Desalination must be compared with a range of water supply alternatives and approaches to demand management that exist to assist San Luis Obispo communities with long-term water supply issues.

Desalination provides a safe and reliable drinking water supply to communities with significant considerations for costs and environmental impact than other alternatives. Operation and maintenance of a reverse osmosis system--the predominate technology used for desalination--is energy intensive. High energy use means high operating costs and, depending on the source of power, an increase in *greenhouse gas* emissions. In the case of seawater desalination, environmental impacts must be properly mitigated to avoid harming marine life.

Successful long-term operation of a regional desalination facility requires well-structured agreements between the supplier and customers to avoid *demand risk*, the condition where alternative water supplies are readily available and cheaper than desalinated water.

The desalination opportunities that were identified for San Luis Obispo County include expanding existing desalination facilities, co-locating a new facility at an existing industrial site, and locating a desalination facility at a new site. The following list includes potential locations for desalination opportunities in San Luis Obispo County:

- Expansion of the Morro Bay Desalination Facility
- Expansion of the Cambria Emergency Water Supply (EWS) Project
- Expansion of the Diablo Canyon Power Plant (DCPP) desalination facility
- Co-location at the South SLO County Wastewater Treatment Plant
- Co-location at the Nipomo Mesa Refinery
- Co-location at the Morro Bay Power Plant
- New facility at the Estero Marine Terminal

The major implementation issues associated with desalination were identified from Chapter 10 of the 2013 California Water Plan (Appendix A):

- Permitting and regulatory framework
- Energy use and sources

- Climate change
- Funding
- Intakes and ocean and freshwater ecosystems
- Concentrate (brine) management
- Subsurface extraction
- Planning and growth

Some of these challenges are discussed in this report and further details are also provided in the 2013 California Water Plan.

For desalination to be a feasible option on a large scale, partnerships are necessary. With a regional approach, certain costs exist regardless of the facility's size, include permitting, intake design, energy needs, brine disposal, and agreement structures between sellers and buyers of the water supply.

Addressing institutional barriers will require each potential partner, including regulatory agencies, to review its relevant guiding regulations and policies, identify what combination of supply enhancement and conservation strategies it wants to plan for and support, and determine how desalination fits in. A particular agency may find that their policies support a certain hierarchy of solution strategies. For example, the County's Conservation and Open Space Element prioritizes optimization of existing infrastructure first before developing new supply via desalination (Water Resources Policy 1.3). Another approach may be to prioritize investing in projects that provide the highest reliability and can be combined with optimization strategies for existing infrastructure and/or conservation programs to meet multiple needs in multiple areas through mutually beneficial partnerships.

Successful regional desalination projects in California have been implemented only after long and extensive project vetting, development and implementation processes. The communities of San Luis Obispo would benefit from discussions to develop and potentially fund integrated regional water resources projects, including a regional desalination concept, in the county.

3 INTRODUCTION

The purpose of this section is to introduce desalination, the quality and quantity of water produced, and California current and proposed projects.

3.1 BACKGROUND

Desalination is the process of removing salt from water. Various technologies are used to lower the salinity of a water, such as thermal distillation, electrodialysis, capacitive deionization, and membrane separation. The majority of the proposed desalination projects within California are utility-scale applications using reverse osmosis (RO) technology. RO uses high pressure to force water across a semi-permeable membrane, which produces a highly pure desalinated water stream and a brine waste stream that contains a higher concentration of salt than the incoming water source.

Desalinated water can be used as a new water source to meet the demands for various beneficial uses including supplementing an existing municipal supply, agricultural/landscape irrigation, groundwater replenishment, and seawater intrusion mitigation.

3.2 QUALITY AND AVAILABILITY OF DESALINATED WATER

The availability and quality of desalinated highly depends on the water source, type of desalination process, and desired end product (e.g., potable or nonpotable). Various water sources can be treated using desalination to provide a municipal water supply including ocean water, inland seas, groundwater aquifers, and wastewater effluent streams.

These water sources can be characterized further by general salinity levels (seawater and brackish water) and general source locations (surface or subsurface).

3.2.1 Seawater and Brackish Water Salinity

Salinity refers to the concentration of dissolved salt for a given water source. Sodium chloride is usually the highest concentration salt and most frequently equated with salinity. Salinity levels are often represented with the measurement of total dissolved solids (TDS), which usually includes other dissolved constituents such as ionic salts and metals. However, TDS remains a common representation of salinity for municipal water sources.

The salinity of ocean water usually ranges between 30,000 milligrams per liter (mg/L) to 50,000 mg/L with an average value of 35,000 mg/L. While the term “seawater” implies water from the ocean, it better describes the degree of salinity commonly found in oceans and inland seas independent of location.

The term “brackish water” while commonly used to refer to groundwater, also better describes a degree of salinity independent of the water source. Brackish water has a salinity level greater than natural fresh water but lower than seawater. Natural fresh water typically has a salinity concentration less than 1,000 mg/L TDS. Municipal drinking water systems using desalinated water produce less than 500 mg/L TDS. Brackish water from a groundwater source or another origin generally describes the salinity level from 1,000 to 30,000 mg/L TDS.

3.2.2 Surface and Subsurface Sources

The general water sources for desalinated water can be from surface waters such as an ocean or an inland sea or from subsurface waters such as a brackish groundwater aquifer.

The Pacific Ocean is the primary surface water considered for desalination projects in California. While ocean water practically provides an inexhaustible source, the marine environment is susceptible to adverse conditions at the intake and outfall structures and surrounding areas. To mitigate environmental impacts from open water intakes and outfalls, subsurface wells can be used to collect water from the ocean or other saline surface water. These wells, galleys, or other structures are located underneath the seafloor, within the beach, under an inland sea, bay or estuary, or other configuration.

Although an intake may be subsurface, the level of salinity encountered can be either category seawater or brackish water as determined by the TDS concentration. Naturally, subsurface intakes in proximity to the ocean will usually be seawater. Locations that are farther inland from the beach may be a mix of ocean water and groundwater salinity, providing a less saline water source to improve treatment cost effectiveness. It's important to consider the impact to the fresh groundwater from inland wells however.

Other potential sources for desalinated water may include brackish groundwater, inland surface water bodies, bays and estuaries, and recycled wastewater. The identification and investigation of brackish

water sources is important for any given project to consider as lower energy is required to desalinate sources with lower salinity.

Most of the current and proposed desalination projects within California are sourced from brackish waters. Further discussion to identify both brackish waters as potential sources—including their locations and safe yields—is recommended.

3.3 DESALINATION PROJECTS IN CALIFORNIA

As California's current drought cycle has constrained the water supplies for many communities including those within San Luis Obispo County, the number of proposed desalination projects within California has significantly increased.

Some communities are anticipating the benefits of increased supply and drought-proof reliability. However, these benefits are coming at high capital/operating costs and environmental challenges.

3.3.1 Existing Desalination Facilities

About two dozen desalination facilities are operating in California, with almost all of these using a brackish water source (e.g., low quality groundwater) to provide an additional water supply for urban and agricultural use. The production capacities for these facilities range from 0.2 to 15 million gallons per day (MGD).

The remaining desalination facilities use seawater but are privately owned and operated for industrial purposes or operate intermittently as an emergency/standby water source. Only three seawater facilities provide consistent municipal water: Santa Catalina Island, San Nicolas Island, and Marina (Fort Ord). However, these facilities are relatively small with a total capacity of 562 acre feet per year (AFY).

In late 2015, the Carlsbad Seawater Desalination Facility (owned and operated by Poseidon Resources) will be the first large utility-scale seawater desalination in California, delivering 50 million gallons per day (56,007 AFY) of potable water to the San Diego County Water Authority. Further study of the Carlsbad facility and other large seawater desalination projects in other states such as Florida and Texas and other countries such as Mexico and Australia can help inform local decision makers on the successful factors for a project in San Luis Obispo County.

3.3.2 Proposed Desalination in California

In California, there are about 17 brackish groundwater desalination projects and about 15 ocean desalination projects in various stages of planning and design. Most of the brackish groundwater facilities will be an expansion of existing sites, contributing to California's municipal water supplies by an estimated 75,000 AFY. The proposed seawater desalination facilities are estimated to contribute a total supply of 380,000 AFY, including two facilities located in Mexico where desalinated water would cross the border for final treatment to the State's drinking water standard.

As interest in desalination grows in California and elsewhere throughout the world, new technologies and processes are making desalination more efficiency and cost effective. Recent research has shown significant gains in efficiency with reverse osmosis including energy use, brine recovery rates and heat recovery potential. Other technologies such as forward osmosis, solar distillation, dual nanofiltration and so on should be include any future feasibility study using a saline water source for supply augmentation.

4 IDENTIFICATION OF OPPORTUNITIES IN SLO COUNTY

Three categories for identifying opportunities in San Luis Obispo County are presented in the following section:

- Increasing capacity at existing desalination facilities
- Using existing facilities to develop a desalination facility
- Identifying potential viable new sites

The presentation of these locations is not exhaustive. Although a seawater desalination project has the potential to be situated along approximately 90 miles of coastline within San Luis Obispo County, careful consideration of factors such as appropriate land use, location of sensitive and protective areas (e.g., National Marine Sanctuaries), siting concerns related to the coastal zone (Appendix B), and proximity to power and piping infrastructure would narrow the feasible locations.

4.1 INCREASING CAPACITY AT EXISTING DESALINATION FACILITIES

The following desalination facilities in SLO County were identified for the potential to expand the existing capacity to provide an increase of water supply:

- Morro Bay Desalination Facility
- Cambria Emergency Water Supply (EWS) Project
- Diablo Canyon Power Plant (DCPP) Desalination Facility

Expansion of these facilities would save time and costs related to permitting, design, infrastructure, and land acquisition. Existing facilities that expand may be subject to improvements related to the State Water Resources Control Board's recent amendment to the Ocean Water Plan (Appendix C), which require specific intake and brine discharge design elements.

The expansion at an existing site may provide a cost effective solution for increasing a water supply at a lower marginal cost per unit of water compared to construction of a new facility. However, certain institutional challenges including facility ownership, agreement structures with communities and water purveyors, and long-term operation exist.

4.1.1 Morro Bay Desalination Facility

The City of Morro Bay constructed a seawater desalination plant in 1992 to address the water emergency at the time. The capital cost for construction was about \$3 million. Since then the facility has been operated intermittently during drought conditions, offsetting seasonal peaking, and routine maintenance. A pretreatment system to remove iron and manganese was added in 2002 at an additional cost of about \$2 million. Currently, the pretreatment system does not adequately address clogging and may require upgrading to be more effective.

In 2009 the City expanded the desalination facility to treat brackish groundwater (due to elevated nitrate levels) from wells within the Morro Valley Groundwater Basin. The low salinity of the brackish groundwater allows for lower energy costs during operation than the seawater treatment system. The brackish water treatment system currently supplies the City in situations of reductions or interruptions from State Water deliveries. This project was funded with CA-CDHP grants.

4.1.1.1 Existing Capacity and Unit Costs

The seawater reverse osmosis (SWRO) system produces 400 gallons per minute (gpm), or 645 acre-feet per year (AFY) of drinking water from five intake wells located along the Embarcadero. The cost to operate the seawater system is about \$1,550 per AF. The brackish water reverse osmosis (BRWO) system capacity produces 450 gpm, or 725 AFY, from groundwater wells within the Morro Valley Groundwater Basin. The City is currently permitted to withdraw up to 581 AFY. The cost to operate the brackish system is about \$1,000 per AF. The total permitted production from both SWRO and BRWO systems is 1,126 AFY, or approximately 1.1 MGD.

The City's entitlement to 1,313 AFY from the State Water Project costs \$1,600 per AF in comparison. However, the City pays the fixed rate for the duration of the contract with the state regardless of water delivery or usage. A surcharge for desalination facility operations has been proposed to cover the cost of producing drinking water from seawater during periods of need. The surcharge would be levied when the plant is operating at a maximum rate of \$3.00 per hundred cubic feet, or \$1,303 per AF.

4.1.1.2 Expansion Opportunities

The Morro Bay Desalination Facility is located adjacent to the existing Morro Bay-Cayucos Wastewater Treatment Plant (WWTP) that is jointly owned by the City of Morro Bay and Cayucos Sanitary District. An agreement between Morro Bay and Cayucos prohibits brine disposal through the existing WWTP outfall. The Morro Bay Desalination Facility currently uses the outfall of the neighboring Morro Bay Power Plant to discharge brine waste.

Planning for the potential upgrade and relocation of the WWTP is currently underway. The City has proposed a site for a new wastewater facility located outside of the city limits and away from the Coastal Hazards, such as tsunamis, sea level rise, increased storm surge and coastal flooding. The future use of the desalination plant at the existing location would need to include a discussion of the fate of the existing WWTP property and infrastructure, including the continued use of the intake and outfall structures to that location.

Expansion of the existing desalination facility at the existing WWTP provides an opportunity for the City of Morro Bay to offset all current and future needs as well as the potential to exchange their entitlement to State Water with other water agencies if desired. The current industrial setting with other existing facilities allow for expanded desalination operations to be appropriately located. However, land use/zoning of the site may be updated in the future to align with community desires.

The potential challenges for an expanded desalination facility at the existing WWTP including the permitting process through the California Coastal Commission, increasing the number of intake wells, future agreements for the Morro Bay Power Plant or existing WWTP outfalls (unless a stand-alone outfall is desired), and the location of a permanent facility in coordination with the City's planning strategies.

Any expansion of the desalination facility would necessarily increase the SWRO treatment train because additional extraction from the Morro Valley Groundwater Basin is currently prohibited, unless additional appropriative rights can be secured. Therefore, seawater as a source for desalination provides a more feasible option for expansion. Additionally, upgrading the pretreatment system for iron and manganese removal would be needed to ensure proper operation of the facility.

4.1.2 Cambria Emergency Water Supply (EWS) Project

The Cambria Emergency Water Supply (EWS) Project began operating in January 2015 to treat brackish water using advanced water treatment at Cambria CSD's San Simeon well field and percolation pond system property. The source for the brackish water is a combination of diluted seawater that occurs from the subterranean dispersion of salts from a deeper saltwater wedge into an overlying freshwater interface zone, creek underflow, and percolated treated wastewater effluent (Cambria Project EIR 2015). The project's advanced water treatment plant includes microfiltration, three-stage reverse osmosis, and advanced oxidation. Treated water is injected near the CCSD's existing San Simeon well field where it travels at least 60 days before entering an existing production well. This system meets the State's requirements for indirect potable reuse of recycled water.

4.1.2.1 Existing Capacity and Costs

The EWS Project can provide up to 250 AF over an assumed six-month dry season to recharge the San Simeon well field aquifer with advance treated water, based on the current permit with the California Water Board.

Cambria CSD's Water Master Plan, adopted in September 2008, provided an evaluation of water supply alternatives for the community, including long-term water solutions such as seawater desalination, surface water from Lake Nacimiento, additional groundwater wells, recycled water, demand management, and basin management. The long-term desalination alternative, depending on the number of RO units and operating days, could provide 300, 520 or 820 AFY. The annualized capital cost and O&M cost (in 2002 dollars) based on 4 percent interest over a 30-year life cycle was estimated at \$800, \$710, or \$680 per AF, respectively.

Further concepts and options were explored in the Cambria Water Supply Alternatives Engineering Technical Memorandum prepared by CDM Smith in 2013. Several seawater reverse osmosis (SWRO) desalination alternatives were identified and screened:

- New SWRO facilities near Cambria at Shamel Park, Lampton Park, and San Simeon Village
- New SWRO facility at the Estero Bay Marine Terminal
- Upgrading and sharing the existing SWRO plant in Morro Bay

Other alternatives included treating brackish water at San Simeon Creek Road, building a pipeline from Lake Nacimiento, exchanging water at Whale Rock Reservoir, hard rock aquifer storage, and small scale storage ponds.

The long-term solutions, including the use of seawater desalination, are currently being analyzed as part of an ongoing Army Corps managed Environmental Impact Statement (EIS) process. The Cambria CSD previously estimated desalination costs at \$1,233 per AF, however their EIS is still in progress and no long-term preferred alternative has been proposed. The feasibility and cost of a seawater desalination water supply solution for Cambria will highly depend on whether one could be permitted in an environmentally sensitive area. Much of the immediate offshore area of Cambria is within the Monterey Bay National Marine Sanctuary, as well as the Cambria State Marine Park. Earlier attempts by the CCSD and Army Corps to explore the San Simeon Creek beach and Santa Rosa Creek beach areas for subterranean seawater intakes were either stopped by appeals to the Coastal Commission, or were denied access by State Parks. The Army Corps has found that deeper alluvial deposits along the coastline that are conducive to subterranean intakes usually coincide with the mouths of creeks, which

are often recreational beach areas. The cost and feasibility for a Cambria seawater desalination facility will depend upon location, total capacity, location of the intake/outfall structures, pipeline delivery, and permitting.

4.1.2.2 Long-Term Permitting Considerations

The Cambria CSD is currently working towards obtaining a regular Coastal Development Permit (CDP), which would ultimately replace its existing EWS emergency CDP. The emergency CDP limits operation of the current EWS to times when the CCSD Board has declared a Stage 3 Water Shortage Emergency. The CCSD's goal is to obtain a regular CDP, which would provide the CCSD greater operating flexibility, including the avoidance of future water shortages, by proactively operating its EWS before such an emergency occurs. To support its regular CDP permitting effort, the CCSD is currently completing an Environmental Impact Report on its EWS. Additionally, the Army Corps managed EIS on its longer-term water supply project is evaluating means to incorporate the EWS into one of its longer-term brackish water supply alternatives. A longer-term brackish water alternative may include consideration of sharing the existing San Simeon CSD outfall for future brine discharge. Such an approach, if deemed feasible, would require future negotiations and agreements between the CCSD and San Simeon CSD.

Expansion of the existing EWS Project to meet other water needs elsewhere in the County may not be appropriate until completion of the CCSD's environmental analyses and longer-term CDP permitting efforts.

4.1.3 Diablo Canyon Power Plant

The Diablo Canyon Power Plant (DCPP) operates a seawater reverse osmosis (SWRO) desalination system to supply water to the remote facility. The SWRO system provides non-potable water for the facility needs such as keeping the raw water pond above minimum levels and feeding the advanced water treatment plant for the steam generation system. The SWRO system also provides potable water for employees and other uses.

4.1.3.1 Existing Capacity

The existing SWRO system shares the intake and outfall structures with the power plant and produces desalinated water at a designed capacity of 600 gpm. The normal average water demand for the DCPP facility is 170 gpm. The excess capacity of the existing system that would be available is 500 AFY. Additional SWRO units could be retrofitted to the existing system to increase the production rate to the permitted capacity.

4.1.3.2 Near Term and Regional Expansion Opportunities

Expansion of DCPP desalination facility may be feasible as a near term solution to supply water to nearby communities. The co-location with the nuclear power plant and the excess capacities of the existing intake/outfall structures also provide opportunities to site a regional facility at larger capacities. Several challenges would require further discussion to evaluate feasibility:

- Lack of an existing pipeline to the nearby water purveyors and communities
- Location of the existing facility on high-level security private property
- Permitting issues including the California Coastal Commission and recent updates to the Ocean Water Plan

The DCPD desalination facility is remotely located on the coast several miles from communities within San Luis Obispo. Potential routes for a pipeline would be along the existing access roads from the facility going to the north (to the communities of Los Osos and Morro Bay) and to the south (to the communities of Avila Beach and Pismo Beach). Generally, a pipeline going eastward toward the City of San Luis Obispo appears less feasible due to the mountainous terrain.

Discussions about near term expansion and regional desalination project opportunities could be investigated further.

4.2 CO-LOCATION FACILITIES

Three sites were initially identified that could be opportunities for the co-location of a desalination facility:

- Morro Bay Power Plant (MBPP)
- Nipomo Mesa Refinery
- South SLO County Wastewater Treatment Plant (WWTP)

The construction of a desalination facility at an existing industrial facility has several advantages over a new undeveloped or redeveloped site. Since these facilities are currently zoned for industrial purposes, the co-location of a desalination facility would be appropriate use. Wastewater treatment plants and power plants located with either intake or outfall structures could be used by a desalination facility with minimal increased impacts to the environment and with reduced infrastructure costs. Industrial facilities also have existing power supply infrastructure that would provide access to the desalination facility to meet the typically high energy demands.

4.2.1 Morro Bay Power Plant

The Morro Bay Power Plant (MBPP), retired in February 2014, is located on about 100 acres of privately owned land within the City of Morro Bay limits. City representatives are discussing the future of the industrial site, including the possibility of repurposing the facility or rezoning the area.

The Morro Bay Power Plant area is appropriately zoned for an industrial facility such as a seawater desalination facility. The adjacent Morro Bay-Cayucos Wastewater Treatment Plant currently operates the City of Morro Bay's desalination facility, which uses the power plant's outfall for brine disposal.

Discussions for an expansion of the existing facility or a planned regional facility would need to consider several challenges:

- Future operation and location of the wastewater treatment plant
- Future use of the facility and properties of the Morro Bay Power Plant area
- Property ownership/transfer considerations
- City of Morro Bay's master plan for the Embarcadero area
- Increasing intake/discharge capacity and associated permitting
- Visual and noise related impacts

Although MBPP is located in an industrial zone, the future development of the existing property, its location within the city limits and near tourism and commerce centers, and potential marine impacts to

the bay and nearby estuary would need to be included in further discussions by the community's decision makers.

4.2.1.1 MBPP Properties

The properties associated with MBPP were discussed at the February 24, 2015 Morro Bay City Council meeting in order to clarify the status of the major parcels of the property as well as identification of restrictions and limitations affecting future development. The following is a review of the properties associated with MBPP property status, as outlined on Figure 1:

- The Dynegy Morro Bay LLC (Dynegy) property
 - Includes the majority of the Morro Bay Power Plant land and facilities
 - Includes the large intake building on the bay side of the Embarcadero
- Parcels to be transferred
 - Includes several contiguous parcels under consideration for transfer to the City of Morro Bay
 - Primarily “green space” on the north side of the property including Lila Kaiser Park
- City of Morro Bay property -- “The Triangle Parking Lot”
 - Consists of a 2.5 acre parcel recently deeded from Dynegy to the City of Morro Bay
 - Zoned as Coastal Dependent Industrial (M-2/PD/I) as with the other properties
- PG&E property (not shown on Figure 1)
 - Includes significant portion of “power plant” land
 - Includes the “switchyard” located immediately west of the power plant
 - Expected to remain essential to PG&E operations

Future use of the MBPP properties owned by Dynegy were briefly identified in the City's staff report and the most relevant issue related to the development of desalination facility was that the City does not have controlling interest or influence on the private ownership of the property.

Considering MBPP's location within the city limits since the 1950s, proximity to the bay intakes/outfall, and connection to a regional pipeline network (i.e., State Water Project), a desalination facility at the Morro Bay Power Plant could warrant further investigation.



Figure 1 Morro Bay Power Plant properties: Dynege property containing the Morro Bay Power Plant (bottom); “Green space” parcels to be transferred to the City of Morro Bay (top left); “Triangle Parking Lot” owned by the City of Morro Bay (top right)

4.2.2 Nipomo Mesa Refinery

The Nipomo Mesa Refinery (Santa Maria Refinery, owned by Phillips 66) was studied by the Nipomo Community Services District (CSD) as a potential site for a seawater desalination facility initially in 2007.

The study evaluated the construction a seawater desalination plant co-located at the Nipomo Mesa Refinery site, which would supply potable water up to 6,300 AFY to the nearest Nipomo CSD pipeline. Directionally drilled wells into the aquifer-bearing sands beneath the ocean were evaluated, which were located approximately two miles from the site. Brine discharge from the desalination facility was evaluated to be mixed with the existing cooling water outfall from the refinery.

The study identified several advantages of co-location of a desalination facility at the Nipomo Mesa Refinery site:

- The refinery is close to the ocean at approximately two miles
- The refinery currently operates as a permitted industrial site
- The refinery has an existing ocean outfall for brine discharge
- Industrial wastewater could be used as a brackish water source to blend with the seawater source, lowering the salinity and thus energy use
- The Nipomo CSD pipeline system is relatively close the site at approximately six miles

See *Section 4.4.2 2007 Nipomo Community Services District Desalination Evaluation* for details from the study about the Nipomo Mesa Refinery.

4.2.3 South San Luis Obispo County Wastewater Treatment Plant

The South San Luis Obispo County Wastewater Treatment Plant was studied by the City of Arroyo Grande, City of Grover Beach and Oceano Community Services District as a potential site for a seawater desalination facility.

The study evaluated the construction of a 2,300 AFY seawater desalination facility co-located at the South San Luis Obispo County Sanitation District's (SSSLOCSO) wastewater treatment plant. A funding study that was prepared in 2008 followed the feasibility study that was prepared in 2006.

See *Section 4.4.1 SSSLOCSO Desalination Studies* for details about the evaluation of a desalination facility at the South San Luis Obispo County Wastewater Treatment Plant.

4.3 POTENTIAL NEW SITES

Two sites were identified that are potentially suitable for a seawater desalination facility:

- Estero Bay Marine Terminal
- Nipomo CSD stand-alone site

The Estero Bay Marine Terminal was initially identified as part of the Cambria EWS Project evaluation (CDM Smith 2013) and the Nipomo CSD stand-alone site was initially identified in the 2007 Nipomo CSD Desalination Evaluation.

Other sites may also be suitable for desalination facilities. The identification of other suitable sites would require further investigation including discussions with potential property owners, proximity to ocean intake/discharge locations, identification of appropriate zoning and permitting requirements, proximity to power and water supply delivery networks.

Fortunately, desalination facilities require relatively small footprints. The 2 MGD (2,300 AFY) plant proposed at the South SLO County WWTP would require a facility footprint of less than an acre. The 50

MGD (56,000 AFY) Carlsbad Desalination Project located at the existing Encina Power Station requires a facility footprint of about four acres. Intake and discharge structures have been typically located up to three miles from the ocean, based on the facilities researched within California. New sites, however, face the permitting and planning challenges that might not apply to an existing desalination facility seeking expansion or a new desalination facility co-located at an industrial site.

Further studies for any new sites are recommended to determine feasibility if a regional desalination facility is considered.

4.3.1 Estero Bay Marine Terminal – New Site

The Estero Bay Marine Terminal is located between Cayucos and Morro Bay along Highway 1. A new desalination facility was identified to be located off Toro Creek Road at a site about one mile east (inland) from Highway 1.

The Estero Bay Marine Terminal was evaluated as a Tier 1 Concept in the *Cambria Water Supply Alternatives Engineering Technical Memorandum* (CDM Smith 2013). The site was not recommended to be further developed or evaluated as part of the Cambria EWS Project. However, regional desalination discussions may be appropriate for the site based on its historical industrial use. Figure 2 shows the location of a SWRO facility at the Estero Bay Marine Terminal as initially proposed in the Cambria Water Supply Alternatives.



Figure 2 Proposed SWRO facility at Estero Bay Marine Terminal (source: CDMSmith 2013)

The proposed facility was proposed to use horizontal direct drilling wells (HDDW) to install to intake structures as a seawater source to a desalination facility. The proposed facility is shown with an existing concentrate return pipeline that runs to Morro Bay and a proposed product water conveyance pipeline that runs to Cambria. The SWRO plant would be located outside of the Coastal Zone boundary.

4.4 DESALINATION STUDIES

4.4.1 South San Luis Obispo County Desalination Studies

The City of Arroyo Grande, City of Grover Beach and the Oceano Community Services District retained the Wallace Group in September 2006 to prepared two studies for a supplemental water analysis. The first study analyzed the extension of the then-proposed Nacimiento Water Project pipeline from the City of San Luis Obispo to the Lopez Water Treatment Plant.

The second study determined the feasibility of a desalination facility at the South San Luis Obispo County Sanitation District (SSLOCSD) wastewater treatment facility. This 2006 SSLOCSD Desalination Feasibility Study (Appendix D) focused on a seawater reverse osmosis (SWRO) system that would provide drinking water for the three agencies. The proposed desalination facility was evaluated at the existing SSLOCSD wastewater treatment facility, which was the most logical location for the purposes of the study. No other site locations for a desalination facility were identified.

The SSLOCSD desalination facility proposed in the feasibility study is approximately shown on Figure 3.



Figure 3 Proposed SSLOCSD Desalination Facility based on the 2006 Feasibility Study and 2008 Funding Study information

The SSLOCSD wastewater treatment facility operates adjacent to the ocean with an existing outfall extending approximately 4,000 feet offshore. The outfall has a total capacity of 16 million gallons per day (mgd) which is shared between SSLOCSD wastewater treatment facility and the City of Pismo Beach. The study estimated that approximately 2 MGD, or 2,300 AFY, would be available as additional capacity through the outfall. For this proposed location, the flow rate available for brine disposal from the SWRO system would limit the total capacity of the desalination facility.

The study generated a cost estimate based on engineering judgement, confirmed bid prices for similar work in the Central Coast area, consultation with vendors and contractors, established budgetary unit prices, and other reliable sources. The capital costs included the intake structure and piping, building, treatment system, pumps and distribution piping, design and permitting costs. Operation and maintenance (O&M) costs included energy usage, membrane replacement, chemical usage and labor.

Based on the 20-year life cycle cost analysis, the total unit cost for the desalination project (in 2005 dollars) was approximately \$2,675 per AFY.

Subsequently, with the conclusion that desalination was a viable water supply, the three agencies secured Proposition 50 grant funding to prepare a follow-up funding study in 2008. The funding study included a preliminary design, identification of regulations and permitting needed for construction, an updated cost estimate, and potential water rate increases for each of the three participating agencies.

The 2008 SSLOCSD Desalination Funding Study (Appendix E) further detailed the preliminary planning and design including the following elements:

- Twenty or more relatively shallow (70 feet deep) beach wells to intake seawater
- Pumping seawater through a 16-inch diameter pipe from the beach wells to the SSLOCSD wastewater treatment facility located up to 3,000 linear feet away
- The total estimated power consumption including pre-treatment using microfiltration and salt removal using reverse osmosis (RO), consuming an equivalent of 5,300 kWh per AF of desalted water produced
- Delivering 2,300 AFY of potable water using 12-inch diameter piping to the three agencies

Depending on variability in permitting and environmental issues associated with the project, the anticipated schedule would require 7 to 8 years to complete.

A rate study analysis, which was included with the funding study, was prepared by Tuckfield & Associates to determine the impact to monthly water bills for each of the three agencies. The analysis identified two project cost alternatives based on project phasing ("High Cost" and "Low Cost"). Additionally, the maximum and minimum annual capital costs that would be required for each alternative was developed based on the requirements of the possible funding sources.

Table 1 summarizes each agency's average monthly water service bill for a single family residential customer, and the range of additional costs that each customer would experience with the proposed desalination project.

Table 1 SSLOCSD Desalination Project Estimated Monthly Water Bill Surcharge

Participating Agency	Average Monthly Water Service Bill ¹	Desalination Project Additional Cost Range ²	Total Monthly Water Service Bill
City of Arroyo Grande	\$ 58.86	\$ 10.82 - \$ 20.15	\$ 69.68 - \$ 79.01
City of Grover Beach	\$ 34.11	\$ 20.74 - \$ 38.65	\$ 54.85 - \$ 72.76
Oceano CSD	\$ 45.90	\$ 41.85 - \$ 79.08	\$ 87.75 - \$ 124.98

Based on the 20-year life cycle cost analysis, the annualized capital costs and annual O&M costs for each agency approximately ranged from \$1.3 million for the minimum annual capital costs of the Low Cost Alternative to \$2.5 million for the maximum annual capital costs of the High Cost Alternative. Table 2 provides the range of total annual cost for each agency and the calculated unit cost per acre-foot per year.

Table 2 SSLOCSD Desalination Project Total Annual Costs and Unit Cost per Acre-Foot per Year (afy)

Participating Agency	Allocated Supply	Total Annual Cost (2008 Dollars) ³ (Annualized Capital Cost + Annual O&M)			
		<u>High Cost</u> Max	<u>High Cost</u> Min	<u>Low Cost</u> Max	<u>Low Cost</u> Min
City of Arroyo Grande	750 AFY	\$ 2.4M	\$ 2.2M	\$ 1.4M	\$ 1.3M
City of Grover Beach	800 AFY	\$ 2.5M	\$ 2.4M	\$ 1.5M	\$ 1.4M
Oceano CSD	750 AFY	\$ 2.5M	\$ 2.3M	\$ 1.5M	\$ 1.3M
UNIT COST PER AFY (CALCULATED)					
City of Arroyo Grande	750 AFY	\$ 3,165	\$ 2,909	\$ 1,909	\$ 1,700
City of Grover Beach	800 AFY	\$ 3,395	\$ 3,137	\$ 2,045	\$ 1,821
Oceano CSD	750 AFY	\$ 3,343	\$ 3,024	\$ 1,979	\$ 1,769

¹ Based on the average monthly consumption for a single family residential customer in July 2008 (reference: SSLOCSD Desalination Funding Study Table 7-4)

² Additional cost range for desalination project using the minimum of the Low Cost Alternative and the maximum of the High Cost Alternative (reference: SSLOCSD Desalination Funding Study Table 7-4)

³ Based on Table 5 Impact of Desalination Project to Participants, Tuckfield & Associates Rate Study Analysis, July 28, 2008

The total unit cost of the proposed desalination project described in the funding study (in 2008 dollars) for each agency ranged from \$1,700 to \$3,165 per AFY (Arroyo Grande), from \$1,821 to \$3,395 per AFY (Grover Beach), and from \$1,769 to \$3,343 per AFY (Oceano).

The study concluded that the construction of a 2,300-AFY desalination plant at the SSLOCSD wastewater treatment plant is technically feasible. The following key issues that may impact the proposed project were identified:

- Intake System – acceptability and capacity
- Outfall System – increasing capacity
- Desalination Facility – available existing and future footprint

Using the existing wastewater treatment facility with its existing outfall structure provides significant cost savings for the project and increases the viability of desalination for the three agencies.

4.4.2 2007 Nipomo Community Services District Desalination Evaluation

The Nipomo Community Services District (CSD) retained Boyle Engineering Corporation in 2007 to perform an evaluation of supplemental water alternatives including the preparation of a two technical memorandums related to a desalination project. Technical Memorandum No. 1 (TM 1) provided an analysis of the constraints for multiple alternatives which included desalination. Technical Memorandum No. 2 (TM 2) Work Plan for Project Implementation (Appendix F) provided a work plan for the implementation of a facility that could reliably deliver a future water demand of 6,300 AFY as determined in the District's Water Master Plan.

4.4.2.1 *TM 2 Work Plan Elements*

The work plan outlined the project approach including the identification of key studies that were needed to proceed with a project and the development of a preliminary schedule and budget. The regulatory agencies and information needs that are applicable to a Nipomo desalination project included the following:

- US Army Corp of Engineers (USACE) – Section 10 and Section 404 Permits
- US Fish and Wildlife Service – Compliance with Endangered Species Act
- US Coast Guard – Review USACE Section 10 permit
- NOAA/National Marine Fisheries Service – Compliance with Endangered Species Act
- US Department of Interior – Compliance with National Historic Preservation Act
- California Coastal Commission – Coastal Development Permit
- State Lands Commission – State Lands Lease
- California Regional Water Quality Control Board – NPDES Permit
- California Department of Health Services – Domestic Water Permit
- California Department of Transportation – Highway 1 Encroachment Permits
- California Department of Fish and Game – Pipelines crossing over streams
- California Office of Historic Preservation – Compliance with National Historic Preservation Act
- County of San Luis Obispo – Coastal Development Permit

In addition to permitting requirements for regulatory agencies, the following studies that would need to be undertaken to provide information for the permitting and design of the proposed project were identified:

- Terrestrial and Freshwater Impact Study
- Marine Impact Study
- Cultural Resource Impact Study
- Hydrogeologic Feasibility Study
- Intake/Discharge Feasibility Study
- Pilot-Scale Treatment Feasibility Study

The remainder of the work plan outlined the tasks related to preliminary engineering, CEQA/NEPA process, public outreach, design and permitting, and bidding and construction. The “best case” projection for the schedule to implement the work plan including construction of the project was estimated over 8 years.

4.4.2.2 Project Location

Three sites for a desalination facility were identified in the evaluation:

- Site 1 – Shared facility with South San Luis Obispo County Sanitation District (SSLOCSD)
- Site 2 – Phillips 66 Santa Maria Refinery (Nipomo Mesa Refinery)
- Site 3 – NCSD stand-alone site on undeveloped parcel (Highway 1)

The potential facility locations including the piping routes from the intake/discharge locations and the tie-in to the Nipomo CSD are shown on Figure 4.

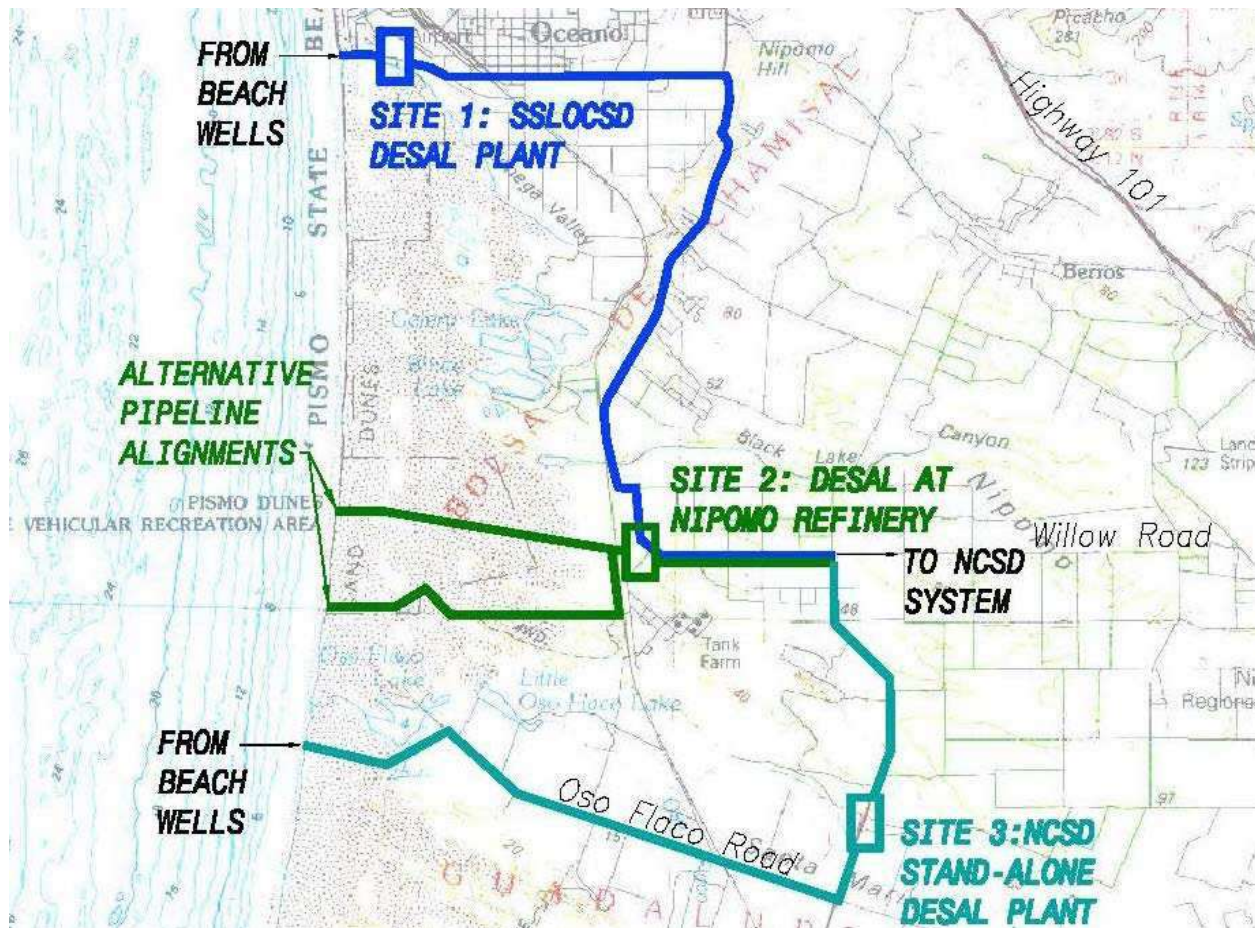


Figure 4 Nipomo CSD Desalination Project Siting and Pipeline Alternatives (Boyle, 2007)

An evaluation of the sites used criteria including the ability to purchase the property, the proximity of the facility to the intake/discharge locations and to the tie-in location, availability of power, zoning of the facility and surrounding areas, and visual impacts.

Site 1 – SSLOCSD

The cities of Arroyo Grande and Grover Beach and the Oceano Community Services District studied the feasibility of a desalination facility located at the existing SSLOCSD wastewater treatment plant. Based on the available capacity of the wastewater treatment plant's existing outfall structure, any facility would be limited to a total of 2,300 AFY of desalinated water. A new brine disposal structure would need to be built to accommodate any additional production.

Site 2 – Nipomo Mesa Refinery

The 1,780-acre Phillips 66 Santa Maria Refinery was evaluated as a potential site for a desalination facility. The property owners operate a petroleum refinery on about 200 acres of the site, which is zoned as an industrial facility, with the remainder used for open space or wildlife preservation.

An existing outfall was considered for the brine disposal of a new desalination facility located on the site in the Nipomo CSD 2007 Water and Sewer Master Plan Update. The refinery used approximately 1.3 MGD of extracted groundwater and the permitted capacity to discharge through the existing outfall was

0.575 MGD. It was assumed that the full capacity of the outfall was used. To create capacity for brine disposal from a desalination facility, disposal alternatives of the refinery effluent would be required, including groundwater recharge, direct injection, or landscape irrigation. Up to 1,900 AFY of desalinated water that could be generated from a new facility was estimated, assuming that some of the outfall capacity was handled through alternate means of disposal or reuse.

The Nipomo Mesa Refinery site would most likely require new intake and discharge structures for desalinated water capacities that are more than 1,900 AFY.

Three preliminary locations for using subsurface seawater intake and surface seawater discharge with alternative pipeline alignments were recommended for investigation (see 5):

- Intake/Discharge Location No. 1 – Black Lake Canyon Extension
- Intake/Discharge Location No. 2 – Willow Road Extension
- Intake/Discharge Location No. 3 – Southern Area of Oso Flaco Creek mouth

According to the work plan, the hydrogeology of the coastal area between Oceano and Osos Flaco is not understood in detail. Brackish groundwater may be encountered in the beach region and would be more cost effective due to the lower energy needed for water source with lower salinity concentrations. However, due to the adjudicated status of the Santa Maria Valley Groundwater Basin, intake wells located within the groundwater basin may be prohibited or limited.

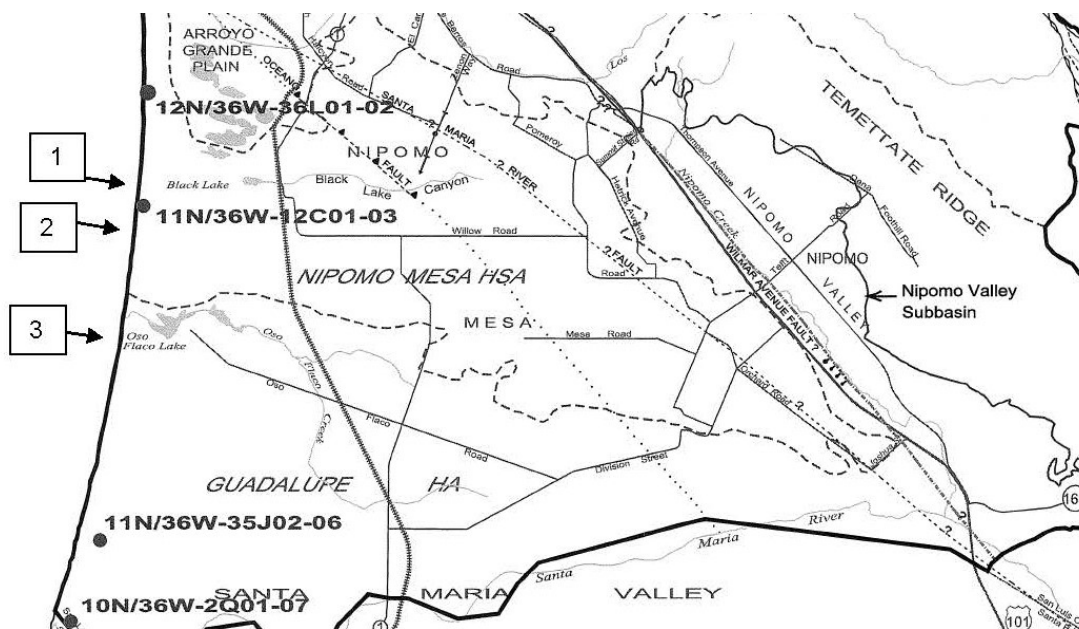


Figure 5 Possible Intake/Discharge Locations for Desalination Facility at Nipomo Mesa Refinery (Boyle, 2007)

Site 3 – Nipomo CSD Stand-Alone Site

A privately owned 35-acre parcel was considered as a stand-alone site to be purchased and owned by Nipomo CSD. The parcel is zoned rural residential, so visual and noise impacts may be significant

concerns. However, the parcel is on Highway 1 and the siting of an adjacent wastewater treatment facility could improve the possibility of a desalination facility being appropriately located on the parcel.

As part of the Nipomo CSD Supplemental Water Alternatives Evaluation prepared on March 15, 2013 by the Supplemental Water Alternatives Evaluation Committee (SWAEC), desalination was considered to meet the stipulated a physical solution to a stipulated.

4.4.2.3 Project Costs

The Technical Memorandum No. 2 provided an opinion of the probable cost of implementing and operating a 6,300 AFY desalination facility for Nipomo CSD, using the primary assumption that the Nipomo Refinery would be suitable. The probable costs of implementation are provided in Table 3 and the probable costs of operation and maintenance are provided in Table 4. The probable costs include a roughly estimated escalation cost for \$20 million from 2007 to 2015.

Table 3 Probable Costs of Implementation and Operation, Nipomo Desalination Facility

IMPLEMENTATION		PROBABLE COST ⁴
Planning & Studies		
	Terrestrial and Freshwater Impact Studies	\$ 440,000
	Phase 1 Marine Impact Studies	250,000
	Cultural Resource Study	66,000
	Phase 1 Hydrogeologic Field Study	360,000
	Pilot-Scale Feasibility Study	2,320,000
	Phase 2 Hydrogeologic Field Study	180,000
	Preliminary Engineering	210,000
	CEQA/NEPA	240,000
	Public Outreach	1,310,000
	Project Management	1,500,000
	TOTAL Planning & Studies	6,876,000
Design & Permitting		
	Design/Construction Management – Design Phase	3,870,000
	TOTAL Design & Permitting	3,870,000
Construction		
	Engineering Services – Construction Phase	6,180,000
	Intake/Discharge/Product	13,560,000
	Treatment Facility	48,200,000
	TOTAL Planning & Studies	67,940,000
	Contingency (20%)	15,737,000

⁴ Section 10 Budget and Appendix D: Opinion of Probable Cost, Technical Memorandum No. 2, Boyle 2007

	<i>Estimated Cost Escalation (2007 to 2015)</i>	<i>20,000,000</i>
	TOTAL Implementation Cost	114,423,000

Table 4 Probable Costs of Operation and Maintenance, Nipomo Desalination Facility

OPERATION & MAINTENANCE		PROBABLE COST ⁵
Annual Operation and Maintenance		
	Intake Pipeline Pumping Cost @ \$0.13/kWh	\$ 180,000
	Delivery Pipeline Pumping Cost @ \$0.13/kWh	630,000
	Treatment Plant O&M	6,220,000
	TOTAL Annual Operation & Maintenance	7,030,000

The total cost for project implementation was \$114,423,000, and the annualized capital cost based on 6% over 20 years was \$ 9,975,919. The total unit cost for the desalination project (estimated in 2015 dollars) was approximately \$2,699 per AFY, with the annualized capital cost at \$ 1,583 per AFY and the annual O&M cost at \$1,116 per AFY.

Additional cost factors that would need to be adjusted include electricity rates, technology advances, heat recovery and efficiency equipment, and impacts from permitting and the new SWRCB's desalination amendment to the Ocean Water Plan, for instance.

4.5 IMPLEMENTATION CHALLENGES

The implementation challenges are briefly discussed to provide a framework for consideration of seawater desalination as a water supply alternative.

- Environment Impacts
- Energy Use
- Demand Risk
- Growth Inducement
- Policy Conflicts

Chapter 10 of the 2013 California Water Plan provides detail discussion of the challenges presented with seawater desalination projects along California's coastline. California Department of Water Resources' California Desalination Planning Handbook (Appendix G) includes key findings and major recommendations to help water managers and stakeholders with a framework for developing a desalination project.

4.5.1 Environmental Impacts

The *Water Quality Control Plan for the Ocean Waters of California* (Ocean Plan) was amended by the State Water Resources Control Board in May 2015 to address the construction and operation of

⁵ Section 10 Budget and Appendix D: Opinion of Probable Cost, Technical Memorandum No. 2, Boyle 2007

seawater desalination facilities. The amendment provides protection to the coastal marine environment while setting up a consistent framework for both industry and communities.

The key provisions in the desalination amendment are requirements for intake structures and brine disposal.

4.5.1.1 Intake Structures

The intake for a desalination facility consists of a structure where source water enters into the pipeline usually by pumping to move the water. Intakes are categorized into surface or open-water intakes, which are generally located above the floor of surface body such as the ocean, and subsurface intakes, which are beneath the floor of a water body or below dry land. Subsurface intakes can include vertical wells, horizontal wells, slant wells, infiltration galleys, and so on. The source of a subsurface intake can be seawater or brackish, which depends on the location of the well either near the seawater source, a groundwater aquifer, at a seawater “wedge” or beneath an inland saline water body.

Surface or open-water intakes impact marine organisms through impingement and entrainment. Impingement occurs as organisms are pulled against filters or screens intake location. Entrainment occurs as organisms are pulled into the intake structure itself. Fish and larger organisms are affected by impingement at the screens while smaller organisms such as phytoplankton and zooplankton are affected by entrainment. The depth and location of the intake, the pumping velocity at the intake, construction of screen or filter mechanism, the type of intake structure, and other factors are critical to minimize adverse impacts to the marine environment.

The amendment requires new or expanded seawater desalination facilities use the best available technology, site, technology and mitigation measures to minimize marine life damage and mortality. The most significant provision is that a desalination project is required to use subsurface intakes unless a comparative analysis demonstrates that subsurface intakes are not feasible.

4.5.1.2 Brine Disposal

Brine is the concentrated discharge from the desalination process. Typically seawater reverse osmosis systems return half of the intake water back to the ocean at a higher salinity. Brine discharge affects brackish water operations as well. Increased salinity concentrations occur at the point of discharge, which can be operated as a solitary outfall by the desalination facility or comingled with a wastewater treatment plant or power plant outfall.

Even small changes in salinity can negatively impact marine species that are located near the outfall. Brine discharge has a higher density than the surrounding water due to the higher salinity concentrations tends to sink, adversely affecting organisms that reside on and below the floor.

Diffusers and mixing strategies can be used to reduce the salinity of the brine discharge to background levels. The standard set by the Ocean Plan amendment is a limit of two parts per thousand above natural background salinity no further than 100 meters from the discharge point. Various brine discharge technologies are identified including a preference to commingling brine discharge with wastewater and using multiport diffusers.

4.5.2 Energy Use

Energy use constitutes the largest single variable cost of a desalination facility, ranging from one-third to one-half the cost of produced water. The energy used for reverse osmosis is a direct function of the salinity and temperature of the source water. Brackish sources such as groundwater and wastewater effluent have lower salinity and require much less energy per unit of water than seawater desalination.

The energy intensity for a SWRO facility ranges between 3,300 kilowatt-hours per acre-foot (kWh/AF) to 5,900 kWh/AF⁶. In comparison, conventional water treatment is typically 50 kWh/AF to 650 kWh/AF⁷. The energy intensity for the current reverse osmosis technology is comparatively high to conventional water treatment as well as water supply alternatives such as treating wastewater (to produce recycled or reclaimed water).

California Governor's Executive Order B-29-15 (Appendix H) addresses the some of the issues with energy by pursuing a Water Energy Technology (WET) program to investigate such innovations as renewable energy-powered desalination.

4.5.3 Demand Risk

A regional desalination project would need to consider the risk of long-term demand and the types of commitments and contracts with the water purveyors. A long-term contract with take-or-pay contracts provides a guaranteed revenue for the project owner but exposes the buyer to demand risk, the condition where alternative water supplies are readily available or cheaper than desalinated water.

As a case study, Australia experienced a recent long-term drought in the past decade and developed six large-scale seawater desalination projects for major cities along the coast. In recent years, four of the facilities are now operating or will be operating in stand-by mode as reservoirs are full and the availability of lower cost alternatives exist (Cooley 2012).

As another case study, the City of Santa Barbara had placed their newly built desalination facility in stand-by after a few months of operation in 1992, following an abundant rainfall in the prior winter season. The Goleta Water District and Montecito Water District, who contracted for a portion of the emergency water supply, elected not to extend or renew their interest in the facility after the initial five year contract period. The sufficient freshwater supplies since the facility was built kept the demand for desalinated water low and resulted in the facility being put into long-term storage and remaining inactive for 22 years. New efforts have been initiated to reactivate the facility with the capital costs estimated at \$55 million and annual operating costs estimated at \$4.1 million to produce 3,125 AFY to the City of Santa Barbara.

The lesson for local water managers would be the need effectively plan for both drought and normal conditions over the entire life-cycle of a desalination project to avoid demand risk.

⁶ California Water Plan Update 2013

⁷ Embedded Energy in Water Studies Study 1: Statewide and Regional Water-Energy Relationship, Prepared by GEI Consultants/Navigant Consulting, Inc., August 31, 2010

4.5.4 Growth Inducing Impacts

The planning process requires community involvement to support projects which minimize impacts to environmental and growth inducing impact while maximizing the benefits on water supply alternatives and the reliability benefit of seawater desalination.

Seawater desalination provides a new water supply which augments the existing water supply structure for a community. While water conservation or other alternative water management strategies have the same potentially growth-inducing impact as desalination, the reliable and inexhaustible natural of ocean water significantly influences the perception about a community's ability to grow.

As part a water supply portfolio, water resource planners can include desalination to meet their community's need for both current and future water supply reliability. However, land development projects should be discussed in the context of the community planning, such as the San Luis Obispo County General Plans, in addition to water supply planning.

4.5.5 Policy Conflicts

San Luis Obispo County's Conservation and Open Space Element (COSE) of the General Plan provides a policy direction for new water supplies, including desalination:

Policy WR 1.3 New Water Supply

Development of new water supplies should focus on efficient use of our existing resources. Use of reclaimed water, interagency cooperative projects, desalination of contaminated groundwater supplies, and groundwater recharge projects should be considered prior to using imported sources of water or seawater desalination, or dams and on-stream reservoirs.

Reusing and re-purposing existing infrastructure provides the benefit of a new source of water while capturing embedded capital and operating costs. The San Luis Obispo County Regional Recycled Water Strategic Plan (2014) identified several potentially viable large (1,000+ AFY) and small (< 100 AFY) recycled water projects throughout the county. Comparing the benefits and impacts of recycled water projects with desalination projects would be appropriate in further analysis.

The County may need to re-prioritize optimization of existing infrastructure with other goals such as investing in projects that provide the highest reliability such has seawater desalination.

4.6 REFERENCES

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<https://agenda.slocounty.ca.gov/IIP/sanluisobispo/file/getfile/49174>

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APPENDIX B

GEOLOGIC SITE SCREENING EVALUATION



TECHNICAL MEMORANDUM

Identification of Potential Seawater Intake Sites – San Luis Obispo County’s Desalination Executable Solution and Logistics (DESAL) Plan

To: Lydia Holmes, Carollo Engineers, Inc.
From: Tim Nicely, PG, CHG, GSI Water Solutions, Inc.
Date: April 22, 2025
Attachments: Figures 1 through 4

Introduction

The San Luis Obispo County Flood Control and Water Conservation District (District) is kicking off the first phase of an effort to identify and implement a desalination facility to augment its potable water supplies. The District is considering developing a seawater desalination facility that would be situated at one of several possible locations along San Luis Obispo County’s approximately 90 miles of coastline. The siting of the desalination facility must include consideration of several factors that narrow the feasible locations, such as appropriate land use, location of sensitive and protective areas (e.g., National Marine Sanctuaries), siting concerns related to the coastal zone, and proximity to power and piping infrastructure.

To this end, the information summarized in this memorandum will serve as input for the siting study being prepared by Carollo Engineers, Inc. (Carollo), in compliance with U.S. Bureau of Reclamation (USBR) guidance for feasibility study preparation. This guidance is in accordance with the USBR’s Manual of Directives and Standards WTR-11-01, which was established to support the preliminary planning and feasibility study phase of desalination projects, such as the work being conducted for the District’s Desalination Executable Solution and Logistics (DESAL) Plan.

In support of identifying potential facility locations, this memorandum identifies 16 preliminary sites and is focused on geologic and hydrogeologic factors and limitations that would present fatal flaws for a potential desalination facility site. This evaluation was conducted by GSI Water Solutions, Inc. (GSI), in support of Chapter 3 of a forthcoming feasibility study being prepared by Carollo and the project consultant team.

Background of Potential Desalination Sites

Based on the District’s prior 2015 Desalination Opportunities Summary Report, it was expected that one of six locations may serve as a starting point for potential alternative desalination sites, along with up to 12 additional sites. The sites identified in this previous study included, from north to south:

- Cambria
- Estero Marine Terminal
- Morro Bay Power Plant Site
- Diablo Canyon Power Plant
- South San Luis Obispo (SLO) County Sanitation District Wastewater Treatment Plan (WWTP)
- Nipomo Mesa Refinery

Alternative Sites Evaluation

To identify additional potential sites for the desalination project, GSI reviewed geologic maps and spatial data, including aerial imagery, along San Luis Obispo County’s roughly 90-mile shoreline. The preliminary consideration that was honored for site screening was to identify locations along the coast where the geologic setting could potentially accommodate sub-seafloor extraction of seawater from mapped alluvial geologic formations of Quaternary age that are present onshore and extend offshore. Based on onshore and recent offshore geologic mapping, these potential locations may have seafloor sediments of adequate lithology and thickness to support the construction of subsurface seawater intakes to provide supply for the desalination facility. The identification of several of the most promising sites has been supplemented by prior studies, which have either considered subsurface seawater intake for desalination directly (San Simeon and Cambria) or indirectly while working on coastal hydrogeologic projects along the SLO County coastline (Morro Bay and Pismo Beach).

Future site analyses, which were beyond the scope of this memorandum, will allow for narrowing of the identified sites based on other factors such as land use, environmental protections (e.g., National Marine Sanctuaries), coastal zone regulations, and access to power and pipeline infrastructure. The final facility location, size, water production capacity, and technology will also be determined in Phase 2 of the District’s DESAL Plan.

Table 1 summarizes the attributes of the 16 potential desalination sites. The table presents the approximate width of the offshore permeable geologic materials that may be able to transmit seawater or brackish subsurface water to wells by one of a series of methods. Note that the nature, depth, and even width of these materials has not yet been confirmed. Where appropriate, the proximity of each potential desalination site to the nearest known wastewater outfall (for discharge of the reverse osmosis process rejected brine) is presented. The potential sites are presented as individual locations but are intended to refer to the general area of each site, which are mostly beaches. The Diablo Canyon Power Plant site was not considered because of the presence of unfavorable geologic materials for the seawater intake in that area.

Table 1 also provides a qualitative ranking of the sites on a scale from 1 (least favorable) to 5 (most favorable) based on GSI’s opinion of hydrogeologic feasibility. The favorable sites generally have defined and laterally extensive offshore geology that is suspected to extend to significant depths, coarse to medium-grained nearshore geologic materials, and/or known or suspected seawater intrusion issues (which may indicate potential salty water offshore in the subsurface). The least favorable sites are those having narrow beaches, steep cliffs surrounding favorable beach, and/or suspected thin or narrow offshore sediments.

Generally, the sites that are the most favorable from a hydrogeologic standpoint are near Cambria at Shamel Park, where previous studies have focused, and areas in the southern portion of the county south of Avila Beach. The northernmost sites, with the exception of the Shamel Park site, were the least geologically favorable, though may be potentially favorable pending future siting studies as warranted.

Table 1. Summary of Potential Desalination Sites

Site No. ¹	Site Name	Latitude	Longitude	Width of Offshore Target Formation ² (feet)	Nearest Community	Nearby Existing Outfall	Qualitative Geologic Feasibility
1	Piedras Blancas	35.6671	-121.27879	1,600	San Simeon	None	1
2	San Simeon – North Pier	35.6423	-121.191882	2,000	San Simeon	None	2
3	San Simeon – Little Pico Creek Bridge	35.6324	-121.163235	1,000	San Simeon	San Simeon (Small)	1
4	San Simeon – Pico Avenue	35.6131	-121.146784	1,000	San Simeon	San Simeon (Small)	2
5	San Simeon Creek	35.5948	-121.126612	1,300	San Simeon	San Simeon (Small)	3
6	Cambria Shamel Park	35.5662	-121.109376	800	Cambria	None	4
7	Cayucos Villa Creek	35.4591	-120.966834	1,320	Cayucos	Cayucos/ Estero Marine Terminal	2
8	Cayucos Pier	35.4478	-120.904393	1,300	Cayucos	Cayucos/ Estero Marine Terminal	3
9	Morro Strand North	35.4330	-120.886792	3,200	Morro Bay	Morro Bay	3
10	Morro Bay High School	35.3842	-120.863287	26,400	Morro Bay	Morro Bay	4
11	Los Osos	35.3080	-120.873572	26,400	Los Osos	None	3
12	Avila Beach – West	35.1777	-120.748996	3,200	Avila Beach	Avila Beach (Small)	3
13	Avila Beach – East	35.1784	-120.734068	4,000	Avila Beach	Avila Beach (Small)	4
14	Pismo Beach	35.1308	-120.638394	26,400	Pismo Beach	South SLO County WWTP	4
15	Oceano Dunes North	35.1046	-120.631578	26,400	Grover Beach	South SLO County WWTP	4
16	Oso Flaco	35.04814	-120.622024	26,400	Guadalupe/ Grover Beach	None	4

Notes
¹ The site numbers are organized from north to south. No ranking criteria were considered in the numbering scheme.

² Cross-sectional length of the Quaternary-age formations identified as a potential target for the construction of seawater intakes.

Potential Desalination Sites

The following section presents a brief description of each site in addition to aerial imagery from the California Coastal Records Project's website.¹ Figure 1 presents the locations of the 16 potential sites along the entire county coastline.

Figures 2 through 4 present detailed views of the sites, along with the offshore geologic units. The Quaternary-age geologic units that may be appropriate for the construction of seawater intakes as target formations are mapped in yellow as Qms, Qmc, and Qls. All other mapped geologic units represent bedrock formations. Some of these bedrock formations may be overlain by a layer of thin Quaternary deposits of less than 2 meters, but these thin deposits were not considered viable units for the purpose of this evaluation.

Site 1. Piedras Blancas

This site is located approximately 0.25 miles from Piedras Blancas Light Station, located just off Pacific Coast Highway. The Light Station is a California Coastal National Monument, which has been managed by the Bureau of Land Management (BLM) since 2001 as a historic park and wildlife sanctuary. In addition to remaining a fully operational light station, Piedras Blancas is a research site for the National Oceanic and Atmospheric Administration, U.S. Geological Survey, the U.S. Fish and Wildlife Service, and University of California researchers.



Picture 1. Piedras Blancas Site

The surrounding area consists of a rugged coastline with an estimated offshore alluvium width of approximately 1,600 feet, which may support subsurface intake.

The site is not located near a known existing outfall.

¹ The California Coastal Records Project, an aerial photographic survey of the California Coastline, is available at www.californiacoastline.org

Site 2. San Simeon – North Pier

The San Simeon – North Pier site is located along Arroyo del Puerto Beach, adjacent to Highway 1 and near the William Randolph Hearst Memorial Beach Pier, approximately 0.15 miles from San Simeon's town center.

The site is not within proximity of an existing outfall.

The area consists of marine sediments and alluvial fan deposits from nearby rivers and streams, creating an offshore alluvium extent of approximately 2,000 feet. The site is accessible via San Simeon Road, adjacent to Highway 1.



Picture 2. San Simeon – North Pier Site

Site 3. San Simeon – Little Pico Creek Bridge

This site is named for the nearby Little Pico Creek Bridge, and the beach is approximately 1.6 miles from the San Simeon town center. The extent of the alluvium offshore is approximately 1,000 feet, which is formed by sediment washout from nearby Little Pico Creek. The site has footpath access onto the sand off of Highway 1.

The site is proximal to an existing outfall at San Simeon.



Picture 3. San Simeon - Little Pico Creek Bridge Site

Site 4. San Simeon – Pico Avenue

This site is located adjacent to approximately 1,000 feet of alluvial deposits offshore. The site is nearly directly in front of San Simeon's city center, which allows for direct access from Highway 1 and has several access options, most prominently from Pico Creek Beach located on Pico Avenue.

The site is proximal to an existing outfall at San Simeon.



Picture 4. San Simeon - Pico Avenue Site

Site 5. San Simeon Creek

This site is located near the confluence of San Simeon Creek and Van Gordon Creek, with approximately 1,300 feet of alluvial deposits. It lies downstream of the San Simeon Creek Campground and about 2 miles south of San Simeon's city center. The site is accessible primarily via Highway 1 and is situated within Hearst San Simeon State Park.

The site is proximal to an existing outfall at San Simeon.



Picture 5. San Simeon Creek Site

Site 6. Cambria – Shamel Park

Approximately 800 feet of alluvial deposits from Santa Rosa Creek are present at Shamel Park in Cambria. The site is roughly 1.5 miles from the Cambria city center and at is south of Moonstone Beach. Primary road access is from Windsor Boulevard, which can be reached easily from Highway 1.

The site is proximal to an existing outfall in Cambria.



Picture 6. Cambria - Shamel Park Site

Site 7. Cayucos – Villa Creek

This site, located near Swallow Creek Ranch and Estero Bay in Cayucos, has an alluvium extent of approximately 1,300 feet wide. The site is about 5 miles northwest of Cayucos city center. The beach is at the base of Ellyslly and Villa Creek, with access from Highway 1.

The site is proximal to an existing outfall at Cayucos/ Estero Marine Terminal.



Picture 7. Villa Creek Site

Site 8. Cayucos – Pier

This site is located at the Cayucos Pier and contains approximately a 1,300-foot width of alluvial deposits. It is situated near the delta of Cayucos Creek and Little Cayucos Creek, within Cayucos State Beach. The site is just off Cayucos's city center and is accessible via Cayucos Drive, D Street, E Street, and Ocean Front Lane.

The site is proximal to an existing outfall at Cayucos / Estero Marine Terminal.



Picture 8. Cayucos Pier Site

Site 9. Morro Strand North

The Morro Strand North site contains an approximately 3,200 feet width of alluvial deposits, potentially suitable for subsurface intake. It is located about 4.7 miles from Morro Bay's city center, near Sand Dollar Beach, and can be accessed via Studio Drive, which connects directly to Highway 1.

The site is proximal to an existing outfall in Morro Bay.

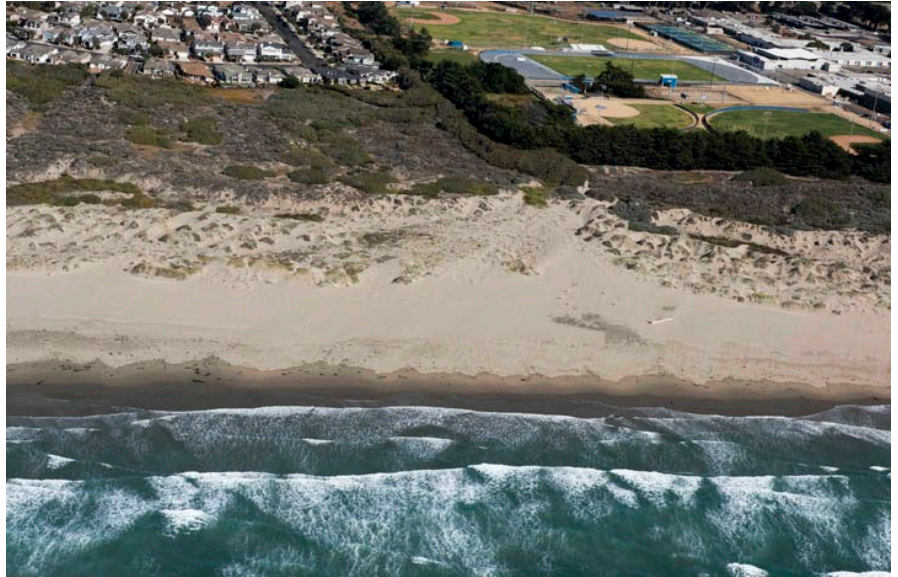


Picture 9. Morro Strand North Site

Site 10. Morro Bay High School

This site features a substantial 26,400 feet width of alluvial deposits that may provide a stable intake zone for desalination. The site is along the beach adjacent to Morro Bay High School's baseball and softball fields, roughly 1 mile from the Morro Bay city center. The closest roadway access is from Atascadero Drive.

The site is proximal to an existing outfall in Morro Bay.



Picture 10. Morro Bay High School Site

Site 11. Los Osos

The Los Osos site is characterized by a 26,400-foot width of alluvial deposits that could support a subsurface intake system near Sandspit Beach which is approximately 0.26 miles from the Los Osos city center. Road access is limited but, can be accessed through Sand Spit Road.

The site is not within proximity of an existing outfall.



Picture 11. Los Osos Site

Site 12. Avila West

This site contains a 3,200-foot width of alluvium, along Olde Port Beach between Cal Poly Pier and Harford Pier. The site can be accessed via Avila Beach Dr and the site is about 1 mile from Avila Beach’s city center.

The site is proximal to a small existing outfall in Avila Beach.

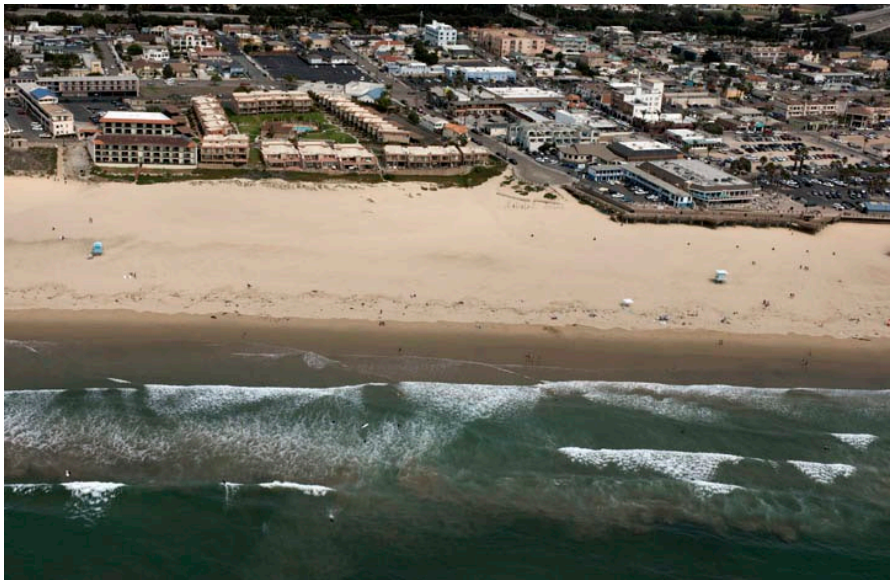


Picture 12. Avila West Site

Site 13. Avila East

This site has an approximately 4,000-foot width of alluvium, which extends offshore, and benefits from an urban beach setting as it sits at the base of Avila city center. It is also located at the base of Avila Beach Pier. The beach can be easily accessed from Front Street.

The site is proximal to a small existing outfall in Avila Beach.

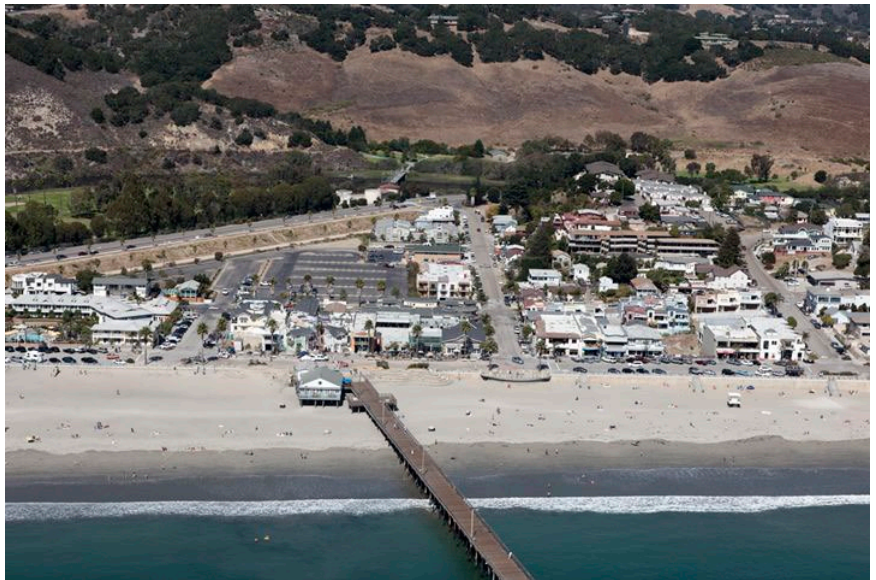


Picture 13. Avila East Site

Site 14. Pismo

This site features 26,400-foot width of alluvium, offering an extensive area for subsurface intake. The site is approximately 1 mile from Pismo Beach’s city center and is located on a section of coastline which is at the base of the Pismo State Beach campgrounds and an RV resort. This can be accessed off of Seashell Drive, or through the Beach Foot Trail.

The site is approximately 2 miles north of the South SLO County WWTP outfall.



Picture 14. Pismo Site

Site 15. Oceano Dunes North

This site is located within a 26,400 feet width of alluvial deposits and is about 2 miles from Grover Beach’s city center. The site can be accessed via Pier Avenue and Strand Way which parallels Oceano Campground within Pismo State Beach. The beach is parallel to a residential neighborhood.

The site is near the South SLO County WWTP outfall.



Picture 15. Oceano Dunes North Site

Site 16. Oso Flaco

The Oso Flaco site features a 26,400-foot width of alluvial deposits that could support a subsurface intake system. The site is about 3.52 miles away from Oceano and 6.10 miles from Guadalupe, along a strip of undeveloped coastline just north of the Guadalupe-Nipomo Dunes National Park. The site lacks clear road access, with the closest road being Highway 1, which is approximately 1.6 miles east, but may have a closer access point near Oso Flaco Lake, which is nearby.

The site is not located near an existing outfall.



Picture 16. Oso Flaco Site



LEGEND

- Potential Well Site
- City Boundary
- County Boundary
-  Major Road
-  Watercourse
-  Waterbody

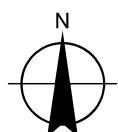
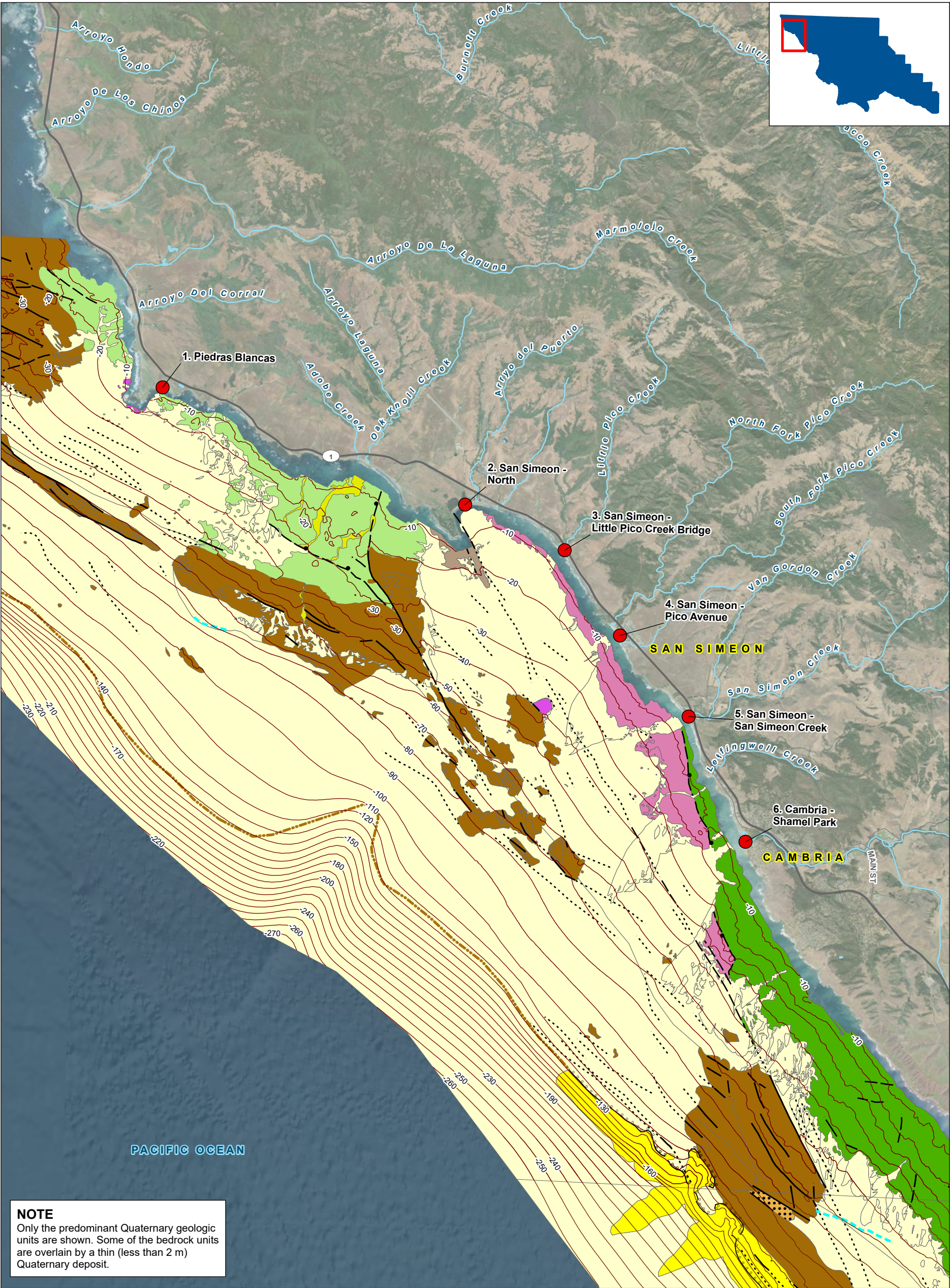


FIGURE 1
DESAL Potential Well Sites
DESAL Plan
San Luis Obispo County, CA





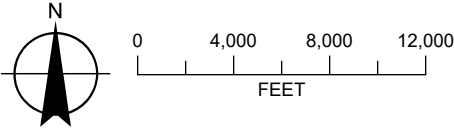
NOTE
Only the predominant Quaternary geologic units are shown. Some of the bedrock units are overlain by a thin (less than 2 m) Quaternary deposit.

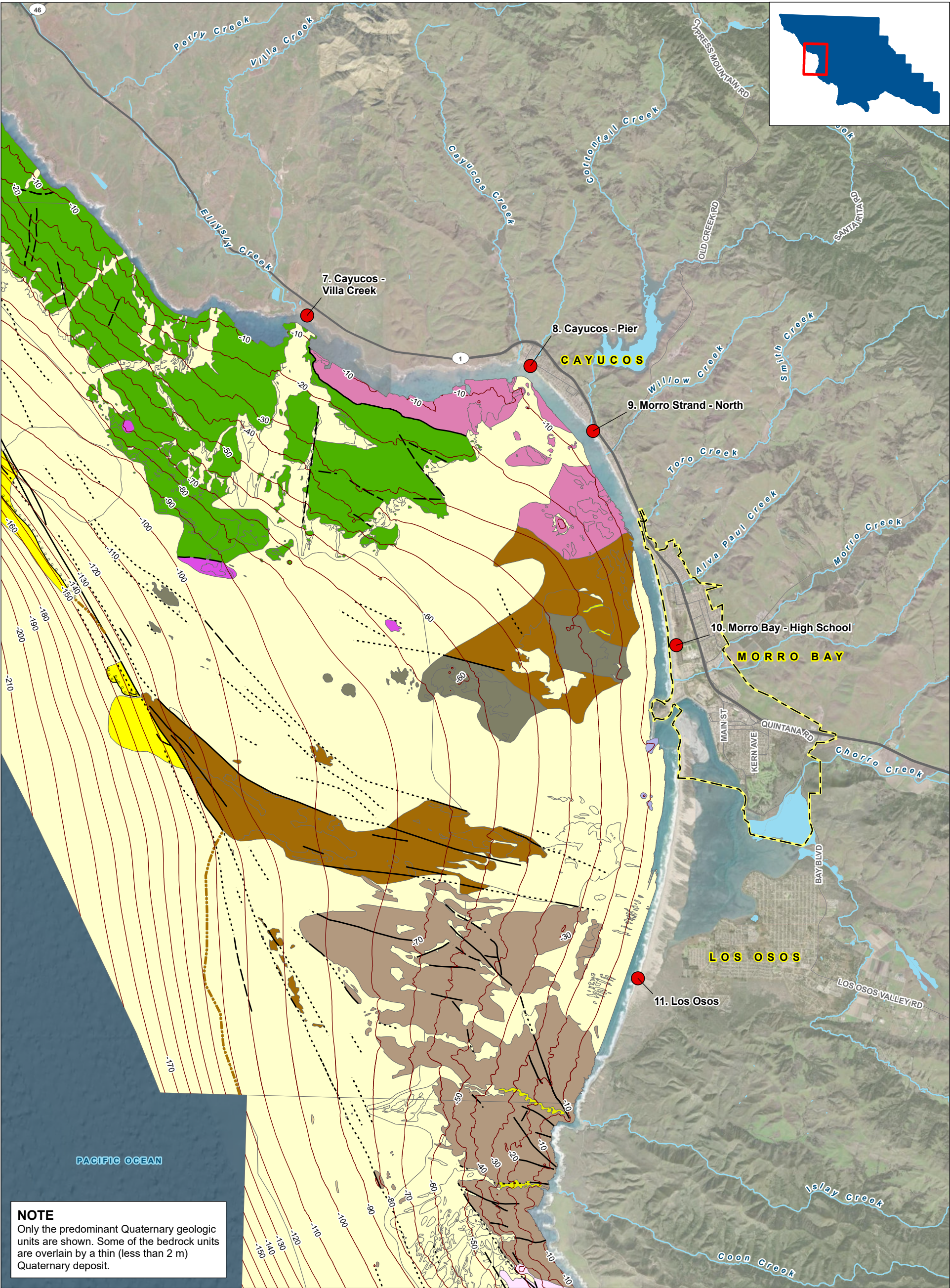
LEGEND

- | | | | |
|---|--|--|--|
| <ul style="list-style-type: none">Potential Well SiteContour (10 ft) | Geology <ul style="list-style-type: none">FaultSlope BreakSubmarine LandslideScarpShelf Break | Quaternary Geologic Unit (Potential Water Source) <ul style="list-style-type: none">QmsQmcQls | Bedrock Unit <ul style="list-style-type: none">TusTmKslKJugKjfJo |
|---|--|--|--|
- All Other Features**
- Waterbody
 - Watercourse
 - Major Road

Date: March 24, 2025
Data Sources: ESRI, USGS (2015, Offshore geology and geomorphology from Point Piedras Blancas to Pismo Beach, San Luis Obispo County, California)

FIGURE 2
Northern San Luis Obispo County
Offshore Geologic Map
DESAL Plan
San Luis Obispo County, CA





NOTE
Only the predominant Quaternary geologic units are shown. Some of the bedrock units are overlain by a thin (less than 2 m) Quaternary deposit.

LEGEND

- Potential Well Site
- Contour (10 ft)
- All Other Features**
- City Boundary
- Major Road
- Watercourse
- Waterbody

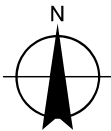
- Geology**
- Fault
- Slope Break
- Submarine Landslide
- Scarp
- Shelf Break

- Quaternary Geologic Unit (Potential Water Source)**
- Qms
- Qmc
- Qls
- Qmp?

- Bedrock Unit**
- Tus
- Tm
- TKu
- Ksl
- Kjf
- Jo
- af

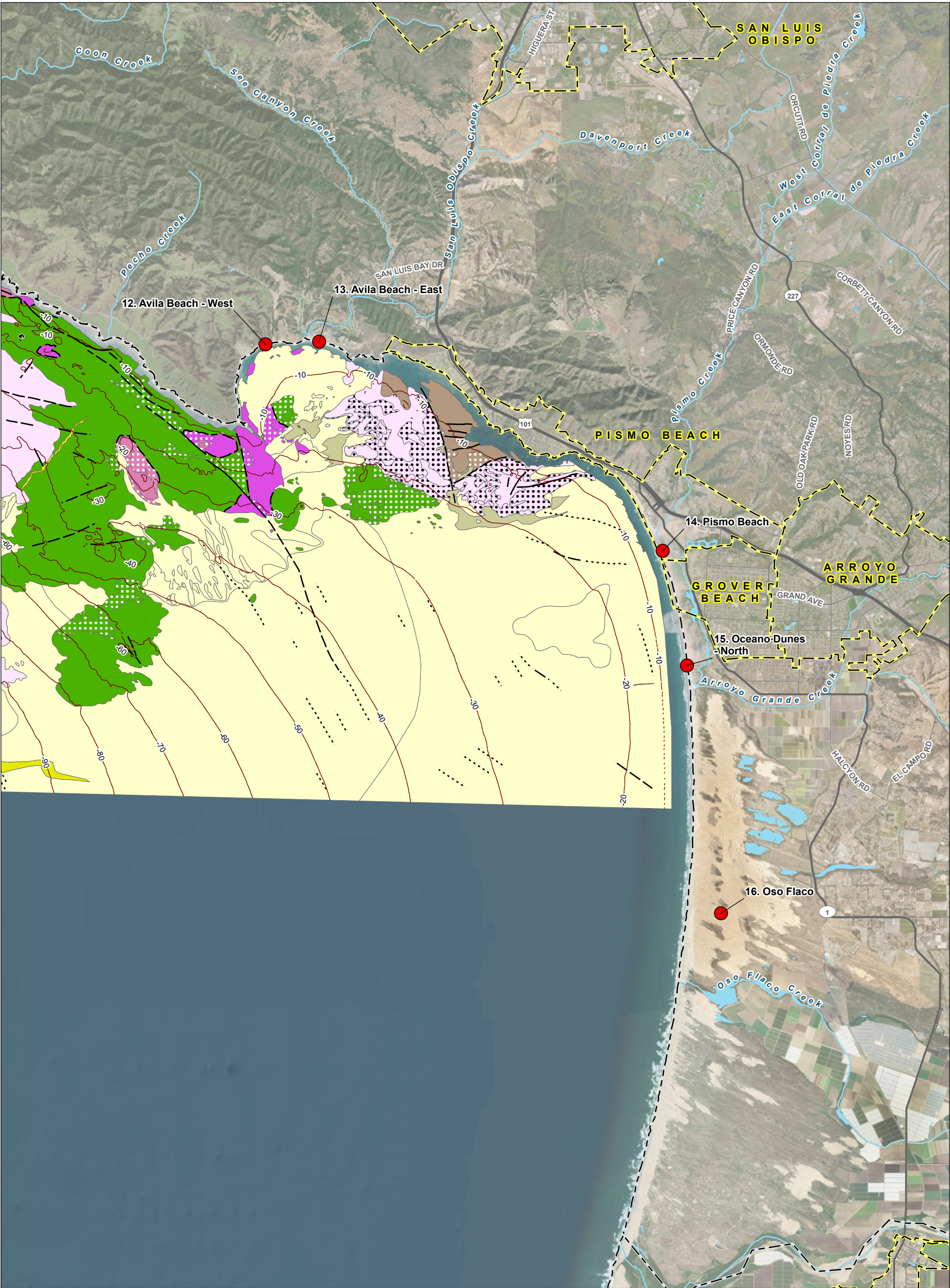
Date: March 24, 2025
Data Sources: ESRI, USGS (2015, Offshore geology and geomorphology from Point Piedras Blancas to Pismo Beach, San Luis Obispo County, California)

FIGURE 3
Central San Luis Obispo County Offshore Geologic Map
DEASL Plan
San Luis Obispo County, CA



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FEET





LEGEND

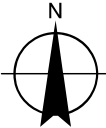
- Potential Well Site
- Contour (10 ft)
- Geology**
- Fault
- Slope Break
- Submarine Landslide Scarp
- Shelf Break
- Date: March 21, 2025
- Data Sources: ESRI, USGS

- Geologic Unit**
- Qms
- Qmc
- Qmr
- Qms/Tm
- Tm
- Qms/To
- To

- Qms/Kslc
- Ksl
- Qms/Kjf
- Kjf
- Qms/Jo
- Jo
- af

- All Other Features**
- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

FIGURE 4
Southern San Luis Obispo County
Offshore Geologic Map
San Luis Obispo County, CA



0 4,000 8,000 12,000
FEET



APPENDIX C

SITE SCREENING EVALUATION PROJECT MEMORANDUM

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT Desalination Executable Solution and Logistics (DESAL) Plan Feasibility Study

Project No.: 203820
Date: August 15, 2025
Prepared By: Anthony Cemo
Reviewed By: Lydia Holmes
Subject: Site Screening Evaluation

Purpose

The San Luis Obispo County Flood Control and Water Conservation District (District) is currently exploring opportunities for the development of a seawater desalination facility in San Luis Obispo County. The County is currently in Phase 2 of a 5-Phase effort of the Desalination Executable Solutions and Logistics (DESAL Plan). Phase 2 – Planning Phase focuses on preparing a comprehensive Feasibility Study to evaluate and compare desalination project alternatives.

The purpose of this memo is to present the site evaluation criteria used to select preferable sites for inclusion in developed project alternatives for the DESAL Plan, focusing primarily on intake and outfall sites as specific sites for treatment have not yet been identified. Additionally, the recommended sites that will be further evaluated and incorporated into Project Alternatives will be presented. Note project alternatives are defined as a site with an associated desalinated water production volume and supporting infrastructure to serve individual users as needed. This project memo is only evaluating potential sites for consideration and not presenting demand user demand criteria, desalination production volume, or specific infrastructure alignments for specific users.

Site Screening Criteria

The site screening criteria is meant to screen individual project sites from different perspectives to ultimately rank the individual sites with respect to one another. Each site screening criteria had a 1 to 5 level scoring system with one (1) being a low score, three (3) moderate, and five (5) high. For some of the criteria a fatal flaw score was assigned, which was equivalent to zero. Table 1 lists the site screening criteria used in this analysis and key considerations associated with each criterion. Power supply was also considered as one of the site screening criteria, however given the anticipated size of a future desalination facility, the regional impact to existing power supply was equivalent across all potential sites. Table 2 lists the screening criteria scoring definitions.

Table 1 Site Screening Criteria

Screening Criteria	Key Considerations
Intake Location	■ Presence of an existing Intake ■ Hydrogeology/suitability for a subsurface intake (e.g. suitable soils for a permissible intake, bathymetry, seabed condition).
Outfall	■ Presence of an existing outfall ■ Capacity of existing outfall ■ Availability of blending water (i.e. treated wastewater effluent) ■ Need for a new outfall
Aquatic Environmental Impacts	■ Marine biology ■ Biological habitat of protected species existing and potential.
Land Impacts (Environmental, Social and Technical)	■ Biological habitat ■ Cultural resources ■ Environmental protected areas (e.g. State Parks, protected lands) ■ SLR, flooding impacts, coastal erosion.
Conveyance Infrastructure for intake & outfall only	■ Distance to connect to regional infrastructure ■ Ability to reach end users with existing regional conveyance ■ Distance for intake/outfall infrastructure.

Table 2 Site Screening Criteria Scoring

Screening Criteria	High Score (5)	Medium Score (3)	Low Score (1)	Fatal Flaw (0)
Intake Location	Existing useable Intake or negligible impacts for a new intake	Suitable for a new subsurface Intake or minimal intake impacts	Unlikely Suitable for a subsurface intake	Not suitable geology for permissible intake.
Outfall	Existing outfall present with sufficient capacity and blending water available.	Existing outfall with moderate blending water availability or moderate capacity.	New outfall required due to lack of outfall or existing outfall having very limited blending water availability.	Not Applicable
Aquatic Environmental Impacts	Minimal Impacts	Moderate Impacts	High Impacts	Not permissible nor mitigatable (multiple significant adverse impacts per CEQA/NEPA)
Land Impacts (Environmental, Social and Technical)	Minimal Impacts (previously disturbed site, brownfield,)	Moderate Impacts (Green or brownfield site, but low impacts to surrounding land)	High Impacts (Greenfield, protected land), known protected species that could be impacted by intake/outfall construction	Not permissible nor mitigatable (multiple significant adverse impacts per CEQA/NEPA)
Conveyance Infrastructure (total distance of infrastructure)	<5 miles of new infrastructure needed in total.	6 to 12 miles of new infrastructure needed in total.	>12 miles of new infrastructure needed in total.	Not Applicable

Evaluated Sites

A total of 22 sites were included in the site screening analysis. Per the California Ocean Plan requirements as well as the California Seawater Desalination Interagency Group Seawater Desalination Siting and Streamlining Report to Expedite Permitting, the most permissible project that falls within the current standards must include a subsurface intake. Subsurface intakes are belowground seawater wells that extract saltwater through the seafloor to a treatment facility. They limit mortality rates of all forms of marine life and thus, are the only intake types that are more likely to be streamlined. The project hydrogeologist selected 16 sites that had preferable subsurface hydrogeology from publicly available geologic surveys from the United State Geologic Survey (USGS). These sites are shown in Figure 1 with the preferable geologic limits also shown. Note in Figure 1, geologic conditions that are not suitable for a subsurface intake are shown in the dark gray polygons. Furthermore, as a result of the 2015 Desalination Opportunities Report (2015 Report) completed by the District, the recommended six sites to be further evaluated were also included in this site screening analysis. These 6 sites are shown in Figure 2.

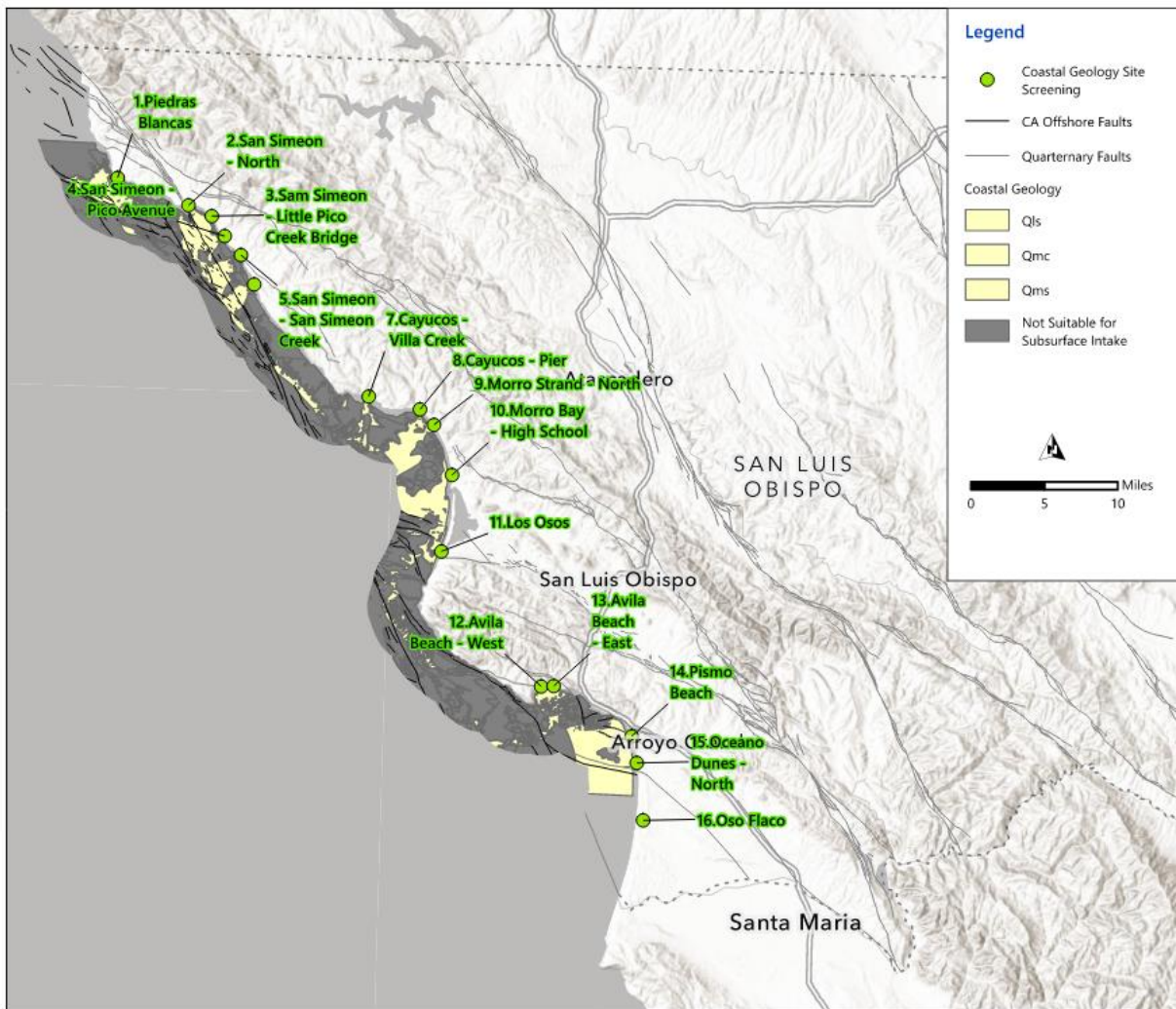


Figure 1 Sites with Preferred Geologic Conditions for a Subsurface Intake

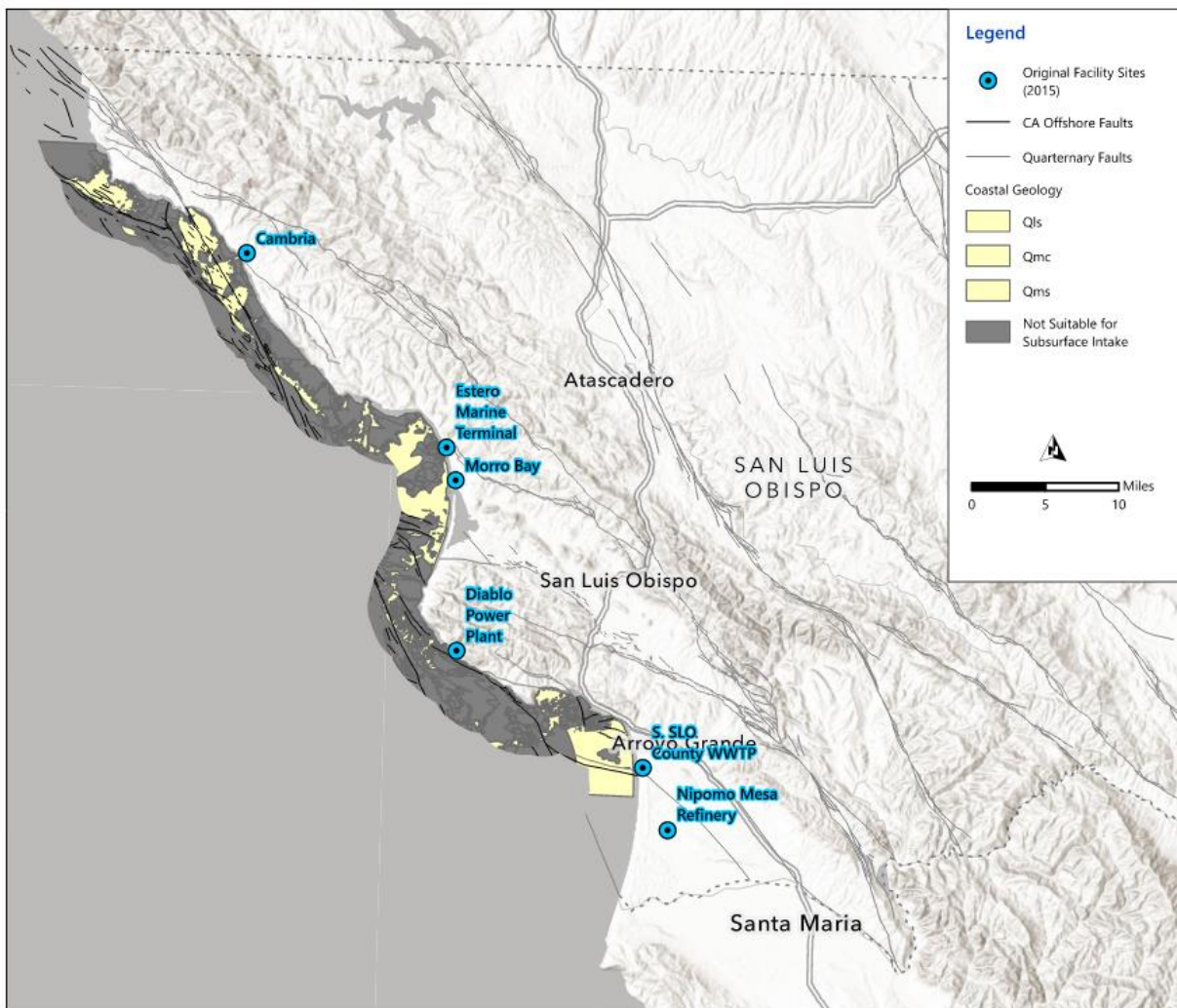


Figure 2 Sites Recommended for further evaluation from 2015 Desalination Opportunities Report.

Results of Evaluation

The District and consultant team met on June 2nd to attend a siting workshop which included a presentation by the consultant team and their subconsultants on the individual screening criteria. The presentation included a description of the screening criteria and specific parameters that should be taken into consideration in the siting analysis as the project site selection and alternative development progresses.

Given the number of sites identified by the Project hydrogeologist, to limit the number of sites evaluated in the screening analysis, the sites shown in Figures 1 and 2 were consolidated through a rough screening analysis. For example, the Geologic Sites 1 through 6 were all within 2 miles of each other and the Cambria site from the 2015 Report is also in that region. All of these sites exhibit very similar constraints therefore will nearly present the same screening results. As a result, the Project team and the District selected a single site to represent the general geography of that region of the County; the Cambria site

from the 2015 Report. This exercise was performed for the following site groupings shown in Figure 1 and the 2015 Report Sites shown in Figure 2.

- Sites 1 through 6 and Cambria → Cambria.
- Sites 7 through 9 and Estero Marine Terminal → Site 9.
- Site 10 and Morro Bay → Morro Bay.
- Sites 14 and 15 → Site 14.
- Site 15, 16 and Nipomo Mesa Refinery → Nipomo Mesa Refinery.

With these site groupings consolidated, the list of sites to be included in the screening analysis are listed below from North to South along the County coast. Figure 3 shows all of the sites spatially.

- Cambria.
- Site 9 – Morro Strand North.
- Estero Marine Terminal.
- Site 11 – Los Osos.
- Diablo Power Plant.
- Site 13 – Avila Beach East.
- Site 14 – Pismo Beach.
- South SLO County Wastewater Treatment Plant (WWTP).
- Nipomo Mesa Refinery.

The screening criteria scoring (Table 2) was applied to each of the nine sites. The results of the scoring for each site is shown in Table 3 and Figure 4. The nine geographic sites were selected with the intention of looking at some of the sites under different conditions. For example, Cambria, Diablo, and Avila were considered twice with the scenario that a new outfall would be included since an existing outfall in all three of those locations had either very low capacity or was not in a permissible condition per Ocean Plan requirements.

Following Table 3 and Figure 4 are additional details regarding each site relevant to how they were scored.

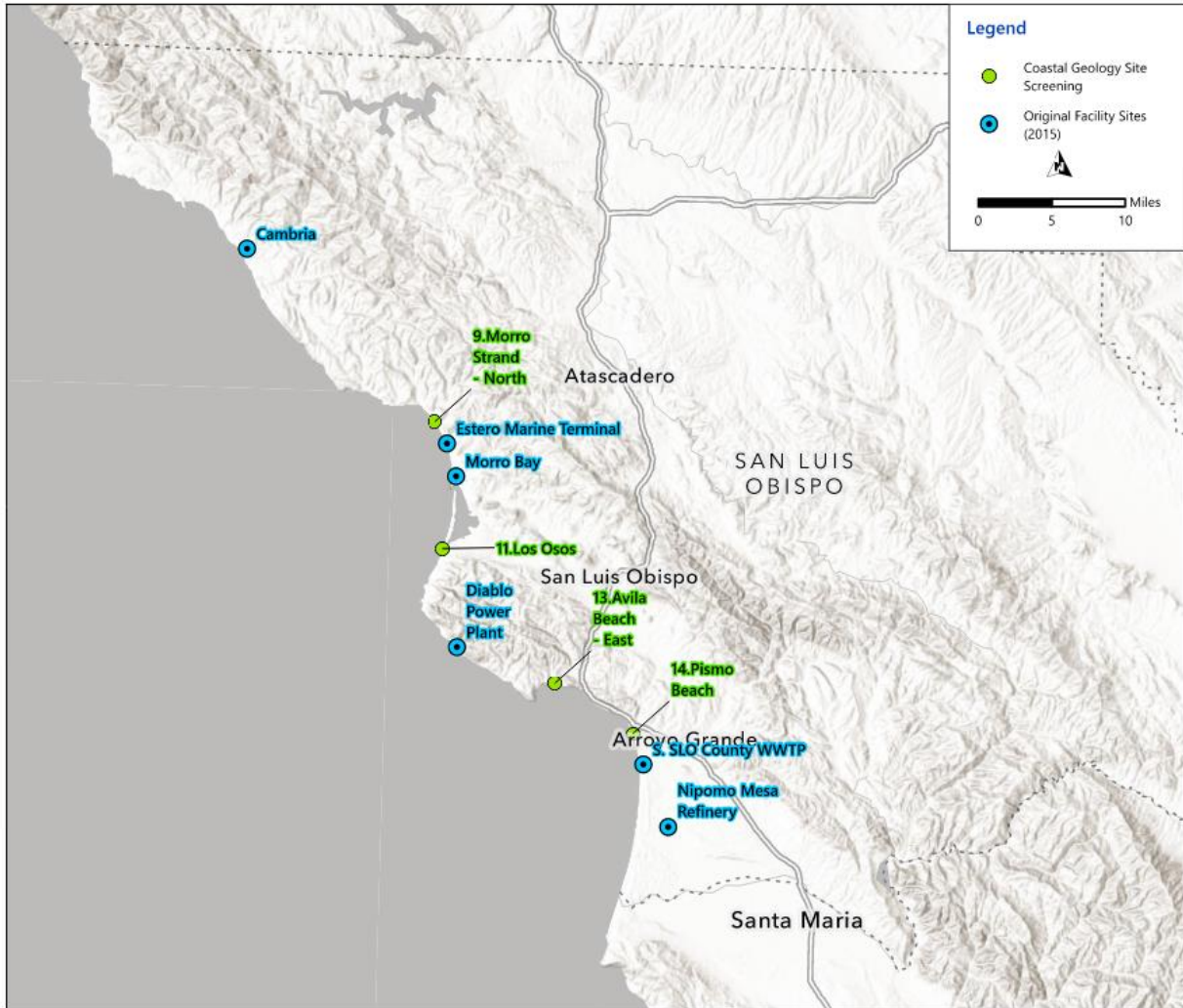


Figure 3 Recommended Consolidated Sites Included in the Screening Analysis

Table 3 Site Screening Scoring Results

Site Description	Intake Suitability	Outfall Location	Aquatic Impacts	Land Impacts	Conveyance Distance	Point to nearest Regional Connection	Total Required Infrastructure, miles	Total Score
Cambria (existing outfall)	5	1	1	3	1	Morro Bay	27.0	11
Cambria (new outfall)	5	1	1	3	1	Morro Bay	25.6	11
Morro Strand North/Estero Outfall	5	3	5	1	3	Morro Bay	7.0	17
Estero Marine Terminal	1	3	5	3	5	Morro Bay	3.7	17
Morro Bay	5	5	5	3	5	Morro Bay	1.5	23
Los Osos	5	3	5	1	1	Morro Bay	14.5	15
Diablo Canyon (existing intake & outfall)	5	5	0	3	1	Lopez Intersection	15.5	14
Diablo Canyon (new intake and new outfall)	0	1	3	3	1	Lopez Intersection	15.5	8
Avila (existing outfall)	4	1	5	3	3	Pismo (using existing pipelines)	6.2	16
Avila (new outfall)	4	1	3	3	3	SLO	10.8	14
Pismo Beach	5	5	4	1	3	Lopez Intersection	5.4	18
South SLO County WWTP	5	5	4	1	5	Lopez Intersection	3.4	20
Nipomo Mesa Refinery	5	3	4	1	3	Lopez Intersection	6.8	16

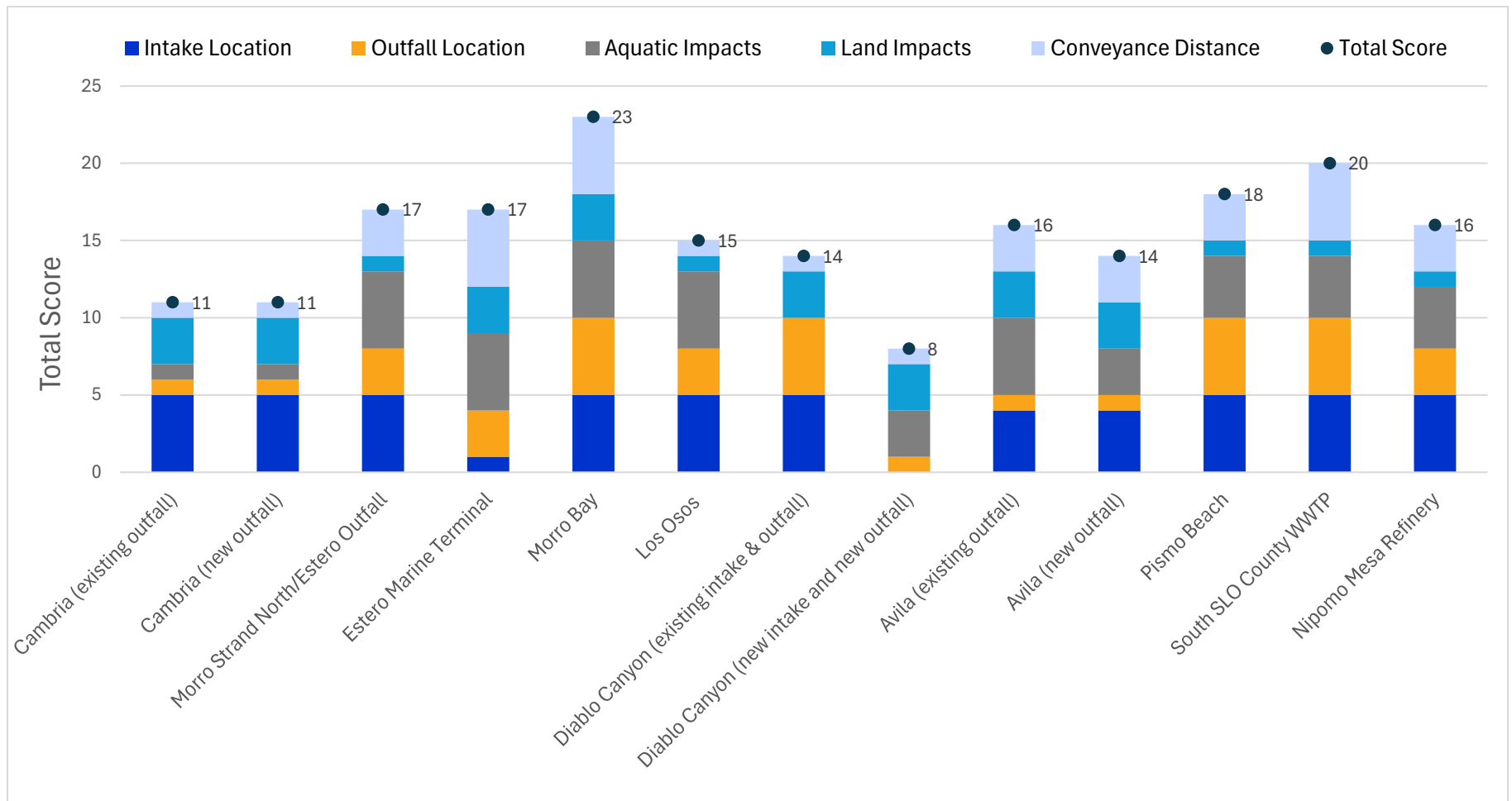


Figure 4 Site Screening Scoring Comparison

Cambria (existing outfall)

The Cambria site is located near the existing Cambria Community Services District (CCSD) water reclamation facility, just off of San Simeon Creek Road. Figure 1 shows that the existing geologic conditions are suitable for a subsurface seawater intake in narrow regions near riverine confluences with the ocean. The nearest existing ocean outfall is the San Simeon Community Services District (SSCSD) WWTP ocean outfall located approximately 1.5 miles North of the Cambria Site. The existing SSCSD outfall has an estimated total capacity of 0.2 mgd and currently experiences about 0.07 mgd average daily flow from SSCSD. This outfall has limited capacity and is known to be old. The coastal region of this site is within both a National Marine Sanctuary (NMS) and a State Marine Conservation Area (SMCA). Land impacts are not out of the ordinary being that a potential site would be near or share property with the CCSD water reclamation facility. Last, the conveyance infrastructure for this site is the furthest distance to all the sites considered due to being approximately 25 miles away from the nearest regional infrastructure point at Morro Bay.

Cambria (new outfall)

This site is the same as the existing outfall configuration described directly above, however the only difference is that this site configuration would install a brand new outfall given the existing SSCSD outfall has such a limited available capacity. Additionally, the existing SSCSD outfall is very old and could potentially require repairs and upgrades if utilized for a desalination project.

Morro Strand North Intake/Estero Outfall

The Morro Strand Site is located at the southern border of the community of Cayucos. This site has coastal geology suitable site for a subsurface seawater intake. Given the existing Estero Marine Terminal (EMT) outfall is less than 2 miles away, it was assumed that this site would use the existing EMT outfall for any potential projects. The EMT outfall has an estimated total design capacity of 1.2 mgd and experiences an average daily flow of about 0.24 mgd of treated wastewater effluent from the Cayucos Water Resources Recovery Facility (WRRF). This outfall was recently upgraded for the WRRF project and could have some available capacity for a small desalination facility. Note a new outfall was not considered in this location. There are no known designated protected aquatic habitats in the area nor protected coastal zones for marine species. The land impacts scored low due to the presence of the of the sandy beach tiger beetle (protected species) and is near or within an estuarine and marine wetland area. to moderate with the site being surrounded primarily by developed residential land use. Lastly, the site is much closer to regional infrastructure therefore making the conveyance requirements much less.

Estero Marine Terminal

The EMT site is located approximately 2 miles south of Cayucos and 0.5 miles north of Morro Bay. The EMT site is a decommissioned oil site refinery site that was used to unload crude oil from tankers to onshore facilities. The existing oil transmission pipeline was refurbished and currently serves as the Cayucos WRRF treated effluent discharge ocean outfall. As mentioned this outfall has a capacity of 1.2 mgd and discharges on average 0.24 mgd of treated effluent. This site does not have suitable offshore geology for a subsurface intake. With this site being a brownfield site (former oil terminal), this site offers relatively low impact to surrounding land. There are no known designated protected aquatic habitats in the area or protected coastal zones for marine species. Lastly, being closer to the City of Morro Bay and

having an existing outfall of moderate capacity, the required amount of conveyance infrastructure is reduced to less than 5 miles.

Morro Bay

The Morro Bay Site is assumed to be located directly off of Atascadero Road near the existing Morro Bay WWTP location, High School, or an alternative more inland location. The City of Morro Bay once had an existing desalination facility to be used for emergencies, however it has since been decommissioned. This area has suitable hydrogeology for subsurface intake for the greater part of the City. The City's existing ocean outfall has a design capacity of approximately 8.1 mgd, and discharges on average 0.84 mgd of treated wastewater effluent. There are no known designated protected aquatic habitats in the area or protected coastal zones for marine species. The land impacts would be relatively minor since most of proposed areas at this site are already developed. Being at Morro Bay, this allows for minimal amount of conveyance infrastructure needed to a regional partner connection points. It should be noted that the City of Morro Bay was recently required by Coastal Commission to move their existing WWTP to an inland location to avoid future coastal hazards. A new desalination facility will need to consider flood and tsunami hazards in any future siting evaluations.

Los Osos

The Los Osos site is located directly 1 mile west of the Los Osos. This site was selected primarily for having suitable geology for an offshore subsurface intake. The Los Osos site has no ocean outfall, however it is assumed it would use the existing Morro Bay outfall for any alternative development. There are no known designated protected aquatic habitats in the area or protected coastal zones for marine species. However the land impacts for this site are high given that the site sits on a known sensitive resource area and is within the Montaña De Oro State Park boundary. Given that this site is assuming that the Morro Bay Outfall would be used as well as being somewhat remote from any developed areas, a high amount of conveyance infrastructure is required for any site development.

Diablo Canyon Power Plant (existing intake and outfall)

The Diablo Canyon Power Plant (DCPP) is located approximately 7 miles directly south of Los Osos and similar the same distance directly north of Avila Beach. The DCPP has an existing open ocean intake and outfall that is used specifically for the plant's cooling systems. The cooling system intakes a tremendous amount of water and the outfall has a capacity of approximately 2,760 mgd. Any operation of a desalination facility would require that the DCPP remains in operation to dilute reverse osmosis concentrate with the cooling water. Decommissioning of the DCPP would require a new ocean intake and outfall (see following site configuration). Use of the plant's existing open intake would have significant aquatic impact per the Ocean Plan and the existing land impacts would be moderate given that the site is an existing site, however the DCPP site is on County known sensitive archaeological resources. Lastly, being so remote, this site would require extensive infrastructure to serve any users or reach any regional connectivity. Per Ocean Plan requirements and based on permitting requirements for the Carlsbad Desalination Project, it is considered highly unlikely that permits would be obtainable using the existing intake and outfall.

Diablo Canyon Power Plant (new intake and outfall)

This site is the same as the existing intake and outfall configuration described directly above, however it includes the development of a new intake and outfall at DCP. This site configuration assumes that the existing DCP will be decommissioned, and the existing intake and outfall would not be permitted for use. The coastal geology near the DCP is not suitable for a subsurface intake, consisting mostly of rocky outcrops. These rocky outcrops and reefs are also suitable aquatic habitats therefore new above surface intakes and outfalls could potentially have a significant impact on aquatic species. With unsuitable hydrogeology a surface intake would be required, which is not preferable and unlikely permissible per Ocean Plan requirements. With the existing DCP assumed to be decommissioned, the presence of cooling water for the power plant would no longer be available therefore the lack of dilution water would make outfall permitting more challenging. The land impacts and conveyance infrastructure remain the same as the existing intake and outfall site configuration.

Avila (existing outfall)

The Avila site is located at the community of Avila Beach directly 7 miles south of DCP and directly North of Pismo Beach. The Avila site has suitable coastal geology for a subsurface intake, however it is known that existing soil and groundwater has been contaminated from leaking crude oil and fuel. Specific locations of these hazards are unknown with respect to a future site at Avila Beach. The existing Avila Beach ocean outfall is relatively small with a design capacity of approximately 0.5 mgd and discharges on average 0.055 mgd from the Avila Beach WWTP. There are no known designated protected aquatic habitats in the area that would be severely impacted from this project, especially if the existing ocean outfall is used, and the recently established Chumash National Marine Sanctuary boundary does not fall within any anticipated development area of a future desalination facility. The regional conveyance infrastructure needed would connect south of Pismo Beach at the Lopez pipeline and would require a moderate amount of conveyance pipelines to reach a regional connection point.

Avila (new outfall)

This site is the same as the Avila site using its existing outfall, however a new outfall would be developed to allow for a larger outfall capacity. A new outfall would require significant more permitting per ocean plan requirements, but would allow for a larger treatment facility to be at this site. However, this new outfall would not have significant diluent water (wastewater discharges) available making permitting more challenging. This site configuration still has the same aquatic and land impacts and the required amount of conveyance infrastructure required to reach a regional connection point. Additionally, having a new outfall could cause more of an aquatic habitat impact than using an existing outfall, therefore, this criteria scored lower than the existing outfall site at Avila.

Pismo Beach

The Pismo Beach site is located approximately at the southern end of the City of Pismo Beach and directly north of the City of Grover Beach. This site was selected due to having suitable offshore geology for a subsurface intake. This site would use the existing ocean outfall at the South SLO County WWTP, however if desired, this site could also be suitable for a new ocean outfall for a desalination project. For now, it is assumed the existing ocean outfall would be used and no outfall capacity increase will be needed. There are no known designated protected aquatic habitats in the area, however this site falls within the recently

established Chumash National Marine Sanctuary. Furthermore, this site would most likely be developed on an area that is either a brownfield or near existing developed land. Pismo State Beach has known protected species (snowy plover and legless lizard) that could be disturbed during intake construction, so land impacts were given a lower score. Given that the existing South SLO County WWTP outfall would be used, a moderate amount of conveyance infrastructure would be required to reach that discharge point in addition to regional transmission pipeline to a regional connection point along the Lopez pipeline.

South SLO County WWTP

The South S. SLO County WWTP has suitable coastal geology offshore for a subsurface intake, similar to the Pismo site and most other south county sites. This site has an existing, active ocean outfall that is used to discharge treated effluent from the WWTP. The capacity of the outfall is approximately 8.4 mgd and an average of 2.30 mgd is discharged by the facility. It is assumed that the existing ocean outfall would be used and no capacity increases would be necessary. Similar to the Pismo Site, there are no known designated protected aquatic habits in the area, however this site falls within the recently established Chumash National Marine Sanctuary. Additionally, there are known protected species (monarch butterfly, red-legged frog and a brackishwater snail) that could be disturbed during construction of an intake, so land impacts were given a lower score. Any future evaluation of this site will need to consider the flood plain limits and/or locate the facility more inland from the WWTP. This site is the closest to a strategic regional water distribution connection point along the Lopez pipeline or the State Water Project Coastal Branch pipeline.

Nipomo Mesa Refinery

The Nipomo Mesa Refinery Site is located approximately 4 miles south of the City of Oceano. The Nipomo Mesa Refinery is a brownfield site once a former oil refinery that is no longer in use. Similar to the other south county sites (Avila, Pismo, S. SLO WWTP), the coastal geology is suitable for a subsurface intake. This site also has an existing ocean outfall that is not in use. The existing outfall would not have significant diluent water (wastewater discharges) available likely requiring stricter permitting efforts through the Ocean Plan. Additionally, the existing outfall has a capacity of approximately 1.7 mgd. There are no known designated protected aquatic habits in the area, however this site falls within the recently established Chumash National Marine Sanctuary. Directly west of this site (between the ocean and the former refinery) is a protected habitat for an endangered plant species that is specific to this region, therefore any intake infrastructure will most likely need to be installed by trenchless methods. If a new ocean outfall were to be installed, any inland piping would need to be installed by trenchless methods to avoid protected vegetation species that are located directly west of this site. The former refinery is a brownfield, therefore the land impacts for developing the refinery site as a desalination treatment facility are low. However, given the plant species' habitat between the refinery and the ocean, the potential land impact is assigned as high. Lastly, given the distance from regional infrastructure and the site which is 2 miles inland, the required amount of conveyance infrastructure is moderate. The nearest regional connection point to existing water distribution lines is approximately 6 miles away.

Selected Sites for Further Consideration

As shown in Table 3 and Figure 4, sites that have suitable offshore geology for a subsurface intake, nearby existing outfall with moderate capacity, and had a minimal distance to connect to regional infrastructure

scored the highest. Aquatic impacts and land impacts were generally consistent scores through all sites with the exception of those sites within the vicinity of known marine habitats or nearby/within protected lands. Of the 13 considered site configurations, the following sites were carried forward for further development into Project Alternatives:

- Cambria – New Outfall or alternative technology.
- Morro Strand North Area/Estero Outfall.
- Morro Bay.
- Avila Beach - New Outfall.
- South SLO County WWTP.
- Nipomo Mesa Refinery.

While Cambria is far from any regional infrastructure and did not score exceptionally high, due to the current and future water supply needs of both Cambria and neighboring San Simeon, this site was included in the final selection. Due to the limited size and age of the existing outfall, this site will be limited to looking at a new outfall or alternative technology.

The Morro Strand North intake site paired with the Estero outfall is a good site for the mid-northern coast. The relatively small outfall will limit the size of the desalination facility at this location. The Estero Marine Terminal site was eliminated as an intake location due to poor hydrogeology.

Morro Bay has both a suitable site for an intake, ample outfall capacity, as well as diluting wastewater flows. This site was preferable to the Los Osos intake due to the lower amount of infrastructure required and lower risk for sensitive species impacts.

Diablo Canyon Power Plant sites being used as-is will not be recommended for further evaluation at this time due to having an open intake which poses a significant impact to aquatic species and therefore would be very difficult to permit. The Diablo site with a new intake will not be considered for further evaluation due to having poor hydrogeology that is not suitable for a subsurface seawater intake. Additionally, the Diablo site would require significant infrastructure distances to regional connection points and has a potential for high land impacts due to the sensitive nature of the surrounding area adjacent to the site.

The Avila Beach location was selected as a central location where the merits of a new outfall could be considered. The existing outfall is too small for regional benefit.

The South SLO County WWTP outfall has significant capacity and diluting wastewater flows. It also is located close to regional infrastructure.

The Nipomo Mesa Refinery, while having a smaller outfall capacity, has the advantage of a brownfield site that is slated for redevelopment. For this reason, it was included as a final site.

APPENDIX D

ALTERNATIVE SITE SCREENING ANALYSIS SCORES

Non-Weighted

Alternative No.	Name	Production Capacity	Regional Benefit	Addressing Critical Need	Blending Water Available	Proximity to Outfall, intake & supply needs and low Hazards	Cultural Resources Impact	Neighbors Impact Land Based Physical Impacts	Environmental/Biological habitat Impact (Land Based)	Environmental/Biological habitat Impact (Ocean Based)	Permitting Complexity	Partners Agreement Complexity	Total
1	Cambria Area and San Simeon	1	1	5	0	3	3	1	3	0	0	5	22
2	Cayucos/Estero Area S. County Lopez via Exchange	1	5	3	1	5	1	3	3	5	5	3	35
3	Cayucos/Estero Area Direct Requests	1	3	5	1	1	1	3	3	5	5	3	31
4	Morro Bay Small	3	5	3	1	3	1	3	3	5	3	3	33
5	Morro Bay medium	5	5	3	1	1	1	3	3	5	3	3	33
6	Morro Bay large	5	5	5	1	1	1	3	3	5	3	1	33
7	Avila to Central County	3	5	3	0	1	3	1	3	5	3	5	32
8	S. SLO WWTP Small	3	5	3	3	1	3	3	3	3	3	5	35
9	S. SLO WWTP Medium	5	5	3	1	1	3	3	3	3	3	3	33
10	S. SLO WWTP Large	5	5	5	1	1	3	3	3	3	3	1	33
11	Nipomo Mesa Refinery South Couty	3	5	3	0	1	5	5	3	3	1	5	34
12	Offshore Technology at Estero Marine Terminal	3	5	5	5	1	1	3	3	1	0	3	30

Weighted

Alternative No.	Name	Production Capacity	Regional Benefit	Addressing Critical Need	Blending Water Available	Proximity to Outfall, intake & supply needs and low Hazards	Cultural Resources Impact	Neighbors Impact Land Based Physical Impacts	Environmental/Biological habitat Impact (Land Based)	Environmental/Biological habitat Impact (Ocean Based)	Permitting Complexity	Partners Agreement Complexity	Total
1	Cambria Area and San Simeon	0.15	0.15	0.75	0	0.15	0.15	0.05	0.15	0	0	0.25	1.80
2	Cayucos/Estero Area S. County Lopez via Exchange	0.15	0.75	0.45	0.1	0.25	0.05	0.15	0.15	0.25	0.75	0.15	3.20
3	Cayucos/Estero Area Direct Requests	0.15	0.45	0.75	0.1	0.05	0.05	0.15	0.15	0.25	0.75	0.15	3.00
4	Morro Bay Small	0.45	0.75	0.45	0.1	0.15	0.05	0.15	0.15	0.25	0.45	0.15	3.10
5	Morro Bay medium	0.75	0.75	0.45	0.1	0.05	0.05	0.15	0.15	0.25	0.45	0.15	3.30
6	Morro Bay large	0.75	0.75	0.75	0.1	0.05	0.05	0.15	0.15	0.25	0.45	0.05	3.50
7	Avila to Central County	0.45	0.75	0.45	0	0.05	0.15	0.05	0.15	0.25	0.45	0.25	3.00
8	S. SLO WWTP Small	0.45	0.75	0.45	0.3	0.05	0.15	0.15	0.15	0.15	0.45	0.25	3.30
9	S. SLO WWTP Medium	0.75	0.75	0.45	0.1	0.05	0.15	0.15	0.15	0.15	0.45	0.15	3.30
10	S. SLO WWTP Large	0.75	0.75	0.75	0.1	0.05	0.15	0.15	0.15	0.15	0.45	0.05	3.50
11	Nipomo Mesa Refinery South Couty	0.45	0.75	0.45	0	0.05	0.25	0.25	0.15	0.15	0.15	0.25	2.90
12	Offshore Technology at Estero Marine Terminal	0.45	0.75	0.75	0.5	0.05	0.05	0.15	0.15	0.05	0	0.15	3.05

APPENDIX E

COST ESTIMATE DETAILS

ALTERNATIVE A

Project Component		Cost*	Notes
New Ocean Outfall		\$ 6,500,000	
Ocean Water Extraction Conveyance		\$ 13,811,000	
Subsurface Extraction Wells		\$ 22,507,000	
Brine Discharge Conveyance		\$ 13,827,000	
Treated Water Transmission		\$ 10,762,000	
Treated Water Pump Station		\$ 9,877,000	
Ocean Water Treatment Plant Costs		\$ 50,269,000	
Soft Costs Factors	Total Construction Cost ⁽¹⁾	\$ 127,553,000	
	5% Planning	\$ 6,380,000	
	10% Engineering and Design	\$ 12,760,000	
	10% Environmental Permitting	\$ 12,760,000	
	5% Administrative and Legal	\$ 6,380,000	
	10% ESDC, Inspection and Construction Management	\$ 12,760,000	
	Soft Costs Subtotal	\$ 51,040,000	
	Total Capital Cost	\$ 178,593,000	

(1) Includes 30% construction cost contingency, sales tax, contractor overhead and profit

*All costs include	
Construction Contingency	30%
Contractor OH, Markup, and GC's	15%
SLO County Sales Tax applied to 50% of construction costs	7.25%

California City and County Sales and Use Tax Rates - Cities, Counties and Tax Rates - California Department of Tax and Fee Administration

Construction Cost Breakdown	
Project Component	Estimated Costs
Ocean Intake Infrastructure	\$ 36,318,000
Brine Discharge Infrastructure	\$ 20,327,000
Treatment Facility	\$ 50,269,000
Treated Water Infrastructure	\$ 11,035,000
To Cambria Pipeline Segment	\$ 7,914,000
To San Simeon Pipeline Segment	\$ 1,690,000
Total Estimated Construction Costs	\$ 127,553,000

SLO COUNTY DESAL-ALT A CAMBRIA TREATMENT BUILDING COSTS																														
<table><tr><th colspan="2">Treatment Building Footprint</th><th>Quantity</th><th>Unit</th></tr><tr><td colspan="2">Wall Height</td><td>25</td><td>ft</td></tr><tr><td colspan="2">Wall Length</td><td>150</td><td>ft</td></tr><tr><td colspan="2">Wall Width</td><td>71</td><td>ft</td></tr><tr><td colspan="2">Total Footprint</td><td>10,650</td><td>sq ft</td></tr><tr><td colspan="2">Total Perimeter</td><td>442</td><td>lin-ft</td></tr></table>							Treatment Building Footprint		Quantity	Unit	Wall Height		25	ft	Wall Length		150	ft	Wall Width		71	ft	Total Footprint		10,650	sq ft	Total Perimeter		442	lin-ft
Treatment Building Footprint		Quantity	Unit																											
Wall Height		25	ft																											
Wall Length		150	ft																											
Wall Width		71	ft																											
Total Footprint		10,650	sq ft																											
Total Perimeter		442	lin-ft																											
SITE WORK																														
No.	Item	Unit	Quantity	Unit Cost		Cost																								
1	Gravel subgrade	CY	394	\$	65	\$ 26,000																								
2	Sidewalks	SF	1,768	\$	35	\$ 62,000																								
3	Demolition, site clearing and Haul	SF	213,444	\$	1	\$ 213,000																								
4	Excavation and Haul	CY	434	\$	25	\$ 11,000																								
6	Paving/Asphalt	SF	55,000	\$	7	\$ 385,000																								
7	Landscaping and irrigation	LS	1	\$	50,000	\$ 50,000																								
9	Structural Fill	CY	394	\$	90	\$ 36,000																								
10	Compaction	CY	789	\$	40	\$ 32,000																								
12	Mods to Existing Manhole	LS	1	\$	10,000	\$ 10,000																								
13	Dewatering	LS	1	\$	50,000	\$ 50,000																								
14	Misc Yard Piping	LS	1	\$	300,000	\$ 300,000																								
Site Work Subtotal						\$ 1,175,000																								
TREATMENT BUILDING																														
Structural																														
No.	Item	Unit	Quantity	Unit Cost		Cost																								
1	Slab on Grade	CY	987	\$	1,700.00	\$ 1,677,900																								
2	Concrete Walls	CY		\$	2,300.00	\$ -																								
3	Veneer	SF	11,050	\$	35.00	\$ 386,750																								
4	Masonry	SF	11,050	\$	55.00	\$ 607,750																								
5	Masonry	SF		\$	55.00	\$ -																								
6	Suspended Slab	CY		\$	2,300.00	\$ -																								
7	Existing Basin - New Walls	SF	0	\$	-	\$ -																								
8	Existing Basin - Elevated Channel	SF	0	\$	-	\$ -																								
9	Misc Modifications/Repairs	LS	0	\$	50,000.00	\$ -																								
10	Stairs/Grating	LS	0	\$	20,000.00	\$ -																								
11	Handrail, OSHA	LF	0	\$	89.00	\$ -																								
12	Misc. Metals	LS	1	\$	75,000.00	\$ 75,000																								
13	Coating/Paintings	LS	1	\$	50,000.00	\$ 50,000																								
14	Windows/Doors	LS	1	\$	77,000	\$ 77,000																								
15	Roof	SF	10,650	\$	160.00	\$ 1,704,000																								
16	Piles	EA	0	\$	-	\$ -																								
17	Columns	EA	6	\$	2,000.00	\$ 12,000																								
Structural Subtotal						\$ 4,590,400																								
Mechanical																														
No.	Item	Unit	Quantity	Unit Cost		Cost																								
Building																														
1	HVAC	LS	1	\$	100,000	\$ 100,000																								
2	Lighting	LS	1	\$	100,000	\$ 100,000																								
3	Plumbing/Drainage	LS	1	\$	100,000	\$ 100,000																								
Subtotal						\$ 300,000																								
Pressure Filter and Tanks																														
1	Filter Vessel (2 vessels - duty/standby)	LS	2	\$	300,000	\$ 600,000																								
2	Backwash Storage Tank and foundation	LS	1	\$	300,000	\$ 300,000																								
3	Backwash Pumps (40 HP)	EA	2	\$	30,000	\$ 60,000																								
Subtotal						\$ 960,000																								
Chemical Storage and Metering Systems																														
1	Polymer	EA	1	\$	494,000	\$ 494,000																								
2	Sulfuric Acid	EA	1	\$	592,800	\$ 592,800																								
3	Sodium Hydroxide	EA	1	\$	592,800	\$ 592,800																								
4	Sodium Hypochlorite	EA	1	\$	494,000	\$ 494,000																								
5	Calcium Chloride	EA	1	\$	494,000	\$ 494,000																								
6	Sodium Bisulfite	EA	1	\$	592,800	\$ 592,800																								
7	Scale Inhibitor	EA	1	\$	494,000	\$ 494,000																								
8	Liquid Ammonium Sulfate (LAS)	EA	1	\$	494,000	\$ 494,000																								
Subtotal						\$ 4,248,400																								
RO System																														
1	RO equipment	LS	1	\$	2,454,370	\$ 2,454,400																								
2	RO Pump VFDs	EA	6	\$	200,000	\$ 1,200,000																								
3	RO Feed Tank (20,000 gal)	EA	1	\$	200,000	\$ 200,000																								
4	RO Transfer Pumps (40 HP)	EA	2	\$	60,000	\$ 144,000																								
5	RO Flush Tank (4,000 gal)	EA	1	\$	50,000	\$ 50,000																								
6	RO Flush Pump (5 HP)	EA	2	\$	7,500	\$ 15,000																								
7	Energy Recovery and Booster Pump 50 HP)	EA	3	\$	50,000	\$ 150,000																								

8	ROC and Off-spec water holding tank	LS	1	\$	300,000	\$	300,000
9	ROC Pumps (50 HP)	EA	2	\$	37,500	\$	75,000
					Subtotal	\$	4,588,400
	UV System						
1	Spektron 200e Reactor	LS	1	\$	256,300	\$	256,300
					Subtotal	\$	256,300
	<i>Equipment Install/Markup</i>	LS	0.60	\$	10,353,000	\$	6,212,000
					Mechanical Subtotal	\$	16,565,100
Electrical and Instrumentation for Equipment							
No.	Item	Unit	Quantity	Unit Cost		Cost	
1	Electrical	LS	0.25	\$	16,565,100	\$	4,141,000
2	Instrumentation	LS	0.25	\$	16,565,100	\$	4,141,000
					E&IC Subtotal	\$	8,282,000
Process Piping							
No.	Item	Unit	Quantity	Unit Cost		Cost	
	RO System						
1	Piping (off skid) and supports	LS	1	\$	100,000	\$	100,000
2	Valves (off skid)	LS	1	\$	50,000	\$	50,000
3	Flow Meters (off skid)	LS	1	\$	50,000	\$	50,000
4	On-line Analyzers	LS	1	\$	50,000	\$	50,000
					Subtotal	\$	250,000
	Misc Piping (Filters, ROC holding tank, etc)						
1	Piping (off skid)	LS	1	\$	100,000	\$	100,000
2	Valves (off skid)	LS	1	\$	30,000	\$	30,000
3	Flow Meters	LS	5	\$	10,000	\$	50,000
4	Misc	LS	1	\$	50,000	\$	50,000
					Subtotal	\$	230,000
	UV System						
1	Piping	LS	1	\$	11,374	\$	11,400
2	Valves	LS	1	\$	19,872	\$	19,900
3	Flow Meters	LS	1	\$	38,400	\$	38,400
4	Misc	LS	1	\$	6,970	\$	7,000
					Subtotal	\$	76,700
	<i>Process Piping Installation/Mark-up</i>	LS	0.50	\$	557,000	\$	279,000
					Process Piping Subtotal	\$	835,700
Control System and Security							
No.	Item	Unit	Quantity	Unit Cost		Cost	
	All Systems on Site						
1	PLCs, SCADA, Telemetry, Security	LS	1	\$	1,000,000	\$	1,000,000
					Control System and Security Subtotal	\$	1,000,000
Total of All Direct Costs						\$	32,448,200
Construction Contingency						30%	\$ 9,734,500
Subtotal							\$ 42,182,700
Sales Tax (SLO County) Applied to 50% of construction costs						7.25%	\$ 1,529,100
Subtotal							\$ 43,711,800
Contractor OH, Markup, and GC's						15%	\$ 6,556,800
Treatment Building Total							\$ 50,269,000

Number of Ports		170
Disengage Pressure Reducing Structure	\$	50,000
Port Replacement	\$	1,700,000
Duckbill Check Valve	\$	204,000
Barge Handling	\$	120,000
Marine Mammal Monitoring	\$	108,000
Cleaning	\$	1,360,000
Total Direct Costs	\$	4,027,544
General Conditions (10%)	\$	402,754
Mobilization (20%)	\$	805,509
Contingency (30%)	\$	1,208,263
Total Costs	\$	6,444,071
Outfall Total (up to the nearest \$250k)	\$	6,500,000

	Includes Flows (AFY)	Length (ft)	Q - Flow (gpm - Max Day)	Q - Flow (cfs)	Diameter (in)	Inner Diameter (ft)	Area (ft^2)	Velocity (fps)	C - Friction Factor (PVC)	H - Headloss (ft)	Headloss Rate (ft/1000 ft)	Unit Cost	Direct Cost
Desalination Intake Pipeline	1160	29715	719.2	1.58224	12	1	0.785398163	2.014570537	110	54.83	1.845097822	\$ 300.00	\$ 8,914,583.58

Total of Pipeline Direct Costs				\$ 8,914,600
	30%			\$2,674,380
Subtotal				\$ 11,589,000
Sales Tax (SLO County) Applied to 50% of construction costs	7.25%			\$420,101
Subtotal				\$ 12,009,100
Contractor OH, Markup, and GC's	15%			\$ 1,801,365
Subtotal	%/Month	Months	Total	\$ 13,810,500
Escalation to Mid Point (% per month to July 2043)	0.00%	212.00	0.00%	\$0
Subtotal				\$ 13,810,500
Intake Pipeline Total (to the nearest \$1k)				\$13,811,000

Well Drilling			QTY	
Well Drilling Cost	\$2,000	per foot	1500	\$ 3,000,000
Equipping	10%	per well	1	\$ 300,000
Well Motor Cost	\$4,500	per HP	110	\$ 495,000
Concrete Pad and Pedestals	\$8,000	each	1	\$8,000
Testing	\$10,000	each	1	\$10,000
			Well Install Cost	\$ 3,813,000
Civil (100' by 100' site)				
Vegetation Removal	\$ 2	SF	10000	\$20,000
Rough grading	\$ 4	SF	10000	\$40,000
Gravel	\$ 25	SF	10000	\$250,000
Access Road	\$ 50	LF	50	\$2,500
Permiter Fencing	\$ 150	LF	400	\$60,000
Access Gate	\$ 3,000	ea	1	\$3,000
20' by 40' CMU building	\$ 1,000	SF	800	\$800,000
Site Lighting	\$ 2,000	ea	4	\$8,000
			Total Civil	\$1,183,500
Above Ground Mechanical				
CARV	\$ 2,500	ea	4	\$ 10,000
Sample Port	\$ 500	ea	2	\$ 1,000
Pressure Gauge	\$ 500	ea	4	\$ 2,000
Dismantling Joint	\$ 2,500	ea	6	\$ 15,000
Check Valve	\$ 10,000	ea	2	\$ 20,000
Magnetic Flowmeter	\$ 15,000	ea	2	\$ 30,000
Butterfly Valve	\$ 8,000	ea	4	\$ 32,000
90 degree reducing 90	\$ 5,000	ea	2	\$ 10,000
90 degree elbow	\$ 3,500	ea	2	\$ 7,000
Pipe Spools	\$ 250	LF	40	\$ 10,000
Pipe Supports	\$ 750	ea	12	\$ 9,000
			Total Mechanical	\$ 146,000
EPIC	25%	of Mech+civil+drill	1	\$ 1,285,625
General				
Mobilization	8.00%	LS	1	\$ 514,250
Demobilization	2.00%	LS	1	\$ 128,563
SWPPP BMPs	2.50%	LS	1	\$ 160,703
Environmental Mitigation Measures	0.50%	LS	1	\$ 32,141
			Total General	\$ 835,700
			Total Single Well Direct Costs	\$ 7,263,800
			Total No. of Wells	\$ 2
Total of All Direct Costs				\$ 14,527,600
Construction Contingency	30%			\$ 4,358,280
Subtotal				\$ 18,885,900
Sales Tax (SLO County) Applied to 50% of construction costs	7.25%			\$ 684,614
Subtotal				\$ 19,570,500
Contractor OH, Markup, and GC's	15%			\$ 2,935,575
Intake Wells Total (to the nearest \$1k)				\$ 22,507,000

	Includes Flows	Length (ft)	Q - Flow (gpm - Max Discharge)	Q - Flow (cfs)	Diameter (in)	Inner Diameter (ft)	Area (ft^2)	Velocity (fps)	C - Friction Factor (PVC)	H - Headloss (ft)	Headloss Rate (ft/1000 ft)	Unit Cost (LF)	Direct Cost
Outfall Discharge Pipe	580	29751	359.6	0.79112	8	0.666666667	0.34906585	2.266391854	110	109.69	3.687044132	\$ 300.00	\$ 8,925,300.00

Total of Pipeline Direct Costs		\$ 8,925,300
	30%	\$ 2,677,600
Subtotal		\$ 11,602,900
Sales Tax (SLO County) Applied to 50% of construction	7.25%	\$420,600
Subtotal		\$ 12,023,500
Contractor OH, Markup, and GC's	15%	\$ 1,803,500
Discharge Pipeline Total (to the nearest \$1k)		\$13,827,000

ALTERNATIVE B

Soft Costs
Factors

Project Component		Cost*	Notes
Ocean Outfall Improvements		\$ 1,500,000	
Ocean Water Extraction Conveyance		\$ 6,623,000	
Subsurface Extraction Wells		\$ 35,384,000	
Brine Discharge Conveyance		\$ 233,000	
Treated Water Transmission		\$ 69,320,000	
Treated Water Pump Stations		\$ 10,458,000	
Ocean Water Treatment Plant Costs		\$ 62,937,000	
Total Construction Cost ⁽¹⁾		\$ 186,455,000	
5%	Planning	\$ 9,320,000	
10%	Engineering and Design	\$ 18,650,000	
10%	Environmental Permitting	\$ 18,650,000	
5%	Administrative and Legal	\$ 9,320,000	
10%	ESDC, Inspection and Construction Management	\$ 18,650,000	
Soft Costs Subtotal		\$ 74,590,000	
Total Capital Cost		\$ 261,045,000	

(1) Includes 30% construction cost contingency, sales tax, contractor overhead and profit

*All costs include	
Construction Contingency	30%
Contractor OH, Markup, and GC's	15%
SLO County Sales Tax applied to 50% of construction costs	7.25%

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Construction Cost Breakdown	
Project Component	Estimated Costs
Ocean Intake Infrastructure	\$ 42,007,000
Brine Discharge Infrastructure	\$ 1,733,000
Treatment Facility	\$ 62,937,000
Treated Water Infrastructure	\$ 10,573,000
To Cambria Pipeline Segment	\$ 43,459,000
To San Simeon Pipeline Segment	\$ 11,293,000
To Los Osos Pipeline Segment	\$ 14,453,000
Total Estimated Construction Costs	\$ 186,455,000

Alternative B O&M Cost info		
Power Costs	\$ 0.50	per kWh
Pipeline O&M Factor	2%	of total direct costs
Site Maintenance	0.50%	of total site costs of PS
Well Pump Motor Lifecycle	20	years
Pipeline Lifecycle	75	years
Pump Station Annual Maintnenace	8%	per year
Inflation %	2.50%	per year
Discount Rate	3.25%	per year
Interest Rate	2%	Assume Drinking Water SRF Low interest loan
Loan Term	30	years

Offsite Facilities Annual O&M Costs			
Ocean Water Extraction			
Pumping Power	\$	1,616,752	\$ 1,617,000
Pumping O&M Costs	\$	1,827,216	\$ 1,828,000
Pumping Site O&M Costs	\$	114,201	\$ 115,000
Subtotal	\$	3,558,169	\$ 3,560,000
Ocean Water Conveyance			
Pipeline O&M Costs	\$	85,498	\$ 86,000
Subtotal	\$	85,498	\$ 86,000
Brine Conveyance			
Pipeline O&M Costs	\$	3,000	\$ 3,000
Subtotal	\$	3,000	\$ 3,000
Treated Water Pump Stations			
Pumping Power	\$	489,925	\$ 490,000
Pumping O&M Costs	\$	60,000	\$ 60,000
Pumping Site O&M Costs	\$	3,750	\$ 4,000
Subtotal	\$	553,675	\$ 554,000
Treated Water Transmission			
Pipeline O&M Costs	\$	894,906	\$ 895,000
Subtotal	\$	894,906	\$ 895,000
Outfall			
Annual Inspection	\$	108,000	\$ 108,000
5-year Cleaning (annualized cost)	\$	50,000	\$ 50,000
Subtotal	\$	158,000	\$ 158,000

Total Offsite O&M Costs			
Treatment Facility Annual O&M Costs			
Total UV O&M Cost	\$302,028.30	\$	303,000
Total RO O&M Cost	\$9,142,459.55	\$	9,143,000
Total Pretreatment O&M Cost	\$50,775	\$	51,000
Subtotal	\$ 9,495,263	\$	9,497,000

Total Offsite O&M	\$	5,253,248	\$	5,256,000
Total Treatment Facility O&M		\$9,497,000	\$	9,500,000
Total Project Alternative O&M	\$	14,750,248	\$	14,756,000

Equipment Replacement Costs	Direct Costs	Notes
Subsurface Extraction Wells	\$ 900,000	equipping costs x # of wells
Treated Water Distribution PS	\$ 750,000	Total Direct Costs of PS
Total Equipment Replacement Costs	\$ 1,650,000	assuming replacement @ 15years over 2 years

[illegible]

NPV of Project Costs	\$612,242,168
Annual Costs	\$20,408,072
Production Volume	1,055
Annualized Unit Cost (\$/AFY)	\$19,344

SLO COUNTY DESAL-ALT B CAYUCOS/ESTERO TREATMENT BUILDING COSTS																													
<table><tr><th colspan="2">Treatment Building Footprint</th><th>Quantity</th><th>Unit</th></tr><tr><td colspan="2">Wall Height</td><td>25</td><td>ft</td></tr><tr><td colspan="2">Wall Length</td><td>158</td><td>ft</td></tr><tr><td colspan="2">Wall Width</td><td>80</td><td>ft</td></tr><tr><td colspan="2">Total Footprint</td><td>10,240</td><td>sq ft.</td></tr><tr><td colspan="2">Total Perimeter</td><td>476</td><td>lin-ft</td></tr></table>						Treatment Building Footprint		Quantity	Unit	Wall Height		25	ft	Wall Length		158	ft	Wall Width		80	ft	Total Footprint		10,240	sq ft.	Total Perimeter		476	lin-ft
Treatment Building Footprint		Quantity	Unit																										
Wall Height		25	ft																										
Wall Length		158	ft																										
Wall Width		80	ft																										
Total Footprint		10,240	sq ft.																										
Total Perimeter		476	lin-ft																										
SITE WORK																													
No.	Item	Unit	Quantity	Unit Cost	Cost																								
1	Gravel subgrade	CY	379	\$ 65	\$ 25,000																								
2	Sidewalks	SF	1,904	\$ 35	\$ 67,000																								
3	Demolition and Haul, Site Clearing	SF	175,000	\$ 1	\$ 175,000																								
4	Excavation and Haul	CY	417	\$ 25	\$ 10,000																								
6	Paving/Asphalt	SF	53,000	\$ 7	\$ 371,000																								
7	Landscaping and irrigation	LS	1	\$ 50,000	\$ 50,000																								
9	Structural Fill	CY	379	\$ 90	\$ 34,000																								
10	Compaction	CY	759	\$ 40	\$ 30,000																								
12	Mods to Existing Manhole	LS	0	\$ -	\$ -																								
13	Dewatering	LS	0	\$ -	\$ -																								
14	Misc Yard Piping	LS	0	\$ -	\$ -																								
				Site Work Subtotal	\$ 762,000																								
TREATMENT BUILDING																													
Structural																													
No.	Item	Unit	Quantity	Unit Cost	Cost																								
1	Slab on Grade	CY	949	\$ 1,700.00	\$ 1,613,300																								
2	Concrete Walls	CY		\$ 2,300.00	\$ -																								
3	Veneer	SF	11900	\$ 35.00	\$ 416,500																								
4	Masonry	SF	11900	\$ 55.00	\$ 654,500																								
5	Masonry	SF		\$ 55.00	\$ -																								
6	Suspended Slab	CY		\$ 2,300.00	\$ -																								
7	Existing Basin - New Walls	SF	0	\$ -	\$ -																								
8	Existing Basin - Elevated Channel	SF	0	\$ -	\$ -																								
9	Misc Modifications/Repairs	LS	0	\$ 50,000.00	\$ -																								
10	Stairs/Grating	LS	0	\$ 20,000.00	\$ -																								
11	Handrail, OSHA	LF	0.00	\$ 89.00	\$ -																								
12	Misc. Metals	LS	1	\$ 75,000.00	\$ 75,000																								
13	Coating/Paintings	LS	1	\$ 50,000.00	\$ 50,000																								
14	Windows/Doors	LS	1	\$ 77,000	\$ 77,000																								
15	Roof	SF	10240	\$ 160.00	\$ 1,638,000																								
16	Piles	EA	0	\$ -	\$ -																								
17	Columns	EA	6	\$ 2,000.00	\$ 12,000																								
				Structural Subtotal	\$ 4,536,300																								
Mechanical																													
No.	Item	Unit	Quantity	Unit Cost	Cost																								
Building																													
1	HVAC	LS	1	\$ 200,000	\$ 200,000																								
2	Lighting	LS	1	\$ 200,000	\$ 200,000																								
3	Plumbing/Drainage	LS	1	\$ 200,000	\$ 200,000																								
				Subtotal	\$ 600,000																								
Pressure Filter and Tanks																													
1	Filter Vessel (2 vessels = 1 + 1 standby)	LS	2	\$ 300,000	\$ 600,000																								
2	Backwash Storage Tank and foundation	LS	1	\$ 300,000	\$ 300,000																								
3	Backwash Pumps (40 HP)	EA	2	\$ 30,000	\$ 60,000																								
				Subtotal	\$ 960,000																								
Chemical Storage and Metering Systems																													
1	Polymer	EA	1	\$ 494,000	\$ 494,000																								
2	Sulfuric Acid	EA	1	\$ 592,800	\$ 592,800																								
3	Sodium Hydroxide	EA	1	\$ 592,800	\$ 592,800																								
4	Sodium Hypochlorite	EA	1	\$ 494,000	\$ 494,000																								
5	Calcium Chloride	EA	1	\$ 494,000	\$ 494,000																								
6	Sodium Bisulfite	EA	1	\$ 592,800	\$ 592,800																								
7	Scale Inhibitor	EA	1	\$ 494,000	\$ 494,000																								
8	Liquid Ammonium Sulfate (LAS)	EA	1	\$ 494,000	\$ 494,000																								
				Subtotal	\$ 4,248,400																								
RO System																													
1	RO equipment	LS	1	\$ 4,054,418	\$ 4,054,400																								
2	RO Pump VFDs	EA	6	\$ 200,000	\$ 1,200,000																								
3	RO Feed Tank (20,000 gal)	EA	1	\$ 200,000	\$ 200,000																								
4	RO Transfer Pumps (40 HP)	EA	2	\$ 60,000	\$ 144,000																								
5	RO Flush Tank (4,000 gal)	EA	1	\$ 50,000	\$ 50,000																								
6	RO Flush Pump (5 HP)	EA	2	\$ 7,500	\$ 15,000																								
7	Energy Recovery and Booster Pump 50 HP)	EA	3	\$ 50,000	\$ 150,000																								
8	ROC and Off-spec water holding tank	LS	1	\$ 300,000	\$ 300,000																								

9	ROC Pumps (50 HP)	EA	2	\$	37,500	\$	75,000
	UV System				Subtotal	\$	6,188,400
1	Spektron 200e Reactor	LS	1	\$	340,900	\$	340,900
					Subtotal	\$	340,900
	<i>Equipment Install/Markup</i>	LS	0.60	\$	16,586,000	\$	9,952,000
					Mechanical Subtotal	\$	22,289,700
Electrical and Instrumentation for Equipment							
No.	Item	Unit	Quantity	Unit Cost		Cost	
1	Electrical	LS	0.25	\$	22,289,700	\$	5,572,000
2	Instrumentation	LS	0.25	\$	22,289,700	\$	5,572,000
					E&IC Subtotal	\$	11,144,000
Process Piping							
No.	Item	Unit	Quantity	Unit Cost		Cost	
	RO System						
1	Piping (off skid) and supports	LS	1	\$	100,000	\$	100,000
2	Valves (off skid)	LS	1	\$	50,000	\$	50,000
3	Flow Meters (off skid)	LS	1	\$	50,000	\$	50,000
4	On-line Analyzers	LS	1	\$	50,000	\$	50,000
					Subtotal	\$	250,000
	Misc Piping (Filters, ROC holding tank, etc)						
1	Piping (off skid)	LS	1	\$	100,000	\$	100,000
2	Valves (off skid)	LS	1	\$	30,000	\$	30,000
3	Flow Meters	LS	5	\$	10,000	\$	50,000
4	Misc	LS	1	\$	50,000	\$	50,000
					Subtotal	\$	230,000
	UV System						
1	Piping	LS	1	\$	17,060	\$	17,100
2	Valves	LS	1	\$	29,808	\$	29,800
3	Flow Meters	LS	1	\$	57,600	\$	57,600
4	Misc	LS	1	\$	10,450	\$	10,500
					Subtotal	\$	115,000
	<i>Process Piping Installation/Mark-up</i>	LS	0.50	\$	595,000	\$	298,000
					Process Piping Subtotal	\$	893,000
Control System and Security							
No.	Item	Unit	Quantity	Unit Cost		Cost	
	All Systems on Site						
1	PLCs, SCADA, Telemetry, Security	LS	1	\$	1,000,000	\$	1,000,000
					Control System and Security Subtotal	\$	1,000,000
Total of All Direct Costs						\$	40,625,000
Construction Contingency		30%				\$	12,187,500
Subtotal						\$	52,812,500
Sales Tax (SLO County) Applied to 50% of construction costs		7.25%				\$	1,914,500
Subtotal						\$	54,727,000
Contractor OH, Markup, and GC's		15%				\$	8,209,100
Treatment Building Total						\$	62,937,000

Ocean Outfall Retrofit and Connection to Existing		
Barge Handling	\$	120,000
Marine Mammal Monitoring	\$	108,000
Cleaning	\$	250,000
New Diffuser Infrastructure	\$	250,000
Connection to Existing Outfall	\$	100,000
Total Direct Costs	\$	828,000
General Conditions (10%)	\$	82,800
Mobilization (20%)	\$	165,600
Contingency (30%)	\$	248,400
Total Costs	\$	1,324,800
Outfall Total (up to the nearest \$250k)	\$	1,500,000

	Includes Flows (AFY)	Length (ft)	Q - Flow (gpm - Max D	Q - Flow (cfs)	Diameter (in)	Inner Diameter (ft)	Area (ft^2)	Velocity (fps)	C - Friction Factor (PVC)	H - Headloss (ft)	Headloss Rate (ft/1000 ft)	Unit Cost	Direct Cost
Desalination Intake Pipeline	2110	10687	1308.2	2.87804	16	1.333333333	1.396263402	2.061244316	110	14.69	1.374811041	\$ 400.00	\$ 4,274,877.70

Total of Pipeline Direct Costs				\$ 4,274,900
	30%			\$ 1,282,500
Subtotal				\$ 5,557,400
Sales Tax (SLO County) Applied to 50% of construction costs	7.25%			\$201,500
Subtotal				\$ 5,758,900
Contractor OH, Markup, and GC's	15%			\$ 863,800
Subototal	%/Month	Months	Total	\$ 6,622,700
Total (to the nearest \$1k)				\$6,623,000

Well Drilling			QTY	
Well Drilling Cost	\$2,000	per foot	1500	\$ 3,000,000
Equipping	10%	per well	1	\$ 300,000
Well Motor Cost	\$4,500	per HP	165	\$ 742,500
Concrete Pad and Pedestals	\$8,000	each	1	\$8,000
Testing	\$10,000	each	1	\$10,000
			Well Install Cost	\$ 4,060,500
Civil (100' by 100' site)				
Vegetation Removal	\$ 2	SF	10000	\$20,000
Rough grading	\$ 4	SF	10000	\$40,000
Gravel	\$ 25	SF	10000	\$250,000
Access Road	\$ 50	LF	50	\$2,500
Permiter Fencing	\$ 150	LF	400	\$60,000
Access Gate	\$ 3,000	ea	1	\$3,000
20' by 40' CMU building	\$ 1,000	SF	800	\$800,000
Site Lighting	\$ 2,000	ea	4	\$8,000
			Total Civil	\$1,183,500
Above Ground Mechanical				
CARV	\$ 2,500	ea	4	\$ 10,000
Sample Port	\$ 500	ea	2	\$ 1,000
Pressure Gauge	\$ 500	ea	4	\$ 2,000
Dismantling Joint	\$ 2,500	ea	6	\$ 15,000
Check Valve	\$ 10,000	ea	2	\$ 20,000
Magnetic Flowmeter	\$ 15,000	ea	2	\$ 30,000
Butterfly Valve	\$ 8,000	ea	4	\$ 32,000
90 degree reducing 90	\$ 5,000	ea	2	\$ 10,000
90 degree elbow	\$ 3,500	ea	2	\$ 7,000
Pipe Spools	\$ 250	LF	40	\$ 10,000
Pipe Supports	\$ 750	ea	12	\$ 9,000
			Total Mechanical	\$ 146,000
EPIC	25%	of Mech+civil+dr	1	\$ 1,347,500
General				
Mobilization	8.00%	LS	1	\$ 539,000
Demobilization	2.00%	LS	1	\$ 134,750
SWPPP BMPs	2.50%	LS	1	\$ 168,438
Environmental Mitigation Measures	0.50%	LS	1	\$ 33,688
			Total General	\$ 875,900
			Single Well Direct Costs	\$ 7,613,400
			Total No. of Wells	\$ 3
Total of All Direct Costs				\$ 22,840,200
Construction Contingency	30%			\$ 6,852,100
Subtotal				\$ 29,692,300
Sales Tax (SLO County) Applied to 50% of construction costs	7.25%			\$ 1,076,300
Subtotal				\$ 30,768,600
Contractor OH, Markup, and GC's	15%			\$ 4,615,300
Intake Wells Total (to the nearest \$1k)				\$ 35,384,000

	Includes Flows	Length (ft)	Q - Flow (gpm - Max Discharge)	Q - Flow (cfs)	Diameter (in)	Inner Diameter (ft)	Area (ft^2)	Velocity (fps)	C - Friction Factor (PVC)	H - Headloss (ft)	Headloss Rate (ft/1000 ft)	Unit Cost (LF)	Direct Cost
Outfall Discharge Pipe	1,055	500	654.1	1.43902	12	1	0.785398163	1.83221717	110	0.77	1.54806491	\$ 300.00	\$ 150,000.00

Total of Pipeline Direct Costs			\$	150,000
Contingency Already taken into consideration in Unit Cost -----	30%		\$	45,000
Subtotal			\$	195,000
Sales Tax (SLO County) Applied to 50% of construction costs	7.25% applied to 50% of costs			\$7,100
Subtotal			\$	202,100
Contractor OH, Markup, and GC's	15%		\$	30,300
Discharge Pipeline Total (to the nearest \$1k)				\$233,000

ALTERNATIVE C

Soft Costs
Factors

Project Component	Cost*	Notes
Ocean Outfall Improvements	\$ 5,250,000	
Ocean Water Extraction Conveyance	\$ 3,490,000	
Subsurface Extraction Wells	\$ 120,332,000	
Brine Discharge Conveyance	\$ 465,000	
Treated Water Transmission	\$ 118,698,000	
Treated Water Pump Station	\$ 14,486,000	
Ocean Water Treatment Plant Costs	\$ 126,306,000	
Total Construction Cost ⁽¹⁾	\$ 389,027,000	
5% Planning	\$ 19,450,000	
10% Engineering and Design	\$ 38,900,000	
10% Environmental Permitting	\$ 38,900,000	
5% Administrative and Legal	\$ 19,450,000	
10% ESDC, Inspection and Construction Management	\$ 38,900,000	
Soft Costs Subtotal	\$ 155,600,000	
Total Capital Cost	\$ 544,627,000	

(1) Includes 30% construction cost contingency, sales tax, contractor overhead and profit

*All costs include	
Construction Contingency	30%
Contractor OH, Markup, and GC's	15%
SLO County Sales Tax applied to 50% of construction costs	7.25%

[California City and County Sales and Use Tax Rates - Cities, Counties and Tax Rates - California Department of Tax and Fee Administration](#)

Construction Cost Breakdown	
Project Component	Estimated Costs
Ocean Intake Infrastructure	\$ 123,822,000
Brine Discharge Infrastructure	\$ 5,715,000
Treatment Facility	\$ 126,306,000
Treated Water Infrastructure	\$ 15,852,000
To Cambria Pipeline Segment	\$ 50,292,000
To San Simeon Pipeline Segment	\$ 3,765,000
To Los Osos Pipeline Segment	\$ 15,467,000
To SLO Pipeline Segment	\$ 43,795,000
To SWP Pipeline Segment	\$ 4,013,000
Total Estimated Construction Costs	\$ 389,027,000

Alternative C O&M Cost info		
Power Costs	\$ 0.50	per kWh
Pipeline O&M Factor	2%	of total direct costs
Site Maintenance	0.50%	of total site costs of PS
Well Pump Motor Lifecycle	20	years
Pipeline Lifecycle	75	years
Pump Station Annual Maintnenace	8%	per year
Inflation %	2.50%	per year
Discount Rate	3.25%	per year
Interest Rate	2%	Assume Drinking Water SRF Low interest loan
Loan Term	30	years

Offsite Facilities Annual O&M Costs			
Ocean Water Extraction			
Pumping Power	\$	9,553,536	\$ 9,554,000
Pumping O&M Costs	\$	6,213,888	\$ 6,214,000
Pumping Site O&M Costs	\$	388,368	\$ 389,000
Subtotal	\$	16,155,792	\$ 16,157,000
Ocean Water Conveyance			
Pipeline O&M Costs	\$	45,044	\$ 46,000
Subtotal	\$	45,044	\$ 46,000
Brine Conveyance			
Pipeline O&M Costs	\$	6,000	\$ 6,000
Subtotal	\$	6,000	\$ 6,000
Treated Water Pump Stations			
Pumping Power	\$	2,286,316	\$ 2,287,000
Pumping O&M Costs	\$	268,000	\$ 268,000
Pumping Site O&M Costs	\$	16,750	\$ 17,000
Subtotal	\$	2,571,066	\$ 2,572,000
Treated Water Transmission			
Pipeline O&M Costs	\$	1,532,374	\$ 1,533,000
Subtotal	\$	1,532,374	\$ 1,533,000
Outfall			
Annual Inspection	\$	125,000	\$ 125,000
5-year Cleaning (annualized cost)	\$	56,000	\$ 56,000
Subtotal	\$	181,000	\$ 181,000

Treatment Facility Annual O&M Costs			
UV System	\$222,489.00	\$	223,000
RO System	\$43,010,345.75	\$	43,011,000
Pretreatment System	\$88,771.65	\$	89,000
Subtotal	\$ 43,321,606	\$	43,323,000

Total Offsite O&M	\$	20,491,276	\$	20,495,000
Total Treatment Facility O&M		\$43,323,000	\$	43,323,000
Total Project Alternative O&M	\$	63,814,276	\$	63,818,000

Equipment Replacement Costs	Direct Costs	Notes
Subsurface Extraction Wells	\$ 2,700,000	equipping costs x # of wells
Treated Water Distribution PS	\$ 3,350,000	Total Direct Costs of PS
Total Equipment Replacement Costs	\$ 6,050,000	assuming replacement @ 15years over 2 years

[illegible]

NPV of Project Costs	\$2,144,823,225
Annual Costs	\$71,494,107
Production Volume	7,135
Annualized Unit Cost (\$/AFY)	\$10,020

SLO COUNTY DESAL-ALT C MORRO BAY TREATMENT BUILDING COSTS																														
<table><tr><th colspan="2">Treatment Building Footprint</th><th>Quantity</th><th>Unit</th></tr><tr><td colspan="2">Wall Height</td><td>25</td><td>ft</td></tr><tr><td colspan="2">Wall Length</td><td>230</td><td>ft</td></tr><tr><td colspan="2">Wall Width</td><td>130</td><td>ft</td></tr><tr><td colspan="2">Total Footprint</td><td>29,900</td><td>sq ft</td></tr><tr><td colspan="2">Total Perimeter</td><td>720</td><td>lin-ft</td></tr></table>							Treatment Building Footprint		Quantity	Unit	Wall Height		25	ft	Wall Length		230	ft	Wall Width		130	ft	Total Footprint		29,900	sq ft	Total Perimeter		720	lin-ft
Treatment Building Footprint		Quantity	Unit																											
Wall Height		25	ft																											
Wall Length		230	ft																											
Wall Width		130	ft																											
Total Footprint		29,900	sq ft																											
Total Perimeter		720	lin-ft																											
SITE WORK																														
No.	Item	Unit	Quantity	Unit Cost		Cost																								
1	Gravel subgrade	CY	1,107	\$	65	\$ 72,000																								
2	Sidewalks	SF	2,880	\$	35	\$ 101,000																								
3	Demolition and Haul	SF	279,000	\$	1	\$ 279,000																								
4	Excavation and Haul	CY	1,218	\$	25	\$ 30,000																								
6	Paving/Asphalt	SF	84,000	\$	7	\$ 588,000																								
7	Landscaping	LS	1	\$	50,000	\$ 50,000																								
9	Structural Fill	CY	1,107	\$	90	\$ 100,000																								
10	Compaction	CY	2,215	\$	40	\$ 89,000																								
12	Mods to Existing Manhole	LS	0	\$	-	\$ -																								
13	Dewatering	LS	0	\$	-	\$ -																								
14	Misc Yard Piping	LS	0	\$	-	\$ -																								
Site Work Subtotal						\$ 1,309,000																								
TREATMENT BUILDING																														
Structural																														
No.	Item	Unit	Quantity	Unit Cost		Cost																								
1	Slab on Grade	CY	2,769	\$	1,700.00	\$ 4,707,300																								
2	Concrete Walls	CY		\$	2,300.00	\$ -																								
3	Veneer	SF	18,000	\$	35.00	\$ 630,000																								
4	Masonry	SF	18,000	\$	55.00	\$ 990,000																								
5	Masonry	SF		\$	55.00	\$ -																								
6	Suspended Slab	CY		\$	2,300.00	\$ -																								
7	Existing Basin - New Walls	SF	0	\$	-	\$ -																								
8	Existing Basin - Elevated Channel	SF	0	\$	-	\$ -																								
9	Misc Modifications/Repairs	LS	0	\$	50,000.00	\$ -																								
10	Stairs/Grating	LS	0	\$	20,000.00	\$ -																								
11	Handrail, OSHA	LF	0	\$	89.00	\$ -																								
12	Misc. Metals	LS	1	\$	75,000.00	\$ 75,000																								
13	Coating/Paintings	LS	1	\$	50,000.00	\$ 50,000																								
14	Windows/Doors	LS	1	\$	132,000	\$ 132,000																								
15	Roof	SF	29,900	\$	160.00	\$ 4,784,000																								
16	Piles	EA	0	\$	-	\$ -																								
17	Columns	EA	12	\$	2,000.00	\$ 24,000																								
Structural Subtotal						\$ 11,392,300																								
Mechanical																														
No.	Item	Unit	Quantity	Unit Cost		Cost																								
Building																														
1	HVAC	LS	1	\$	700,000	\$ 700,000																								
2	Lighting	LS	1	\$	700,000	\$ 700,000																								
3	Plumbing/Drainage	LS	1	\$	700,000	\$ 700,000																								
Subtotal						\$ 2,100,000																								
Pressure Filter and Tanks																														
1	Filter Vessel (5 vessels = 4+1 standby)	LS	5	\$	300,000	\$ 1,500,000																								
2	Backwash Storage Tank and foundation	LS	1	\$	300,000	\$ 300,000																								
3	Backwash Pumps (40 HP)	EA	2	\$	30,000	\$ 60,000																								
Subtotal						\$ 1,860,000																								
Chemical Storage and Metering Systems																														
1	Polymer	EA	1	\$	494,000	\$ 494,000																								
2	Sulfuric Acid	EA	1	\$	592,800	\$ 592,800																								
3	Sodium Hydroxide	EA	1	\$	592,800	\$ 592,800																								
4	Sodium Hypochlorite	EA	1	\$	494,000	\$ 494,000																								
5	Calcium Chloride	EA	1	\$	494,000	\$ 494,000																								
6	Sodium Bisulfite	EA	1	\$	592,800	\$ 592,800																								
7	Scale Inhibitor	EA	1	\$	494,000	\$ 494,000																								
8	Liquid Ammonium Sulfate (LAS)	EA	1	\$	494,000	\$ 494,000																								
Subtotal						\$ 4,248,400																								
RO System																														
1	RO equipment	LS	1	\$	14,265,513	\$ 14,265,500																								
2	RO Pump VFDs	EA	16	\$	200,000	\$ 3,200,000																								
3	RO Feed Tank (20,000 gal)	EA	1	\$	200,000	\$ 200,000																								
4	RO Transfer Pumps (40 HP)	EA	2	\$	60,000	\$ 120,000																								
5	RO Flush Tank (4,000 gal)	EA	1	\$	50,000	\$ 50,000																								
6	RO Flush Pump (5 HP)	EA	2	\$	7,500	\$ 15,000																								
7	Energy Recovery and Booster Pump 50 HP)	EA	3	\$	50,000	\$ 150,000																								

8	ROC and Off-spec water holding tank	LS	1	\$	300,000	\$	300,000
9	ROC Pumps (50 HP)	EA	2	\$	37,500	\$	75,000
					Subtotal	\$	18,375,500
	UV System						
1	Spektron 200e Reactor	LS	1	\$	471,350	\$	471,400
					Subtotal	\$	471,400
	Equipment Install/Markup	LS	0.60	\$	27,055,000	\$	16,233,000
					Mechanical Subtotal	\$	43,288,300
Electrical and Instrumentation for Equipment							
No.	Item	Unit	Quantity	Unit Cost		Cost	
	Electrical	LS	0.25	\$	43,288,300	\$	10,822,000
	Instrumentation	LS	0.25	\$	43,288,300	\$	10,822,000
					E&IC Subtotal	\$	21,644,000
Process Piping							
No.	Item	Unit	Quantity	Unit Cost		Cost	
	RO System						
1	Piping (off skid) and supports	LS	1	\$	300,000	\$	300,000
2	Valves (off skid)	LS	1	\$	150,000	\$	150,000
3	Flow Meters (off skid)	LS	1	\$	150,000	\$	150,000
4	On-line Analyzers	LS	1	\$	100,000	\$	100,000
					Subtotal	\$	700,000
	Misc Piping (Filters, ROC holding tank, etc)						
1	Piping (off skid)	LS	1	\$	300,000	\$	300,000
2	Valves (off skid)	LS	1	\$	100,000	\$	100,000
3	Flow Meters	LS	5	\$	100,000	\$	500,000
4	Misc	LS	1	\$	100,000	\$	100,000
					Subtotal	\$	1,000,000
	UV System						
1	Piping	LS	1	\$	65,590	\$	65,600
2	Valves	LS	1	\$	57,809	\$	57,800
3	Flow Meters	LS	1	\$	86,400	\$	86,400
4	Misc	LS	1	\$	20,980	\$	21,000
					Subtotal	\$	230,800
	Process Piping Installation/Mark-up	LS	0.50	\$	1,931,000	\$	966,000
					Process Piping Subtotal	\$	2,896,800
Control System and Security							
No.	Item	Unit	Quantity	Unit Cost		Cost	
	All Systems on Site						
1	PLCs, SCADA, Telemetry, Security	LS	1	\$	1,000,000	\$	1,000,000
					Control System and Security Subtotal	\$	1,000,000
Total of All Direct Costs						\$	81,530,000
Construction Contingency		30%				\$	24,459,000
Subtotal						\$	105,989,000
Sales Tax (SLO County) Applied to 50% of construction costs		7.25%				\$	3,842,000
Subtotal						\$	109,831,000
Contractor OH, Markup, and GC's		15%				\$	16,474,700
Treatment Building Total						Total \$	126,306,000

Ocean Outfall Retrofit and Connection to Existing		
Number of Ports		35
Pipeline Rehab	\$	2,250,000
Port Replacement	\$	350,000
Duckbill Check Valve	\$	42,000
Barge Handling	\$	150,000
Marine Mammal Monitoring	\$	125,000
Cleaning	\$	280,000
Total Direct Costs	\$	3,197,000
General Conditions (10%)	\$	319,700
Mobilization (20%)	\$	639,400
Contingency (30%)	\$	959,100
Total Costs	\$	5,115,200
Outfall Total (up to the nearest \$250k)	\$	5,250,000

	Includes Flows (AFY)	Length (ft)	Q - Flow (gpm - Max D	Q - Flow (cfs)	Diameter (in)	Inner Diameter (ft)	Area (ft^2)	Velocity (fps)	C - Friction Factor (PVC)	H - Headloss (ft)	Headloss Rate (ft/1000 ft)	Unit Cost	Direct Cost
Desalination Intake Pipeline	16270	3465	10087.4	22.19228	30	2.5	4.908738521	4.520974157	110	9.76	2.817547503	\$ 650.00	\$ 2,252,191.37
Total Capital Cost													
(1) Includes 30% construction cost contingency, sales tax, contractor overhead and profit													
Total of Pipeline Direct Costs				\$	2,252,200								
	30%			\$	675,700								
Subtotal				\$	2,927,900								
Sales Tax (SLO County) Appl	7.25%				\$106,100								
Subtotal				\$	3,034,000								
Contractor OH, Markup, and	15%			\$	455,100								
Subtotal	%/Month	Months	Total	\$	3,489,100								
Escalation to Mid Point (% p	0.00%	212.00	0.00%		\$0								
Subtotal				\$	3,489,100								
Intake Pipeline Total (to the nearest \$1k)					\$3,490,000								

Subsurface Wells

Slant Wells

Assume Capacity1200 gpm

Well Drilling			QTY		
Well Drilling Cost	\$2,000	per foot	1500	\$	3,000,000
Equipping	10%	per well	1	\$	300,000
Well Motor Cost	\$4,500	per HP	325	\$	1,462,500
Concrete Pad and Pedestals	\$8,000	each	1		\$8,000
Testing	\$10,000	each	1		\$10,000
			Well Install Cost	\$	4,780,500
Civil (100' by 100' site)					
Vegetation Removal	\$ 2	SF	10000		\$20,000
Rough grading	\$ 4	SF	10000		\$40,000
Gravel	\$ 25	SF	10000		\$250,000
Access Road	\$ 50	LF	50		\$2,500
Perimeter Fencing	\$ 150	LF	400		\$60,000
Access Gate	\$ 3,000	ea	1		\$3,000
20' by 40' CMU building	\$ 1,000	SF	800		\$800,000
Site Lighting	\$ 2,000	ea	4		\$8,000
			Total Civil		\$1,183,500
Above Ground Mechanical					
CARV	\$ 2,500	ea	4	\$	10,000
Sample Port	\$ 500	ea	2	\$	1,000
Pressure Gauge	\$ 500	ea	4	\$	2,000
Dismantling Joint	\$ 2,500	ea	6	\$	15,000
Check Valve	\$ 10,000	ea	2	\$	20,000
Magnetic Flowmeter	\$ 15,000	ea	2	\$	30,000
Butterfly Valve	\$ 8,000	ea	4	\$	32,000
90 degree reducing 90	\$ 5,000	ea	2	\$	10,000
90 degree elbow	\$ 3,500	ea	2	\$	7,000
Pipe Spools	\$ 250	LF	40	\$	10,000
Pipe Supports	\$ 750	ea	12	\$	9,000
			Total Mechanical	\$	146,000
EPIC	25%	of Mech+civil+dr	1	\$	1,527,500
General					
Mobilization	8.00%	LS	1	\$	611,000
Demobilization	2.00%	LS	1	\$	152,750
SWPPP BMPs	2.50%	LS	1	\$	190,938
Environmental Mitigation M	0.50%	LS	1	\$	38,188
			Total General	\$	992,900
			Single Well Direct Costs	\$	8,630,400
			Total No. of Wells	\$	9
Total of All Direct Costs				\$	77,673,600
Construction Contingency	30%			\$	23,302,100
Subtotal				\$	100,975,700
Sales Tax (SLO County) Appl	7.25%			\$	3,660,400
Subtotal				\$	104,636,100
Contractor OH, Markup, and	15%			\$	15,695,400
Intake Wells Total (to the nearest \$1k)				\$	120,332,000

	Includes Flows	Length (ft)	Q - Flow (gpm - Max Discharge)	Q - Flow (cfs)	Diameter (in)	Inner Diameter (ft)	Area (ft^2)	Velocity (fps)	C - Friction Factor (PVC)	H - Headloss (ft)	Headloss Rate (ft/1000 ft)	Unit Cost	Direct Cost
Outfall Discharge Pipe	8,135	500	5043.7	11.09614	24	2	3.141592654	3.53201106	110	1.16	2.316954569	\$ 600.00	\$ 300,000.00

Total of Pipeline Direct Costs		\$	300,000
	30%	\$	90,000
Subtotal		\$	390,000
Sales Tax (SLO County) Applied to 50% of construction costs	7.25%		\$14,100
Subtotal		\$	404,100
Contractor OH, Markup, and GC's	15%	\$	60,600
Discharge Pipeline Total (to the nearest \$1k)			\$465,000

ALTERNATIVE D

Soft Costs
Factors

Project Component	Cost*	Notes
Ocean Outfall Improvements	\$ 5,250,000	
Ocean Water Extraction Conveyance	\$ 7,139,000	
Subsurface Extraction Wells	\$ 87,137,000	
Brine Discharge Conveyance	\$ 1,502,000	
Treated Water Transmission	\$ 87,697,000	
Treated Water Pump Stations	\$ 14,718,000	
Ocean Water Treatment Plant Costs	\$ 141,254,000	
Total Construction Cost ⁽¹⁾	\$ 344,697,000	
5% Planning	\$ 17,230,000	
10% Engineering and Design	\$ 34,470,000	
10% Environmental Permitting	\$ 34,470,000	
5% Administrative and Legal	\$ 17,230,000	
10% ESDC, Inspection and Construction Management	\$ 34,470,000	
Soft Costs Subtotal	\$ 137,870,000	
Total Capital Cost	\$ 482,567,000	

(1) Includes 30% construction cost contingency, sales tax, contractor overhead and profit

*All costs include	
Construction Contingency	30%
Contractor OH, Markup, and GC's	15%
SLO County Sales Tax applied to 50% of construction costs	7.25%

[California City and County Sales and Use Tax Rates - Cities, Counties and Tax Rates - California Department of Tax and Fee Administration](#)

Construction Cost Breakdown	
Project Component	Estimated Costs
Ocean Intake Infrastructure	\$ 94,276,000
Brine Discharge Infrastructure	\$ 6,752,000
Treatment Facility	\$ 141,254,000
Treated Water Infrastructure	\$ 20,783,000
To Nipomo Pipeline Segment	\$ 18,866,000
To Lopez Pipeline Pipeline Segment	\$ 17,324,000
To SLO Pipeline Segment	\$ 27,684,000
To Los Osos Pipeline Segment	\$ 17,758,000
Total Estimated Construction Costs	\$ 344,697,000

Alternative D O&M Cost info		
Power Costs	\$ 0.50	per kWh
Pipeline O&M Factor	2%	of total direct costs
Site Maintenance	0.50%	of total site costs of PS
Well Pump Motor Lifecycle	20	years
Pipeline Lifecycle	75	years
Pump Station Annual Maintnenace	8%	per year
Inflation %	2.50%	per year
Discount Rate	3.25%	per year
Interest Rate	2%	Assume Drinking Water SRF Low interest loan
Loan Term	30	years

Offsite Facilities Annual O&M Costs			
Ocean Water Extraction			
Pumping Power	\$	8,492,032	\$ 8,493,000
Pumping O&M Costs	\$	4,499,696	\$ 4,500,000
Pumping Site O&M Costs	\$	281,231	\$ 282,000
Subtotal	\$	13,272,959	\$ 13,275,000
Ocean Water Conveyance			
Pipeline O&M Costs	\$	92,158	\$ 93,000
Subtotal	\$	92,158	\$ 93,000
Brine Conveyance			
Pipeline O&M Costs	\$	19,380	\$ 20,000
Subtotal	\$	19,380	\$ 20,000
Treated Water Pump Stations			
Pumping Power	\$	2,286,316	\$ 2,287,000
Pumping O&M Costs	\$	280,000	\$ 280,000
Pumping Site O&M Costs	\$	17,500	\$ 18,000
Subtotal	\$	2,583,816	\$ 2,585,000
Treated Water Transmission			
Pipeline O&M Costs	\$	1,132,160	\$ 1,133,000
Subtotal	\$	1,132,160	\$ 1,133,000
Outfall			
Annual Inspection	\$	125,000	\$ 125,000
5-year Cleaning (annualized cost)	\$	56,000	\$ 56,000
Subtotal	\$	181,000	\$ 181,000

Treatment Facility Annual O&M Costs			
UV System	\$222,489.00	\$	223,000
RO System	\$37,887,795.49	\$	37,888,000
Pretreatment System	\$101,437.07	\$	102,000
Subtotal	\$ 38,211,722	\$	38,213,000

Total Offsite O&M	\$	17,281,472.80	\$	17,287,000.00
Total Treatment Facility O&M	\$	38,213,000.00	\$	38,210,000.00
Total Project Alternative O&M	\$	55,494,472.80	\$	55,497,000

Equipment Replacement Costs	Direct Costs	Notes
Subsurface Extraction Wells	\$ 2,400,000	<i>equipping costs x # of wells</i>
Treated Water Distribution PS	\$ 3,500,000	<i>Total Direct Costs of PS</i>
Total Equipment Replacement Costs	\$ 5,900,000	<i>assuming replacement @ 15years over 2 years</i>

[illegible]

NPV of Project Costs	\$1,873,415,962
Annual Costs	\$62,447,199
Production Volume	6,825
Annualized Unit Cost (\$/AFY)	\$9,150

SLO COUNTY DESAL-ALT D SLO COUNTY WWTP TREATMENT BUILDING COSTS

Treatment Building Footprint	Quantity	Unit
Wall Height	25	ft
Wall Length	230	ft
Wall Width	123	ft
Total Footprint	28290	sq ft.
Total Perimeter	706.00	lin-ft

SITE WORK

No.	Item	Unit	Quantity	Unit Cost	Cost
1	Gravel subgrade	CY	1,048	\$ 65	\$ 68,000
2	Sidewalks	SF	2,824	\$ 35	\$ 99,000
3	Demolition and Haul	SF	279,000	\$ 1	\$ 279,000
4	Excavation and Haul	CY	1,153	\$ 25	\$ 29,000
6	Paving/Asphalt	SF	84,000	\$ 7	\$ 588,000
7	Landscaping	LS	1	\$ 50,000	\$ 50,000
9	Structural Fill	CY	1,048	\$ 90	\$ 94,000
10	Compaction	CY	2,096	\$ 40	\$ 84,000
12	Mods to Existing Manhole	LS	0	\$ -	\$ -
13	Dewatering	LS	0	\$ -	\$ -
14	Misc Yard Piping	LS	0	\$ -	\$ -
Site Work Subtotal					\$ 1,291,000

TREATMENT BUILDING

Structural					
No.	Item	Unit	Quantity	Unit Cost	Cost
1	Slab on Grade	CY	2,620	\$ 1,700.00	\$ 4,454,000
2	Concrete Walls	CY		\$ 2,300.00	\$ -
3	Veneer	SF	17,650	\$ 35.00	\$ 617,750
4	Masonry	SF	17,650	\$ 55.00	\$ 970,750
5	Masonry	SF		\$ 55.00	\$ -
6	Suspended Slab	CY		\$ 2,300.00	\$ -
7	Existing Basin - New Walls	SF	0	\$ -	\$ -
8	Existing Basin - Elevated Channel	SF	0	\$ -	\$ -
9	Misc Modifications/Repairs	LS	0	\$ 50,000.00	\$ -
10	Stairs/Grating	LS	0	\$ 20,000.00	\$ -
11	Handrail, OSHA	LF	0	\$ 89.00	\$ -
12	Misc. Metals	LS	1	\$ 75,000.00	\$ 75,000
13	Coating/Paintings	LS	1	\$ 50,000.00	\$ 50,000
14	Windows/Doors	LS	1	\$ 132,000	\$ 132,000
15	Roof	SF	28,290	\$ 160.00	\$ 4,526,400
16	Piles	EA	0	\$ -	\$ -
17	Columns	EA	6	\$ 2,000.00	\$ 12,000
Structural Subtotal					\$ 10,837,900

Mechanical

No.	Item	Unit	Quantity	Unit Cost	Cost
Building					
1	HVAC	LS	1	\$ 600,000	\$ 600,000
2	Lighting	LS	1	\$ 600,000	\$ 600,000
3	Plumbing/Drainage	LS	1	\$ 600,000	\$ 600,000
Subtotal					\$ 1,800,000
Pressure Filter and Tanks					
1	Filter Vessel (6 vessels = 5+1 standby)	LS	6	\$ 300,000	\$ 1,800,000
2	Backwash Storage Tank and foundation	LS	1	\$ 300,000	\$ 300,000
3	Backwash Pumps (40 HP)	EA	2	\$ 30,000	\$ 60,000
Subtotal					\$ 2,160,000
Chemical Storage and Metering Systems					
1	Polymer	EA	1	\$ 494,000	\$ 494,000
2	Sulfuric Acid	EA	1	\$ 592,800	\$ 592,800
3	Sodium Hydroxide	EA	1	\$ 592,800	\$ 592,800
4	Sodium Hypochlorite	EA	1	\$ 494,000	\$ 494,000
5	Calcium Chloride	EA	1	\$ 494,000	\$ 494,000
6	Sodium Bisulfite	EA	1	\$ 592,800	\$ 592,800
7	Scale Inhibitor	EA	1	\$ 494,000	\$ 494,000
8	Liquid Ammonium Sulfate (LAS)	EA	1	\$ 494,000	\$ 494,000
Subtotal					\$ 4,248,400
RO System					
1	RO equipment	LS	1	\$ 12,562,520	\$ 12,562,500
2	RO Pump VFDs	EA	14	\$ 200,000	\$ 2,800,000
3	RO Feed Tank (20,000 gal)	EA	1	\$ 200,000	\$ 200,000
4	RO Transfer Pumps (40 HP)	EA	2	\$ 60,000	\$ 144,000
5	RO Flush Tank (4,000 gal)	EA	1	\$ 50,000	\$ 50,000
6	RO Flush Pump (5 HP)	EA	2	\$ 7,500	\$ 15,000
7	Energy Recovery and Booster Pump 50 HP)	EA	3	\$ 50,000	\$ 150,000

8	ROC and Off-spec water holding tank	LS	1	\$	300,000	\$	300,000
9	ROC Pumps (50 HP)	EA	2	\$	37,500	\$	75,000
					Subtotal	\$	16,296,500
UV System							
1	Spektron 200e Reactor	LS	1	\$	471,350	\$	471,400
					Subtotal	\$	471,400
	Equipment Install/Markup	LS	0.60	\$	24,976,000	\$	14,986,000
					Mechanical Subtotal	\$	49,952,300
Electrical and Instrumentation for Equipment							
No.	Item	Unit	Quantity		Unit Cost		Cost
1	Electrical	LS	0.25	\$	49,952,300	\$	12,488,000
2	Instrumentation	LS	0.25	\$	49,952,300	\$	12,488,000
					E&IC Subtotal	\$	24,976,000
Process Piping							
No.	Item	Unit	Quantity		Unit Cost		Cost
RO System							
1	Piping (off skid) and supports	LS	1	\$	300,000	\$	300,000
2	Valves (off skid)	LS	1	\$	150,000	\$	150,000
3	Flow Meters (off skid)	LS	1	\$	150,000	\$	150,000
4	On-line Analyzers	LS	1	\$	150,000	\$	150,000
					Subtotal	\$	750,000
Misc Piping (Filters, ROC holding tank, etc)							
1	Piping (off skid)	LS	1	\$	300,000	\$	300,000
2	Valves (off skid)	LS	1	\$	100,000	\$	100,000
3	Flow Meters	LS	5	\$	100,000	\$	500,000
4	Misc	LS	1	\$	200,000	\$	200,000
					Subtotal	\$	1,100,000
UV System							
1	Piping	LS	1	\$	65,590	\$	65,600
2	Valves	LS	1	\$	57,809	\$	57,800
3	Flow Meters	LS	1	\$	86,400	\$	86,400
4	Misc	LS	1	\$	20,980	\$	21,000
					Subtotal	\$	230,800
	Process Piping Installation/Mark-up	LS	0.50	\$	2,081,000	\$	1,041,000
					Process Piping Subtotal	\$	3,121,800
Control System and Security							
No.	Item	Unit	Quantity		Unit Cost		Cost
All Systems on Site							
1	PLCs, SCADA, Telemetry, Security	LS	1	\$	1,000,000	\$	1,000,000
					Control System and Security Subtotal	\$	1,000,000
Total of All Direct Costs						\$	91,179,000
Construction Contingency		30%				\$	27,353,700
Subtotal						\$	118,532,700
Sales Tax (SLO County) Applied to 50% of construction cost		7.25%				\$	4,296,800
Subtotal						\$	122,829,500
Contractor OH, Markup, and GC's		15%				\$	18,424,400
Treatment Building Total						\$	141,254,000

Ocean Outfall Retrofit and Connection to Existing		
Number of Ports		35
Connection to existing, junction and mechanical	\$	2,250,000
Port Replacement	\$	350,000
Duckbill Check Valve	\$	42,000
Barge Handling	\$	150,000
Marine Mammal Monitoring	\$	125,000
Cleaning	\$	280,000
Total Direct Costs	\$	3,197,000
General Conditions (10%)	\$	319,700
Mobilization (20%)	\$	639,400
Contingency (30%)	\$	959,100
Total Costs	\$	5,115,200
Outfall Total (up to the nearest \$250k)	\$	5,250,000

	Includes Flows (AFY)	Length (ft)	Q - Flow (gpm - Max D	Q - Flow (cfs)	Diameter (in)	Inner Diameter (ft)	Area (ft^2)	Velocity (fps)	C - Friction Factor (PVC)	H - Headloss (ft)	Headloss Rate (ft/1000 ft)	Unit Cost (LF	Direct Cost
Desalination Intake Pipeline	13650	7680	8463	18.6186	30	2.5	4.908738521	3.792950046	110	15.64	2.036102696	\$ 600.00	\$ 4,607,858.37

Total of Pipeline Direct Costs				4,607,900
	30%			\$ 1,382,400
Subtotal				\$ 5,990,300
Sales Tax (SLO County) Applied to 50% of construction costs	7.25%			\$217,100
Subtotal				\$ 6,207,400
Contractor OH, Markup, and GC's	15%			\$ 931,100
Intake Pipeline Total (to the nearest \$1k)				\$7,139,000

Subsurface Wells

Assume Capacity

1200 gpm

Well Drilling			QTY	
Well Drilling Cost	\$2,000	per foot	1500	\$ 3,000,000
Equipping	10%	per well	1	\$ 300,000
Well Motor Cost	\$2,000	per HP	325	\$ 650,000
Concrete Pad and Pedestals	\$8,000	each	1	\$8,000
Testing	\$10,000	each	1	\$10,000
			Well Install Cost	\$ 3,968,000
Civil (100' by 100' site)				
Vegetation Removal	\$ 2	SF	10000	\$20,000
Rough grading	\$ 4	SF	10000	\$40,000
Gravel	\$ 25	SF	10000	\$250,000
Access Road	\$ 50	LF	50	\$2,500
Perimeter Fencing	\$ 150	LF	400	\$60,000
Access Gate	\$ 3,000	ea	1	\$3,000
20' by 40' CMU building	\$ 600	SF	800	\$480,000
Site Lighting	\$ 2,000	ea	4	\$8,000
			Total Civil	\$863,500
Above Ground Mechanical				
CARV	\$ 2,500	ea	4	\$ 10,000
Sample Port	\$ 500	ea	2	\$ 1,000
Pressure Gauge	\$ 500	ea	4	\$ 2,000
Dismantling Joint	\$ 2,500	ea	6	\$ 15,000
Check Valve	\$ 10,000	ea	2	\$ 20,000
Magnetic Flowmeter	\$ 15,000	ea	2	\$ 30,000
Butterfly Valve	\$ 8,000	ea	4	\$ 32,000
90 degree reducing 90	\$ 5,000	ea	2	\$ 10,000
90 degree elbow	\$ 3,500	ea	2	\$ 7,000
Pipe Spools	\$ 250	LF	40	\$ 10,000
Pipe Supports	\$ 750	ea	12	\$ 9,000
			Total Mechanical	\$ 146,000
EPIC	25%	of Mech+civil+dr	1	\$ 1,244,375
General				
Mobilization	8.00%	LS	1	\$ 497,750
Demobilization	2.00%	LS	1	\$ 124,438
SWPPP BMPs	2.50%	LS	1	\$ 155,547
Environmental Mitigation Measures	0.50%	LS	1	\$ 31,109
			Total General	\$ 808,900
			Single Well Direct Costs	\$ 7,030,775
			Total No. of Wells	\$ 8
Total of All Direct Costs				\$ 56,246,200
Construction Contingency	30%			\$ 16,873,860
Subtotal				\$ 73,120,060
Sales Tax (SLO County) Applied to 50% of construction costs	7.25%			\$ 2,650,602
Subtotal				\$ 75,770,662
Contractor OH, Markup, and GC's	15%			\$ 11,365,599
Intake Wells Total (to the nearest \$1k)				\$ 87,137,000

	Includes Flows	Length (ft)	Q - Flow (gpm - Max Discharge)	Q - Flow (cfs)	Diameter (in)	Inner Diameter (ft)	Area (ft^2)	Velocity (fps)	C - Friction Factor (PVC)	H - Headloss (ft)	Headloss Rate (ft/1000 ft)	Unit Cost	Direct Cost	
Outfall Discharge Pipe		6,825	1615	4231.5	9.3093	24	2	3.141592654	2.963242223	110	2.70	1.674348858	\$ 600.00	\$ 968,998.36

Total of Pipeline Direct Costs		\$	969,000
	30%	\$	290,700
Subtotal		\$	1,259,700
Sales Tax (SLO County) Applied to 50% of construction costs	7.25%		\$45,700
Subtotal		\$	1,305,400
Contractor OH, Markup, and GC's	15%	\$	195,800
Discharge Pipeline Total (to the nearest \$1k)			\$1,502,000

ALTERNATIVE E

Soft Costs
Factors

Project Component		Cost*	Notes
Ocean Outfall Improvements		\$ 6,250,000	
Ocean Water Extraction Conveyance		\$ 18,663,000	
Subsurface Extraction Wells		\$ 32,282,000	
Brine Discharge Conveyance		\$ 6,522,000	
Treated Water Transmission		\$ 35,969,000	
Treated Water Pump Stations		\$ 10,458,000	
Ocean Water Treatment Plant Costs		\$ 71,350,000	
Total Construction Cost ⁽¹⁾		\$ 181,494,000	
5%	Planning	\$ 9,070,000	
10%	Engineering and Design	\$ 18,150,000	
10%	Environmental Permitting	\$ 18,150,000	
5%	Administrative and Legal	\$ 9,070,000	
10%	ESDC, Inspection and Construction Management	\$ 18,150,000	
Soft Costs Subtotal		\$ 72,590,000	
Total Capital Cost		\$ 254,084,000	

(1) Includes 30% construction cost contingency, sales tax, contractor overhead and profit

*All costs include	
Construction Contingency	30%
Contractor OH, Markup, and GC's	15%
SLO County Sales Tax applied to 50% of construction costs	7.25%

[California City and County Sales and Use Tax Rates - Cities, Counties and Tax Rates - California Department of Tax and Fee Administration](#)

Construction Cost Breakdown	
Project Component	Estimated Costs
Ocean Intake Infrastructure	\$ 50,945,000
Brine Discharge Infrastructure	\$ 12,772,000
Treatment Facility	\$ 71,350,000
Treated Water Infrastructure	\$ 17,823,000
To Nipomo CSD Pipeline Segment	\$ 14,373,000
To SB County Pipeline Segment	\$ 1,076,000
To South County Pipeline Segment	\$ 13,155,000
Total Estimated Construction Costs	\$ 181,494,000

Alternative E O&M Cost info		
Power Costs	\$ 0.50	per kWh
Pipeline O&M Factor	2%	of total direct costs
Site Maintenance	0.50%	of total site costs of PS
Well Pump Motor Lifecycle	20	years
Pipeline Lifecycle	75	years
Pump Station Annual Maintnenace	8%	per year
Inflation %	2.50%	per year
Discount Rate	3.25%	per year
Interest Rate	2%	Assume Drinking Water SRF Low interest loan
Loan Term	30	years

Offsite Facilities Annual O&M Costs			
Ocean Water Extraction			
Pumping Power	\$	2,155,670	\$ 2,156,000
Pumping O&M Costs	\$	1,667,032	\$ 1,668,000
Pumping Site O&M Costs	\$	104,190	\$ 105,000
Subtotal	\$	3,926,891	\$ 3,929,000
Ocean Water Conveyance			
Pipeline O&M Costs	\$	240,928	\$ 241,000
Subtotal	\$	240,928	\$ 241,000
Brine Conveyance			
Pipeline O&M Costs	\$	84,188	\$ 85,000
Subtotal	\$	84,188	\$ 85,000
Treated Water Pump Stations			
Pumping Power	\$	489,925	\$ 490,000
Pumping O&M Costs	\$	60,000	\$ 60,000
Pumping Site O&M Costs	\$	3,750	\$ 4,000
Subtotal	\$	553,675	\$ 554,000
Treated Water Transmission			
Pipeline O&M Costs	\$	464,358	\$ 465,000
Subtotal	\$	464,358	\$ 465,000
Outfall			
Annual Inspection	\$	108,000	\$ 108,000
5-year Cleaning (annualized cost)	\$	272,000	\$ 272,000
Subtotal	\$	380,000	\$ 380,000

Treatment Facility Annual O&M Costs			
UV System	\$134,837.10	\$	135,000
RO System	\$14,399,943.92	\$	14,400,000
Pretreatment System	\$50,775.41	\$	51,000
Subtotal	\$ 14,585,556	\$	14,586,000

Total Offsite O&M	\$	5,650,040	\$	5,654,000
Total Treatment Facility O&M	\$	14,586,000	\$	14,590,000
Total Project Alternative O&M	\$	20,236,040	\$	20,244,000

Equipment Replacement Costs	Direct Costs	Notes
Subsurface Extraction Wells	\$ 900,000	<i>equipping costs x # of wells</i>
Treated Water Distribution PS	\$ 750,000	<i>Total Direct Costs of PS</i>
Total Equipment Replacement Costs	\$ 1,650,000	<i>assuming replacement @ 15years over 2 years</i>

[illegible]

NPV of Project Costs	\$747,036,019
Annual Costs	\$24,901,201
Production Volume	1,905
Annualized Unit Cost (\$/AFY)	\$13,071

SLO COUNTY DESAL-ALT E NIPOMO MESA AREA TREATMENT BUILDING COSTS

Treatment Building Footprint	Quantity	Unit
Wall Height	25	ft
Wall Length	186	ft
Wall Width	81	ft
Total Footprint	15,066	sq ft.
Total Perimeter	534	lin-ft

SITE WORK

No.	Item	Unit	Quantity	Unit Cost	Cost
1	Gravel subgrade	CY	558	\$ 65	\$ 36,000
2	Sidewalks	SF	2,136	\$ 35	\$ 75,000
3	Demolition and Haul	SF	166,000	\$ 1	\$ 166,000
4	Excavation and Haul	CY	614	\$ 25	\$ 15,000
6	Paving/Asphalt	SF	50,000	\$ 7	\$ 350,000
7	Landscaping	LS	1	\$ 50,000	\$ 50,000
9	Structural Fill	CY	558	\$ 90	\$ 50,000
10	Compaction	CY	1,116	\$ 40	\$ 45,000
12	Mods to Existing Manhole	LS	0	\$ -	\$ -
13	Dewatering	LS	0	\$ -	\$ -
14	Misc Yard Piping	LS	0	\$ -	\$ -
				Site Work Subtotal	\$ 787,000

TREATMENT BUILDING

Structural					
No.	Item	Unit	Quantity	Unit Cost	Cost
1	Slab on Grade	CY	1,395	\$ 1,700.00	\$ 2,371,500
2	Concrete Walls	CY		\$ 2,300.00	\$ -
3	Veneer	SF	13,350	\$ 35.00	\$ 467,250
4	Masonry	SF	13,350	\$ 55.00	\$ 734,250
5	Masonry	SF		\$ 55.00	\$ -
6	Suspended Slab	CY		\$ 2,300.00	\$ -
7	Existing Basin - New Walls	SF	0	\$ -	\$ -
8	Existing Basin - Elevated Channel	SF	0	\$ -	\$ -
9	Misc Modifications/Repairs	LS	0	\$ 50,000.00	\$ -
10	Stairs/Grating	LS	0	\$ 20,000.00	\$ -
11	Handrail, OSHA	LF	0	\$ 89.00	\$ -
12	Misc. Metals	LS	1	\$ 75,000.00	\$ 75,000
13	Coating/Paintings	LS	1	\$ 50,000.00	\$ 50,000
14	Windows/Doors	LS	1	\$ 77,000	\$ 77,000
15	Roof	SF	15,066	\$ 160.00	\$ 2,410,560
16	Piles	EA	0	\$ -	\$ -
17	Columns	EA	12	\$ 2,000.00	\$ 24,000
				Structural Subtotal	\$ 6,209,560

Mechanical

No.	Item	Unit	Quantity	Unit Cost	Cost
Building					
1	HVAC	LS	1	\$ 200,000	\$ 200,000
2	Lighting	LS	1	\$ 200,000	\$ 200,000
3	Plumbing/Drainage	LS	1	\$ 200,000	\$ 200,000
				Subtotal	\$ 600,000
Pressure Filter and Tanks					
1	Filter Vessel (2 vessels = 1+1 standby)	LS	2	\$ 300,000	\$ 600,000
2	Backwash Storage Tank and foundation	LS	1	\$ 300,000	\$ 300,000
3	Backwash Pumps (40 HP)	EA	2	\$ 30,000	\$ 60,000
				Subtotal	\$ 960,000
Chemical Storage and Metering Systems					
1	Polymer	EA	1	\$ 494,000	\$ 494,000
2	Sulfuric Acid	EA	1	\$ 592,800	\$ 592,800
3	Sodium Hydroxide	EA	1	\$ 592,800	\$ 592,800
4	Sodium Hypochlorite	EA	1	\$ 494,000	\$ 494,000
5	Calcium Chloride	EA	1	\$ 494,000	\$ 494,000
6	Sodium Bisulfite	EA	1	\$ 592,800	\$ 592,800
7	Scale Inhibitor	EA	1	\$ 494,000	\$ 494,000
8	Liquid Ammonium Sulfate (LAS)	EA	1	\$ 494,000	\$ 494,000
				Subtotal	\$ 4,248,400
RO System					
1	RO equipment	LS	1	\$ 6,402,640	\$ 6,402,600
2	RO Pump VFDs	EA	10	\$ 200,000	\$ 2,000,000
3	RO Feed Tank (20,000 gal)	EA	1	\$ 200,000	\$ 200,000
4	RO Transfer Pumps (40 HP)	EA	2	\$ 60,000	\$ 120,000
5	RO Flush Tank (4,000 gal)	EA	1	\$ 50,000	\$ 50,000
6	RO Flush Pump (5 HP)	EA	2	\$ 7,500	\$ 15,000
7	Energy Recovery and Booster Pump 50 HP)	EA	3	\$ 50,000	\$ 150,000
8	ROC and Off-spec water holding tank	LS	1	\$ 300,000	\$ 300,000

9	ROC Pumps (50 HP)	EA	2	\$	37,500	\$	75,000
	UV System				Subtotal	\$	9,312,600
1	Spektron 200e Reactor	LS	1	\$	282,500	\$	282,500
					Subtotal	\$	282,500
	<i>Equipment Install/Markup</i>	LS	0.60	\$	15,570,000	\$	9,342,000
					Mechanical Subtotal	\$	24,745,500
Electrical and Instrumentation for Equipment							
No.	Item	Unit	Quantity		Unit Cost		Cost
1	Electrical	LS	0.25	\$	24,745,500	\$	6,186,000
2	Instrumentation	LS	0.25	\$	24,745,500	\$	6,186,000
					E&IC Subtotal	\$	12,372,000
Process Piping							
No.	Item	Unit	Quantity		Unit Cost		Cost
	RO System						
1	Piping (off skid) and supports	LS	1	\$	100,000	\$	100,000
2	Valves (off skid)	LS	1	\$	50,000	\$	50,000
3	Flow Meters (off skid)	LS	1	\$	50,000	\$	50,000
4	On-line Analyzers	LS	1	\$	50,000	\$	50,000
					Subtotal	\$	250,000
	Misc Piping (Filters, ROC holding tank, etc)						
1	Piping (off skid)	LS	1	\$	100,000	\$	100,000
2	Valves (off skid)	LS	1	\$	30,000	\$	30,000
3	Flow Meters	LS	5	\$	10,000	\$	50,000
4	Misc	LS	1	\$	50,000	\$	50,000
					Subtotal	\$	230,000
	UV System						
1	Piping	LS	1	\$	37,306	\$	37,300
2	Valves	LS	1	\$	48,875	\$	48,900
3	Flow Meters	LS	1	\$	48,000	\$	48,000
4	Misc	LS	1	\$	13,420	\$	13,400
					Subtotal	\$	147,600
	<i>Process Piping Installation/Mark-up</i>	LS	0.50	\$	628,000	\$	314,000
					Process Piping Subtotal	\$	941,600
Control System and Security							
No.	Item	Unit	Quantity		Unit Cost		Cost
	All Systems on Site						
1	PLCs, SCADA, Telemetry, Security	LS	1	\$	1,000,000	\$	1,000,000
					Control System and Security Subtotal	\$	1,000,000
Total of All Direct Costs						\$	46,056,000
Construction Contingency		30%				\$	13,816,800
Subtotal						\$	59,872,800
Sales Tax (SLO County) Applied to 50% of construction costs		7.25%				\$	2,170,400
Subtotal						\$	62,043,200
Contractor OH, Markup, and GC's		15%				\$	9,306,500
Treatment Building Total						\$	71,350,000

Ocean Outfall Retrofit and Connection to Existing		
Number of Ports		170
Connection to existing	\$	50,000
Port Replacement	\$	1,700,000
Duckbill Check Valve	\$	204,000
Barge Handling	\$	120,000
Marine Mammal Monitoring	\$	108,000
Cleaning	\$	1,360,000
New Diffuser Infrastructure	\$	224,400
Total Direct Costs	\$	3,766,400
General Conditions (10%)	\$	376,640
Mobilization (20%)	\$	753,280
Contingency (30%)	\$	1,129,920
Total Costs	\$	6,026,240
Outfall Total (up to the nearest \$250k)	\$	6,250,000

	Includes Flows (AFY)	Length (ft)	Q - Flow (gpm - Max Discharge)	Q - Flow (cfs)	Diameter (in)	Inner Diameter (ft)	Area (ft^2)	Velocity (fps)	C - Friction Factor (PVC)	H - Headloss (ft)	Headloss Rate (ft/1000 ft)	Unit Cost	Direct Cost
Desalination Intake Pipeline	3810	15058	2362.2	5.19684	16	1.333333333	1.396263402	3.721962485	110	61.77	4.10234021	\$ 800.00	\$12,046,355.73

Total of Pipeline Direct Costs				\$ 12,046,400
	30%			\$ 3,613,900
Subtotal				\$ 15,660,300
Sales Tax (SLO County) Applied to 50% of construction costs	7.25%			\$567,700
Subtotal				\$ 16,228,000
Contractor OH, Markup, and GC's	15%			\$ 2,434,200
Intake Pipeline Total (to the nearest \$1k)				\$18,663,000

Subsurface Wells

Slant Wells

Assume Capacity 800 gpm

Well Drilling			QTY	
Well Drilling Cost	\$2,000	per foot	1500	\$ 3,000,000
Equipping	10%	per well	1	\$ 300,000
Well Motor Cost	\$4,500	per HP	220	\$ 990,000
Concrete Pad and Pedestals	\$8,000	each	1	\$8,000
Testing	\$10,000	each	1	\$10,000
			Well Install Cost	\$ 4,308,000
Civil (100' by 100' site)				
Vegetation Removal	\$ 2	SF	10000	\$20,000
Rough grading	\$ 4	SF	10000	\$40,000
Gravel	\$ 25	SF	10000	\$250,000
Access Road	\$ 50	LF	50	\$2,500
Perimeter Fencing	\$ 150	LF	400	\$60,000
Access Gate	\$ 3,000	ea	1	\$3,000
20' by 40' CMU building	\$ 100	SF	800	\$80,000
Site Lighting	\$ 2,000	ea	4	\$8,000
			Total Civil	\$463,500
Above Ground Mechanical				
CARV	\$ 2,500	ea	4	\$ 10,000
Sample Port	\$ 500	ea	2	\$ 1,000
Pressure Gauge	\$ 500	ea	4	\$ 2,000
Dismantling Joint	\$ 2,500	ea	6	\$ 15,000
Check Valve	\$ 10,000	ea	2	\$ 20,000
Magnetic Flowmeter	\$ 15,000	ea	2	\$ 30,000
Butterfly Valve	\$ 8,000	ea	4	\$ 32,000
90 degree reducing 90	\$ 5,000	ea	2	\$ 10,000
90 degree elbow	\$ 3,500	ea	2	\$ 7,000
Pipe Spools	\$ 250	LF	40	\$ 10,000
Pipe Supports	\$ 750	ea	12	\$ 9,000
			Total Mechanical	\$ 146,000
EPIC	25%	of Mech+civil+dr	1	\$ 1,229,375
General				
Mobilization	8.00%	LS	1	\$ 491,750
Demobilization	2.00%	LS	1	\$ 122,938
SWPPP BMPs	2.50%	LS	1	\$ 153,672
Environmental Mitigation Measures	0.50%	LS	1	\$ 30,734
			Total General	\$ 799,100
			Single Well Direct Costs	\$ 6,945,975
			Total No. of Wells	\$ 3
Total of All Direct Costs				\$ 20,837,900
Construction Contingency	30%			\$ 6,251,400
Subtotal				\$ 27,089,300
Sales Tax (SLO County) Applied to 50% of construction costs	7.25%			\$ 982,000
Subtotal				\$ 28,071,300
Contractor OH, Markup, and GC's	15%			\$ 4,210,700
Intake Wells Total (to the nearest \$1k)				\$ 32,282,000

	Includes Flows	Length (ft)	Q - Flow (gpm - Max Discharge)	Q - Flow (cfs)	Diameter (in)	Inner Diameter (ft)	Area (ft^2)	Velocity (fps)	C - Friction Factor (PVC)	H - Headloss (ft)	Headloss Rate (ft/1000 ft)	Unit Cost	Direct Cost
Outfall Discharge Pipe	1,905	14031	1181.1	2.59842	12	1	0.785398163	3.308411098	110	64.81	4.619317665	\$ 300.00	\$ 4,209,372.97

Total of Pipeline Direct Costs		\$	4,209,400
	30%	\$	1,262,800
Subtotal		\$	5,472,200
Sales Tax (SLO County) Applied to 50% of construction	7.25%		\$198,400
Subtotal		\$	5,670,600
Contractor OH, Markup, and GC's	15%	\$	850,600
Discharge Pipeline Total (to the nearest \$1k)			\$6,522,000

APPENDIX F

DISTRICT DESAL PLAN GOVERNANCE STRUCTURE TECHNICAL MEMORANDUM

Technical Memorandum

DESAL Plan – Governance

Considerations and Institutional

Structures

June 16, 2026



1. Introduction

The San Luis Obispo County Flood Control and Water Conservation District (District), in collaboration with local water agencies and regional partners, is undertaking a multi-phase effort to evaluate the feasibility of developing a regional ocean desalination project within San Luis Obispo County.

The Desalination Executable Solution and Logistics (DESAL) Plan is funded through a United States Bureau of Reclamation (USBR) WaterSMART grant and is intended to evaluate whether ocean desalination could provide a safe, reliable, drought-resilient, and locally controlled water supply source to help meet future regional water needs.

As part of the planning process, the District is evaluating the institutional frameworks that could be used to develop, finance, govern, and operate a future desalination project.

2. Purpose

The purpose of this memorandum is to document governance considerations, potential governance models, relevant regional and statewide precedents, and key observations regarding the strengths and limitations of various governance approaches for regional desalination projects.

Governance and institutional structure concepts summarized in this memorandum were presented to the Countywide Water Action Team (CWAT) on March 16, 2026.

3. Why Governance Structures Matter

Selection of an appropriate governance structure is a critical component of regional water infrastructure development. Governance structures influence project financing, ownership, risk allocation, decision-making authority, operations and maintenance responsibilities, and long-term project implementation.

Key considerations for a regional ocean desalination project include:

- Capital intensity and significant financing requirements
- Long development and permitting timelines
- Cost and benefit allocation among participating agencies
- Coastal and environmental permitting risks
- Cross-jurisdictional project beneficiaries
- Long-term operations and maintenance responsibilities
- Decision-making processes and governance complexity
- Revenue certainty as a prerequisite for project financing

Governance structures may evolve throughout project development as participating agencies, project beneficiaries, and implementation strategies become better defined.

4. Distinguishing Governance from Project Delivery and Operations

Governance structure, project delivery method, and operational responsibility are distinct but related project considerations. These elements are frequently conflated in early-stage discussions; however, they represent independent choices, and a project's governance structure does not predetermine its delivery method or operations model.

For example, a project governed by a JPA may be publicly operated, privately operated, or delivered through a variety of procurement methods. Examples of the three elements are summarized below.

Governance Structure	Delivery Method	Operations Model
• Single Agency Lead • Joint Powers Authority (JPA) • Wholesale Authority / Special District • Private / Public-Private Partnership (P3)	• Design-Bid-Build • Construction Manager at Risk (CMAR) • Progressive Design-Build • Fixed Price Design-Build • Design-Build-Operate (DBO) • Design-Build-Own-Operate-Transfer (DBOOT)	• Utility (Public) Operation • Contract (Private) Operation

5. Governance Structure Alternatives

Four primary governance structures were identified as potentially applicable to regional desalination projects. Each is summarized below, followed by a comparative table.

5.1 Single Agency Lead

Under a single agency lead model, one public agency serves as project sponsor, owner, and operator. Participating agencies receive water through contractual agreements such as wholesale water contracts or capacity reservation agreements.

This model generally allows for more straightforward rate-setting, as Proposition 218 compliance is the responsibility of each user agency individually. Financial, operational, and permitting risks are concentrated with the lead agency, which must have sufficient institutional and financial capacity to carry the project.

5.2 Joint Powers Authority (JPA)

A JPA allows multiple public agencies to create a separate legal entity responsible for project development, financing, and administration. Local examples include the Central Coast Water Authority, the Morro Bay–Cayucos Wastewater Treatment Plant JPA, the Cuyama Groundwater Sustainability Agency, the Five Cities Fire Authority, the Paso Robles Area Groundwater Authority, San Luis Obispo Council of Governments (SLOCOG), and San Luis Obispo Regional Transit Authority (SLO RTA).

JPAs distribute governance, costs, and risks among member agencies, which can increase stakeholder buy-in and creditworthiness. However, rate-setting requires coordination and

agreement among all participants, decision-making is typically more complex, and the structure involves negotiating voting rights, cost allocation, and member withdrawal provisions upfront.

Non-JPA multi-agency coordination is also possible through Memoranda of Agreement (MOA) or Regional Water Management Groups, which may be appropriate for lower-commitment coordination structures.

5.3 Wholesale Authority / Special District

A wholesale authority or special district model centralizes ownership and administration of water infrastructure while delivering water to participating agencies through contractual agreements. This model is common in California and may require Local Agency Formation Commission (LAFCO) review for formation of a new district.

A hybrid variant—sometimes called a Wholesaler/JPA—allows a subset of customers to participate in governance while the wholesale authority delivers water contractually to other agencies that are not JPA members. This approach can balance governance participation with operational simplicity.

5.4 Public-Private Partnership (P3) / Private Utility

Under a public-private partnership (P3), a private entity participates in project financing, construction, ownership, and/or operations. This may take the form of a Design-Build-Finance-Operate-Maintain (DBFOM) contract or a concession agreement and is sometimes structured as a California Public Utilities Commission (CPUC) regulated utility.

P3 models can transfer significant construction and operations risk to the private sector and provide access to private capital without relying solely on public bonding capacity. However, they typically require firm long-term take-or-pay commitments to support private financing, and if a private entity owns the infrastructure, the public agency may lose direct control over its water supply. CPUC-regulated utilities are subject to a distinct rate-setting process administered by the state, which represents a meaningful departure from public rate governance.

5.5 Comparative Summary

The following table summarizes key characteristics of the four governance models across dimensions relevant to DESAL planning.

Model	Lead	Finance Source	Ownership	Risk Allocation	Complexity	Potential Required Agreements
Single Agency Lead	One Agency	Public debt	Lead	Concentrated	Moderate	- MOA with participating agencies - Capacity Reservation Agreements - CEQA Cost-Sharing Agreements - Wholesale Water Contracts
JPA	Shared	Public debt	Shared	Shared	High	- Joint Powers Agreement - Cost Allocation Agreement - Water Purchase Agreements - O&M Agreement - Bond Financing Documents - Member Withdrawal Terms
Wholesale Authority/ Special District	JPA/Lead	Public debt	Centralized	Contractual	Moderate	- Wholesale Water Purchase Agreements - Capacity Reservation Agreements - Operating Agreements (if not self-operated) - Revenue Bond Documents (if financing) - Cost Allocation Policy - LAFCO issues
Private (P3) or CPUC regulated utility	Private	Private capital	Private (term)	Transferred	High	- Concession Agreement - Water Purchase Agreement (Take-or-Pay) - Performance Guarantees - Step-in Rights - Financing & Security Agreements - Termination/Transfer Agreement

As part of the March 16, 2026 CWAT meeting, these governance structures were considered in the context of five rough-screened DESAL alternatives and stakeholder input was solicited from CWAT participants. Governance structures for each alternative are expected to evolve as input is incorporated, alternatives are refined, and additional project information becomes available.

7. Regional Governance Precedents

Several existing regional water infrastructure projects in San Luis Obispo County provide examples of governance approaches that may inform future desalination project governance. Notably, the District has served as lead agency or administrator for multiple major regional water projects, demonstrating institutional capacity relevant to the DESAL planning effort.

Salinas Dam and Reservoir (District-Operated Contract Water Supply)

Operated and managed by the District with contractual delivery arrangements under a long-term lease from the U.S. Army Corps of Engineers. The City of San Luis Obispo is the primary water contractor and is responsible for project costs through agreement with the District. This model illustrates the District's capacity to manage complex water supply infrastructure while maintaining direct local precedence.

Lopez Project (Wholesale with Zone of Benefit Financing)

Governed under the District through Flood Control Zone 3 (Zone of Benefit). The District established the Zone of Benefit to finance, operate, and maintain Lopez Project facilities, including Lopez Lake and Dam, Lopez Terminal Reservoir, Lopez Water Treatment Plant, and distribution system. Participating agencies receive water through contractual entitlements.

Nacimiento Project (Wholesale)

Governed by the District, which holds contractual rights to 17,500 AFY and operates through the Nacimiento Project Commission and contractual water delivery agreements.

Whale Rock Reservoir (Joint Venture Commission, similar to JPA)

Governed by the Whale Rock Commission, a multi-agency joint venture composed of representatives from the City of San Luis Obispo, Cal Poly, and the California Men's Colony. Ownership shares are allocated proportionally among partners.

Central Coast Water Authority (JPA / Wholesale Authority)

State Water Project participation in Santa Barbara County is administered through the Central Coast Water Authority (CCWA), a Joint Powers Authority that holds the SWP contract and delivers water wholesale to member agencies.

District SWP Water

Within San Luis Obispo County, the District serves as the SWP Contractor with the Department of Water Resources and managed entitlements and deliveries to local SWP subcontractors through contractual agreements.

8. Statewide Governance Examples

The following California water infrastructure projects illustrate how each governance model has been applied at scale, providing relevant precedents for DESAL planning.

Carlsbad Desalination Facility – DBFOM Public-Private Partnership (P3)

The largest ocean desalination plant in the Western Hemisphere, developed by Poseidon Water under a Design-Build-Finance-Operate-Maintain agreement with the San Diego County Water Authority. The P3 structure transferred significant construction and operations risk to the private sector; however, the project has also been associated with significant rate impacts, long-term take-or-pay obligations, and ongoing public debate regarding private control over a public water supply. The Carlsbad project is the most commonly cited statewide cautionary reference for P3 governance in desalination.

Metropolitan Water District of Southern California – Wholesale Authority (Special District)

A statutory special district that wholesales water to 26 member agencies across six counties, Metropolitan Water District demonstrates the long-term viability of centralized wholesale governance at regional scale.

Central Coast Water Authority (CCWA) – Wholesale Authority (JPA)

A JPA that holds the State Water Project contract for Santa Barbara County and delivers water wholesale to member agencies.

San Diego County Water Authority – Wholesale Authority (Special Act Authority)

Created by special legislation as a water authority to wholesale imported water to member agencies in San Diego County. Distinct from a JPA in that it was established by a special act of the Legislature rather than a joint exercise of existing powers.

Sites Reservoir Joint Powers Authority (JPA)

A JPA formed to develop the Sites Reservoir off-stream storage project in Colusa County, with multiple public agency participants sharing governance, costs, and risks. Illustrates the JPA model applied to large-scale new water supply infrastructure with diverse beneficiaries.

Doheny Ocean Desalination Project – Lead Agency Model (South Coast Water District)

South Coast Water District is serving as the lead agency for the Doheny desalination project in Dana Point, with other participating agencies receiving water through contractual arrangements. This model closely parallels the single agency lead structure and is a relevant precedent for smaller-scale or localized ocean desalination projects.

Santa Barbara Charles E. Meyer Desalination Facility – Public Ownership with DBO Operations

The City of Santa Barbara reactivated its desalination facility using a Design-Build-Operate delivery model while retaining public ownership and financing. The City has water purchase agreements with other agencies. This model illustrates that a public agency can retain ownership and governance control while transferring operational responsibility to a private operator — a hybrid approach that may be relevant to DESAL planning.

9. CWAT Discussion Summary

The governance concepts summarized in this memorandum were presented to CWAT on March 16, 2026. In addition to discussing governance structures and regional precedents, the preliminary lead agency and institutional structure concepts described in Section 6 of this memorandum were presented for each of the five rough-screened alternatives.

CWAT discussion questions posed to participants included:

1.	Is there overall agreement for a recommended lead agency and institutional structure for each alternative? Are there other options not yet mentioned?
2.	Is any agency willing to serve as CEQA lead for any of the alternatives?
3.	Is any agency willing to operate a facility for any of the alternatives?
4.	Do agencies prefer direct ownership or contractual water supply?
5.	Is there appetite for private financing?
6.	Would agencies commit to long-term take-or-pay agreements?
7.	Is a cross-county JPA politically viable?
8.	What additional information is needed to inform governance decisions?

CWAT participants provided input regarding potential lead agency considerations, governance structures, regional coordination needs, use of existing infrastructure, financing considerations, lifecycle costs, and the potential role of private-sector participation. A more complete record of CWAT comments will be compiled separately and incorporated into future project documentation as alternatives continue to be evaluated and refined.

10. Key Observations

The governance evaluation to date has identified the following recurring themes and observations:

- Governance structure selection fundamentally influences project financing, ownership, risk allocation, decision-making, and long-term operations. These choices should be made deliberately and in alignment with participating agencies' capacity, risk tolerance, and policy preferences.
- Long-term water purchase or capacity reservation commitments (take-or-pay agreements) are likely required under most governance models to support project financing, regardless of whether the project is publicly or privately financed.
- Revenue certainty is often a key prerequisite for project financing. The ability of a governance structure to deliver contractually committed revenues to support debt service is a central factor in financing feasibility.
- Rate-setting processes differ meaningfully among governance models. A single agency lead generally allows a more straightforward rate-setting approach, with Proposition 218 compliance managed by each user agency. JPA rate-setting requires coordination and agreement among all participants. P3 and CPUC-regulated utility models involve state regulatory oversight.
- Existing regional infrastructure and institutional frameworks — including the District's existing role in the Salinas, Lopez, Nacimiento, and State Water Project programs — may provide opportunities to reduce implementation complexity and leverage proven governance structures.

- Governance complexity generally increases as ownership and decision-making authority become more distributed among participants.
- Public-private partnership models may transfer construction and operations risk and provide access to private capital, but typically require firm long-term revenue guarantees and may reduce direct public control over water supply assets.
- Lifecycle costs should be considered alongside capital costs when evaluating governance alternatives. Governance models that transfer operational risk (e.g., DBFOM) may appear to reduce public cost exposure but can result in higher long-term contract costs.

11. Next Steps

The governance evaluation will continue in parallel with ongoing alternatives screening and feasibility analysis. Key next steps include:

- Developing recommendations for lead agency and institutional structure options for five rough-screened DESAL project alternatives based on CWAT input
- Evaluating financing feasibility in conjunction with governance structure, including preliminary assessment of bonding capacity, take-or-pay commitment levels, and revenue certainty requirements
- Obtaining endorsement from agencies willing to assume lead agency, CEQA lead, and/or operational roles to support continued alternatives evaluation
- Continued stakeholder engagement to build consensus around preferred governance structure

Questions regarding this memorandum may be directed to the District and/or DESAL project team.