SOUTH SAN LUIS OBISPO COUNTY DESALINATION FUNDING STUDY

Prepared for the
City of Arroyo Grande
City of Grover Beach
and Oceano CSD

WALLACE GROUP®

In Conjunction With:
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October 2008

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EXECUTIVE SUMMARY

Three agencies, the City of Arroyo Grande, the City of Grover Beach, and the Oceano Community Services District (Agencies), have come together to participate in the evaluation of a potential drought-proof water supply, seawater desalination, to supplement their existing potable water sources. Currently, all three Agencies receive water from various sources, including: the California State Water Project, Lopez Lake Reservoir, and groundwater from the Arroyo Grande Plain/Tri-Cities Mesa Groundwater Basin. Recent projections of water supply shortfalls in the region have warranted a more detailed study and consideration of desalination as a supplemental water supply.

The initial February 2006 Desalination Study formed the basis for this focused feasibility and funding study. The study focused on utilizing the existing South San Luis Obispo County Sanitation District's (SSLOCSD) wastewater treatment plant site to take advantage of utilizing the existing ocean outfall, while having the plant located near the ocean seawater source. This February 2006 study concluded that desalination was a viable water supply and that further detailed study of this water supply alternative was warranted. Subsequently, the Agencies were successful in securing a Proposition 50 grant to help fund this study.

Each Agency identified their desired allocation of produce water from the desalination facility. The total capacity of the desalination plant will be 2,300 acre-feet per year (AFY), with each agency's share in the plant capacity as follows:

- City of Arroyo Grande, 750 AFY
- City of Grover Beach, 800 AFY
- Oceano CSD, 750 AFY

Raw Water Supply

A hydrogeologic study was conducted to assess the viability of various options of seawater intake by beach wells. Open water intakes were considered too environmentally unfriendly, and extremely difficult to permit with the California Coastal Commission. The study concluded that a series of relatively shallow beach wells, on the order of 70 feet deep, would optimize draw of seawater and minimize draw of groundwater basin water from inland. Actual pilot testing would be required to confirm the capacity of each beach well, and to determine construction details and installation depths. Based on the hydrogeologic study, it is expected that for a series of 20 or more beach wells could be required to accomplish the seawater intake requirements (3,830 AFY of seawater) to produce 2,300 AFY of fresh potable water.

A beach well gallery constructed on the State Beach would be required, including a piping gallery and series of pumps to convey seawater to the SSLOCSD WWTP. A 14" to 16" diameter pipeline would be required to convey the seawater to the plant. Three alignment alternatives were considered as follows:

- **Alignment Option 1, Arroyo Grande Creek Levee**. From the beach well gallery, the raw water pipeline would extend from the beach onto the north bank/levee of Arroyo Grande Creek, entering the south side of the SSLOCSD

WWTP to the desalination plant. The total length of Option 1 is 1,800 lineal feet (lf).

- **Alignment Option 2, Slough Undercrossing**. From the beach well gallery, the raw water supply pipeline would cross through the residential neighborhood adjacent to the beach utilizing standard open-trench construction. The pipeline would then cross under the slough, utilizing trenchless technology, to an adjacent residential neighborhood near the plant, then would follow residential streets to the SSLOCSD WWTP entrance. Total length of pipeline for Option 2 is 1,600 lf.

- **Alignment Option 3, State Beach Ramp**. From the beach well gallery, the raw water supply pipeline would extend north on the State Beach to the Oceano Beach vehicle access ramp. From Pier Avenue, the alignment would head east to Lakeside Avenue and then to the SSLOCSD WWTP. Total length of Option 3 is 3,000 lf.

Alignment Option 2 overall, is the most viable alternative, although each alternative offers advantages and disadvantages over the other. Option 3 is considered the least desirable due to impacts to Pier Avenue and the State Beach vehicle access ramp.

Desalination Treatment Process

The evaluation of the desalination treatment process includes consideration of water quality of existing water sources, quality of the desalination (sea) water, establishing potable water quality treatment goals, pretreatment requirements, membrane process considerations, energy and chemical requirements, building layout and spatial requirements, and other considerations.

<u>Preliminary Water Quality Review</u>. A preliminary review of the Agencies' water sources and quality were assessed. Each of the agencies depend on local groundwater for water supply. The Cities of Grover Beach and Arroyo Grande also receive surface water from Lopez Lake. Although the Cities do not receive State Water, they receive a mixture of State/Lopez water as this water is delivered through the Lopez Lake water delivery system. Oceano CSD receives State water to supplement their groundwater supply. Details of water quality parameters can be referenced in Table 3-1 of this Report.

<u>Treated Water Quality Goals</u>. Product water from the desalination facility must meet all State and Federal drinking water regulations, similar to any potable water supply. Water quality goals are established for constituents for which Secondary Drinking Water Regulations (SDWR) are established. SDWRs are non-enforceable guidelines regarding cosmetic or aesthetic effects of drinking water. Table ES-1 summarizes the treated water quality goals for this Project.

Table ES-1 Finished Water Quality Goals

Constituent	Water Quality Goal
TDS (mg/L)	500
Hardness as $CaCO_3$ (mg/L)	100
Alkalinity as $CaCO_3$ (mg/L)	100
Sodium (mg/L)	60 to 200
Chloride (mg/L)	250

Raw Water Quality. The majority of the raw water delivered to the treatment plant will be seawater, although it is expected that some fresh water will be drawn into the beach wells. Therefore, the pretreatment system should be designed to accommodate a mixture of seawater, groundwater, and stream discharge. Additional investigations (i.e., a pilot pumping and treatment project, possibly with additional groundwater/seawater/surface water modeling) will be required to accurately estimate typical water quality in the intake water, and its variability.

In the absence of this additional information, some preliminary estimates of the range of dissolved solids in the feed water to the desalination facility can be calculated, assuming 10% groundwater, 10% surface water, and 80% seawater: Based on this, it is expected that the intake water will have total dissolved solids (TDS) concentrations ranging from 27,000 to 35,000 mg/L.

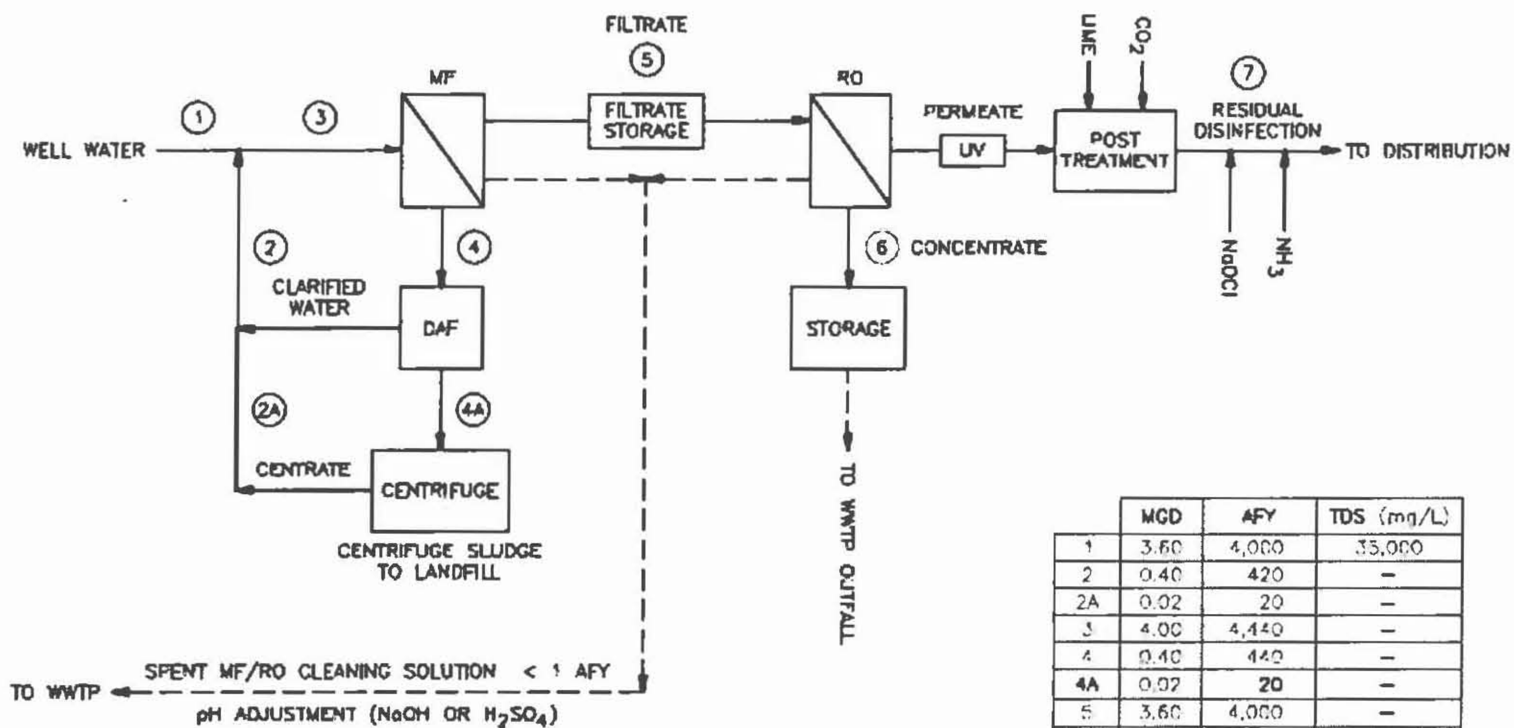
Desalination Process (Reverse Osmosis). Figure ES-1 shows the process flowrates assuming the plant is producing desalted water at its ultimate rate of 2400 AFY (x 95% plant availability = 2300 AFY). The proposed process includes the following steps:

- Membrane Filtration. Well water will enter the desalting plant and be mixed with recovered MF backwash water and centrate. The MF process will recover at least 90% of the feed water as filtrate which will flow to the RO process. The MF filtrate will be sent to the RO process.

- MF Backwash Water Recovery. The MF backwash water will be treated with a dissolved flotation (DAF) process. Coagulant will be added to the backwash water ahead of the DAF process. About 95% of the backwash water will be returned to the front end of the MF process as clarified water. The remaining 5%, containing the solids, will be processed by a centrifuge. The centrate (water) from the centrifuge will be recycled to the front end of the MF process. The sludge from the centrifuge will be transported to a landfill for disposal.

- MF Filtrate Storage. It will probably be necessary to include an MF filtrate storage tank between the MF equipment and the RO feed pumps to accommodate fluctuations in filtrate production and RO feed water flowrate. The tank should be as small as practical to minimize the chances of biological growth contaminating the filtrate. A tank volume of about 30 minutes of filtrate production (approximately 75,000 gallons) is proposed.

Figure ES-1. Conceptual Desalting Process



	MGD	AFY	TDS (mg/L)
1	3.60	4,000	35,000
2	0.40	420	–
2A	0.02	20	–
3	4.00	4,440	–
4	0.40	440	–
4A	0.02	20	–
5	3.60	4,000	–
6	1.40	1,600	87,000
7	2.10	2,400	<500

NOTE: FLOW RATE ASSUMES 2300 AFY PRODUCTION AT 95% PLANT AVAILABILITY

RO Desalting. The RO process will recover 60% (2400 AFY) of the MF filtrate feed water (4000 AFY) as permeate (desalted water). The remaining 1600 AFY (RO concentrate) will be discharged to the ocean with effluent from the WWTP.

- Post-Treatment. The permeate (the desalted water) will be low in dissolved solids (which will consist primarily of sodium and chloride), have a low pH, and will have essentially no hardness or alkalinity. Consequently, the water will be highly corrosive. If it were delivered to the distribution system without additional treatment, aesthetic issues related to the taste of the water would develop. At this conceptual design level, it was assumed that the post-treatment would consist of the use of lime and carbon dioxide to adjust the pH and alkalinity of the treated water.

- Primary Disinfection. The California Department of Public Health (CDPH) will require disinfection of the post-treated permeate before it is delivered to customers. Primary disinfection to satisfy expected CDPH requirements of 0.5 log giardia inactivation and 2.0 log inactivation of viruses could be accomplished using chlorine or ultraviolet (UV) light. If chlorine is used, chlorine contact time of about 30 minutes will be needed. This time could be provided in a contact tank or in a pipeline. The UV alternative would take up considerably less room on the site. The construction cost might be less than if chlorination were used for primary disinfection. However, the O&M costs will likely be higher. It was assumed for purposes of this report that UV would be used for primary disinfection because of the severe site constraints.

- Secondary Disinfection. After the UV process, residual disinfection will need to be provided. Because the participants in the project use chloraminated water from the State Water Project and Lopez Water Treatment Plant, it is proposed to use chloramines to provide the residual disinfectant chemical in the desalted water.

- Membrane Cleaning. The MF and RO membranes will require chemical cleaning on occasion. The frequency of the cleaning depends of the quality of the water and how the plant is operated. It is expected that the total volume of water required for chemical cleaning would be no more than 1 AFY. The spent cleaning solution will be pH neutralized and sent to the front end of the WWTP with ultimate disposal to the ocean.

Chemical Requirements. Various chemicals will be required as part of the RO process. A summary of these chemicals are as follows:

1. **Post-RO --** Lime and carbon dioxide will be added to the water to provide hardness and alkalinity and reduce corrosivity

2. **Disinfection --** The water will be subjected to UV for primary disinfection and then sodium hypochlorite and ammonia added to provide a chloramine disinfectant chemical residual prior to discharging the water into the distribution system.

3. **Membrane Cleaning Chemicals --** Caustic soda (sodium hydroxide), citric acid, surfactant (detergent), and, perhaps, proprietary membrane cleaning chemicals, will be used, depending on the membrane systems suppliers.

Power Consumption. Desalting plants are relatively large electric power consumers. To minimize power consumption, energy recovery will be included in the RO equipment design. At the assumed 60% RO recovery, 60% of the RO feed water exits the RO process as permeate and 40% exits as concentrate. The RO feed water pressure will be on the order of 1100 psi. Assuming RO feed pump efficiency of 75% at a flow of 4400 AFY of RO feed water, the RO feed pumps will consume about 14,000,000 KWHr per year.

The concentrate exits the RO system at about 20 psi less than the RO feed water pressure. Essentially, 40% of the energy input to the feed water exits the desalting process in the concentrate. Modern energy recovery devices used on RO plants can have efficiencies of 90% or more. Assuming that the energy recovery devices employed at the desalting plant recover 90% of the energy, about 5,500,000 KWHr per year of RO feed pump energy input will be recovered.

Therefore, the RO desalting process will consume about 8,500,000 KWHr per year. This is equivalent to about 3700 KWHr per AF of desalted water produced. The total estimated power consumption is 5,300 KWHr per AF, including all of the various processes throughout the plant, but excluding that required for raw water delivery and product water delivery.

Treatment Plant Layout

The proposed site at the South San Luis Obispo WWTP is irregularly shaped and covers about 0.6 acres, as shown below.

Figure ES-2. Proposed Desalination Plant Site

This is a very small site. The site may be adequate but will require a multi-story facility and construction will be more expensive per square foot than for a 1-story facility. One potential arrangement would be to construct a multiple-story structure covering about 10,000 square feet (100 feet square, for example):

1. **Bottom floor** --brine storage (1 MG--approximately one-half day concentrate production at the peak desalted water production rate of 2.2 MGD);
2. **Second floor**--Membrane filtration, and reverse osmosis desalting.

This building, with working clearances from the access road, would probably take up most of the site. Room on the site would be needed for chemical storage, parking, access to and around structures and equipment, treated water pump station, etc. There would be no room for a treated water (or chlorine contact) tank on the site of any significant volume. In addition to spatial constraints, underground utilities, particularly the Pismo Beach efflfuent pipeline, will need to be relocated as part of this Project.

Brine Disposal and Outfall

The South San Luis Obispo Sanitation District's existing ocean outfall is shared with the City of Pismo Beach (Pismo). According to the agreement between the City of Pismo Beach and SSLOCSD, the total capacity of the outfall line is contractually defined as follows:

Pismo Beach	44%
SSLOCSD	56%

According to Kennedy Jenks, the engineering firm who originally designed the outfall line, the exact capacity of the outfall line is not known. However, recent upgrades to the Pismo WWTP spurred an evaluation of the existing pipeline capacity. According to the recent analysis, the total capacity of the pipeline is estimated at 16 MGD. Therefore, utilizing the percentages listed above, the SSLOCSD portion of the total estimated outfall capacity is approximately 9 MGD.

The permitted average and peak flow for the SSLOCSD WWTP is 5 MGD and 9 MGD, respectively. Thus, during periods of high flow through the WWTP, capacity will temporarily not be available in the existing outfall configuration for brine disposal from the proposed desalination plant. Therefore, brine storage will likely be necessary at the desalination plant site to account for management of brine disposal through the outfall line. Based on an analysis of plant flows throughout the day, and considering future capacity considerations, it is estimated that a 750,000 gallon brine storage tank will be required. Without brine storage on site, the desalination plant production capacity may need to be reduced to avoid overloading the outfall during certain times of the day.

Product Water Delivery

From the desalination plant, potable water will be discharged to a clearwell before being pumped to the customers. The main route from the treatment plant will traverse along existing Oceano CSD water line routes, utilizing existing utility easements under the airport property, Highway 1, and the railroad. The shared pipeline would terminate near the intersection of 19th Street and The Pike, in Oceano. From this location, the shared pipeline would divert in three different directions: to Oceano's reservoir on 19th Street, and to individually owned booster pump stations for Grover Beach and Arroyo Grande. The pressure from the main pipeline would need to be sufficient to convey product water to Oceano's reservoir, while the two booster pump stations would be used to pump water into the higher pressure distribution systems for Grover Beach and Arroyo Grande. A 12" diameter trunk would be required to convey water to Oceano's reservoir, then 8" pipelines would convey the remaining water to the Cities of Grover Beach and Arroyo Grande.

Other alternatives for product water delivery included delivering all the product water to Oceano in lieu of pumping rights from the groundwater basin or Lopez water. Several problems were discovered with this alternative, including the fact that the product water from the desalination plant is more than double the quantity of water the Oceano has available to "trade".

Environmental Considerations

Environmental constraints and issues were identified as part of this Study, and the anticipated permitting requirements of the various local, State and Federal agencies were identified. Details of this analysis are included in Chapter 6. Table ES-2 provides a a summary of the environmental concerns identified as part of this review.

The potentially significant issues are identified with particular emphasis on the key environmental issues. This environmental screening assessment can be used as a tool for scoping the project-level environmental document in accordance with the California Environmental Quality Act (CEQA). However, the emphasis of this environmental screening is to identify major scoping issues and to confirm that the documentation appropriate for the future CEQA compliance in an Environmental Impact Report (EIR). The appropriate analysis and documentation for these issues must be included in the future EIR for the project, should the Lead Agency and the other partners proceed.

Table ES-2
POTENTIAL PERMITS AND APPROVALS FOR THE PROJECT

Agency of Department	Permit of Approval	Required for
FEDERAL AGENCIES		
U.S. Fish and Wildlife Service (USFWS)	Endangered Species Act compliance (ESA Section 7/10 consultation)	Incidental take of federally listed species
	Fish and Wildlife Coordination Act (16 U.S.C. 661-667e; the Act of March 10, 1934; ch. 55; 38 stat. 401)	Provide comments to prevent loss of and damage to wildlife resources.
National Oceanic & Atmospheric Administration (NOAA) – Fisheries	Endangered Species Act compliance (ESA Section 7/10 consultation)	Incidental take of federally listed species
Army Corps of Engineers (Corps)	Nationwide Section 404 Permit (CWA, 33 USC 1341)	Discharge of dredge/fill into Waters of the United States, including wetlands
	Section 10, Rivers and Harbors Act Permit (33 U.S.C. 403)	Activities, including the placement of structures, affecting navigable waters

Table ES-2 POTENTIAL PERMITS AND APPROVALS FOR THE PROJECT		
Agency of Department	**Permit of Approval**	**Required for**
U.S. Coast Guard	Federal Consultation	Coastal Commission CDP and ACOE Section 10 Permit
STATE AGENCIES		
State Water Resources Control Board, Regional Water Quality Control Board	General Construction Activity Storm Water Permit (WQO99-08-DWQ)	Storm water discharges associated with construction activity
	401 Water Quality Certification (CWA Section 401)	Discharge into waters and wetlands (see USACE Section 404 Permit)
	National Pollutant Discharge Elimination System (NPDES) Permit (CWA Section 402)(Amendment)	Discharge into waters and wetlands
California State Lands Commission	Right-of-Way Permit (Land Use Lease) (California Public Resource Code Section 1900)	Insurance of a grant of right-of-way across state lines potential
California Department of Fish and Game (CDFG)	Incidental Take Permits (CESA Title 14, Section 783.2)	Activity where a State-listed candidate, threatened, or endangered species under California ESA may be present in the project area and a State agency is acting as lead agency for CEQA compliance.
	Lake/Streambed Alteration Agreement (California Fish and Game Code Section 1601)	Change in natural state of river, steam, lake (includes road or land construction across a natural streambed)
California Coastal Commission (CCC)	Coastal Development Permit. (Public Resources Code 30000 et seq.)	Development of desalination facility within the Coastal Zone
California Department of Parks and Recreation (CDPR)	Land Conveyance/sale lease and/or easement	Overall project approval and CEQA review (potentially)
	Right-of-Way Permit (Public Resource Code Section 5012)	Access across State park property
California Department of Health Services (CDOHS)	Permit to Operate a Public Water System (California Health and Safety Code Section 116525)	Operation of a public water system.
California Department of Transportation (Caltrans)	Encroachment Permit (streets and Highway Code Section 660)	Encroachments on State highway rights-of way distribution pipelines
California State Historic Preservation Officer (SHPO)	Section 106 Consultation, National Historic Preservation Act (16 USC 470)	Consult regarding activities potentially affecting cultural resources.
LOCAL AGENCIES		
San Luis Obispo County Public Works Department	Encroachment Permit (San Luis Obispo County Code (SLOCC) Title 13 Chapter 13.08	Activities within County right-of-way.
San Luis Obispo County Health Department, Environmental Health Division	Well Construction Permit (SLOCC, Title 8 Chapter 8.40)	Construction of new water supply wells.
	Hazardous Materials Business Plan (Health and Safety Code Chapter 6.95)	Handling of hazardous materials in quantities equal to or greater than threshold quantities.

Table ES-2 POTENTIAL PERMITS AND APPROVALS FOR THE PROJECT		
Agency of Department	**Permit of Approval**	**Required for**
	Hazardous Materials Inventory (Health and Safety Code Chapter 6.95)	Handling of hazardous materials in quantities equal to or greater than threshold quantities.
San Luis Obispo County Planning and Building Inspection Department	Development Plan approval (SLBAP/C Chapter 8), Site Plan Approval and/or Use Permit (SLOCC Coastal Zone Land Use Title 23)	Activities whose use is conditional in a particular zone
	Coastal Development Permit (Public Resources Code 30000 et seq.)	Development within the Coastal Zone where County has jurisdiction through existing Local Coastal Plans
	Grading Permit (SLOCC, Title 19, Chapter 19.04 and 23.05)	Excavation and fill activities
San Luis Obispo Air Pollution Control District (SLOAPCD)	Authority To Construct. (Local district rules, per Health and Safety Code 42300 et seq.)	Constructing, modifying, or operating a stationary source facility or equipment that might emit pollutants.
	Permit to Operate. (Local district rules)	Operating stationary source equipment that might emit pollutants.

Permitting Considerations

The California Department of Health (DHS) was established to protect and improve the health of all Californians. The DHS was recently reorganized into the California Department of Health Care Services and the Department of Public Health (DPH). California DPH's Drinking Water Program (DWP) is within the Division of Drinking Water and Environmental Management. DWP regulates public drinking water systems. In particular, the California DPH implements and enforces Title 17 and 22 of the California Code of Regulations, which includes regulations on recycled and drinking water. The California DPH establishes regulations such as maximum contaminant levels, etc., in an effort to protect human health. The proposed project would be required to submit a permit application and technical report to the DPH (California Health and Safety Code, Section 116525, et seq.).

The application must include a technical report detailing the various aspects of the desalination project. In addition, a Drinking Water Source Assessment and Protection (DWSAP) plan will be required as part of the permit application for this new drinking water source.

In addition to CDPH permitting, other permitting for the Desalination facility is anticipated to be relatively extensive, and complex. The permitting process will include the following, at a minimum:

- Updated NPDES Permit from Regional Water Quality Control Board. This process will take a minimum of 6 months to complete, following preparation and receipt of a Report of Waste Discharge to the Regional Board. It is anticipated that this will require 6 to 9 months to complete.

- Coastal Commission Permit. Although the Commission has indicated a 30-day turn-around for review and comment on a permit application for such a project, it is anticipated that the Coastal Commission Permit process will take up to 6 months, following adoption of the Regional Board updated NPDES Permit.

- There will likely be a number of other permits required for a desalination project of this nature, including possibly the California Department of Fish & Game, US Fish & Wildlife Service, US Army Corps of Engineers, State Department of Public Health, County of San Luis Obispo, and others. Specific permitting requirements of each and every agency was beyond the scope of this feasibility study; however, planning for a project of this nature should take into account some schedule buffer to allow for permitting delays and unanticipated permit requirements from various agencies.

Given the complexity of the permitting process, it is anticipated that 12 to 24 months following design completion, would be required to complete the permitting process for a desalination plant.

Proposed Project Timeline

The estimated project timeline will span over a period of 8 years. A portrayal of this estimated timeline is shown in Figure ES-3 below:

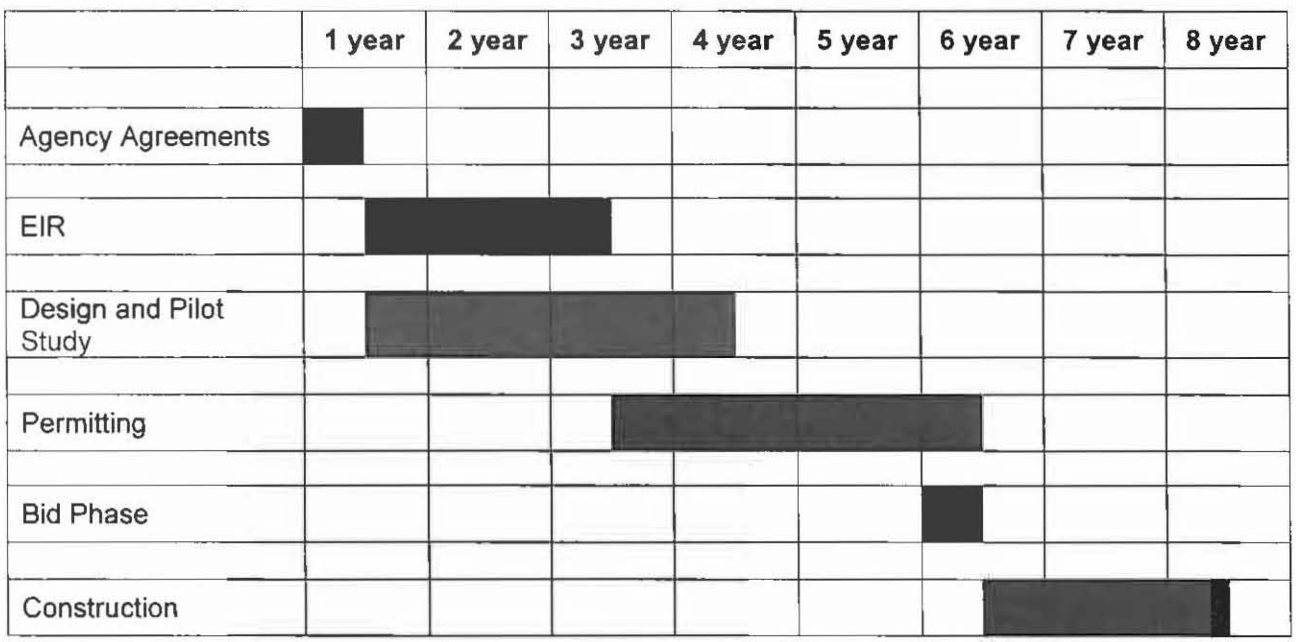


Figure ES-3 Estimated Timeline for Project Implementation

Based on the figure above, it is anticipated that this Project would require a minimum of 7 to 8 years to complete, and possibly longer factoring in the variability in permitting and environmental

Project Cost Analysis

Tables ES-3 and ES-4 summarize the project "hard" and "soft" costs based on implementation of the project as a whole, and phased in three phases. As can be seen by Table ES-4, there is still a significant cost impact as part of Phase 1 to get the initial plant into production. A number of components to this system need to be built initially, including the raw water feed pipeline, brine storage, building pad, site utilities, and product water delivery system to Oceano.

An analysis was prepared by Tuckfield & Associates (Appendix B) to determine the impact to monthly water bills for each project participant of the Desal Project. The impact was determined for a High Cost and Low Cost alternative that includes a maximum and a minimum impact to monthly water bills for each alternative based on the available financing choices of the facilities. In addition, several funding options were evaluated for financing the proposed project. An outline of the possible funding sources is included in Appendix B.

The maximum annual capital cost assumes the project would be financed with Certificates of Participation (COPs). This is generally a more expensive option, however is commonly used when forming a Joint Powers Authority for financing facilities used by several different agencies. The minimum annual capital cost assumes the project would be a mix of the least expensive financing sources available, typically low interest loans. The result of this analysis is a range of maximum and minimum annual capital cost that would be required under each of the High Cost and Low Cost Project alternatives (see Table 3 in Appendix B).

Impact on Monthly Water Bills. In order to compare the Desal Project's impact on monthly water bills, Project costs must be expressed in terms consistent with common billing methods. For this study, Project costs will be expressed in terms of volume charge based on each Project participant's metered water volume charge, and expressed as a fixed monthly charge per single family dwelling unit equivalent (SFDUE). The impact to the monthly water bill for each project participant is outlined in Table ES-5.

The monthly impact is determined for each High and Low Cost alternative, while also providing a range in dollar terms of what the impact may be based on the combination of minimum and maximum financing options.

The summarized comparison in Table ES-5 shows that a single-family Arroyo Grande customer could experience an increase in their monthly bill between $10.82 and $20.15 per month. For a single-family Grover Beach customer, the monthly bill could increase between $20.74 and $38.65 per month. Oceano's single family customers could see an increase between $41.85 and $79.08 per month.

Table ES-3. Overall Cost Summary

CAPITAL COSTS

Item	Description	Quantity	Unit	Amount
1	Raw Water Delivery System	1	EA	$2,700,000
2	Desalination Facility	1	EA	$24,500,000
3	Product Water Delivery System	1	EA	$2,100,000
	Sub Total Construction			**$29,300,000**
4	*Permitting*	1	LS	$200,000
5	*Environmental Impact Report*	1	LS	$300,000
6	*Design Services*	1	LS	$3,250,000
7	*Construction Management*	1	LS	$3,000,000
8	*Administration*	1	LS	$1,500,000
	Subtotal - "Soft Costs"			**$8,250,000**
	TOTAL CAPITAL COSTS			**$37,550,000**

ANNUAL O&M COSTS

Item	Description	Quantity	Unit	Amount
1	Raw Water and Product Water Systems	1	EA	$600,000
2	Desalination Facility	1	EA	$3,900,000
	Total Annual O&M Costs			**$4,500,000**

Table ES-4. Overall Cost Summary – Phased Approach

CAPITAL COSTS

Item	Description	Phase 1	Phase 2	Phase 3
1	Raw Water Delivery System	1,214,000	959,000	$0
2	Desalination Facility	13,716,667	3,266,667	$3,266,667
3	Product Water Delivery System	1,225,000	350,000	$200,000
	Sub Total Construction	**$16,155,667**	**$4,575,667**	**$3,466,667**
	Contingency@30%	**$4,846,700**	**$1,372,700**	**$1,040,000**
	TOTAL CONSTRUCTION COSTS	**$21,002,367**	**$5,948,367**	**$4,506,667**
4	*Permitting*	150,000	100,000	$75,000
5	*Environmental Impact Report*	300,000	0	$0
6	*Design Services*	1,750,000	600,000	$450,000
7	*Construction Management*	1,750,000	500,000	$400,000
8	*Administration*	1,000,000	500,000	$400,000
	Subtotal - "Soft Costs"	**$4,950,000**	**$1,700,000**	**$1,325,000**
	TOTAL CAPITAL COSTS	**$26,000,000**	**$7,700,000**	**$5,900,000**

Table ES-5

South SLO County Desalination Project

Impact of Desalination Project to Participants

Agency	High Cost Alternative Max	High Cost Alternative Min	Low Cost Alternative Max	Low Cost Alternative Min
Arroyo Grande				
Annualized Capital Cost [1]	$958,985	$767,393	$629,318	$472,274
Annual OM&R [2]	$1,414,600	$1,414,600	$802,500	$802,500
Total Annual Cost	$2,373,585	$2,181,993	$1,431,818	$1,274,774
Metered Water Sales Volume [3]	1,413,700	1,413,700	1,413,700	1,413,700
Charge per Ccf	**$1.68**	**$1.54**	**$1.01**	**$0.90**
SFDUE [3]	7,854	7,854	7,854	7,854
Cost per SFDUE per month	**$25.18**	**$23.15**	**$15.19**	**$13.53**
Grover Beach				
Annualized Capital Cost [1]	$1,022,035	$828,607	$671,271	$503,758
Annual OM&R [2]	$1,523,900	$1,523,900	$862,200	$862,200
Total Annual Cost	$2,545,935	$2,352,507	$1,533,471	$1,365,958
Metered Water Sales Volume [3]	790,400	790,400	790,400	790,400
Charge per Ccf	**$3.22**	**$2.98**	**$1.94**	**$1.73**
SFDUE [3]	5,489	5,489	5,489	5,489
Cost per SFDUE per month	**$38.65**	**$35.72**	**$23.28**	**$20.74**
Oceano CSD				
Annualized Capital Cost [1]	$945,980	$706,400	$629,311	$472,268
Annual OM&R [2]	$1,561,500	$1,561,500	$854,700	$854,700
Total Annual Cost	$2,507,480	$2,267,900	$1,484,011	$1,326,968
Metered Water Sales Volume [3]	380,500	380,500	380,500	380,500
Charge per Ccf	**$6.59**	**$5.96**	**$3.90**	**$3.49**
SFDUE [3]	2,439	2,439	2,439	2,439
Cost per SFDUE per month	**$85.67**	**$77.49**	**$50.70**	**$45.34**

[1] From Table 3, Summary of Annual Capital Cost.

[2] From Table 2, Summary of Allocation of Desalination Project Costs.

[3] From Table 4, Determination of Single Family Dwelling Unit Equivalents.

Table ES-6

South SLO County Desalination Project

Single Family Monthly Water Service Bills

For Selected Cities and Districts Within San Luis Obispo County

at 12 Ccf Monthly Consumption

		Existing Rates in Effect July 2008			Desalination Project Additional Monthly Cost [4]				Total Monthly Bill			
		Service Charge	Commodity Charge [1]	Monthly Bill	High Cost Alt		Low Cost Alt		High Cost Alt		Low Cost Alt	
Agency		3/4" Meter	@ 12 Ccf	Bill	Max	Min	Max	Min	Max	Min	Max	Min
Arroyo Grande	[3]	$44.94	$13.92	$58.86	$20.15	$18.52	$12.15	$10.82	$79.01	$77.38	$71.01	$69.68
Grover Beach		$6.75	$27.36	$34.11	$38.65	$35.72	$23.28	$20.74	$72.76	$69.83	$57.39	$54.85
Oceano CSD	[5][7]	$11.97	$33.93	$45.90	$79.08	$71.52	$46.80	$41.85	$124.98	$117.42	$92.70	$87.75
Morro Bay		$0.00	$67.55	$67.55					$67.55	$67.55	$67.55	$67.55
Nipomo CSD	[5][6]	$14.52	$18.24	$32.76					$32.76	$32.76	$32.76	$32.76
Paso Robles	[5][8]	$18.00	$15.36	$33.36					$33.36	$33.36	$33.36	$33.36
Pismo Beach	[5][9]	$20.50	$24.30	$44.80					$44.80	$44.80	$44.80	$44.80
San Luis Obispo	[5]	$0.00	$60.26	$60.26					$60.26	$60.26	$60.26	$60.26

[1] Used as an example of average monthly consumption for a single family residential customer.
[2] Cost per Ccf from Table 5 multiplied by 12 Ccf.
[3] Includes Lopez Meter Charge.
[5] Billed bimonthly.
[6] Includes monthly Litigation Charge.
[7] Includes Lopez consumption charge.
[8] Includes monthly Nacimiento charge.
[9] Includes annual Water Tax Fund charge divided by 12 for payment of State Water.and Lopez fixed charges.

Escalation to Midpoint of Construction. Since the project will take some 6 to 8 years to implement, current day costs provided in this report will need to be escalated to future years to anticipate true costs. Since the existing water rate structures will also increase in future years, irrespective of the desalination project, it is recommended that the Agencies utilize the current-day costs presented in this report, and use recent historical trends of the Engineering News Record (ENR) indices as a means of forecasting to future year costs. Although actual water rates in future years cannot be projected, it is expected that the percentage rate increases described in this Study, due to the desalination plant project, will be similar.

The September 2000 ENR index was 6228, and the September 2008 ENR index is 8557. The ratio of these numbers shows a 37% increase in costs in the past 8 years. With current economic trends, it is not expected that another 37% increase will be realized in the next 8 years, however, the Agencies should anticipate a 25% to 30% increase in overall project costs in the next 6 to 8 years.

An analysis was performed to determine the financial impacts of the Project should Oceano CSD not participate in the Project. The overall project costs only reduce marginally compared to the reduction in size of the project. With Oceano CSD excluded from the Project, the plant production reduces from 2,300 AFY to 1,550 AFY, or 33 percent. The Project capital cost to implant this scaled down alternative, however, reduces only by 7 to 8 percent. The updated financial tables reflecting this modified project scenario, are included in Appendix C.

The cost impacts to the City of Grover Beach and Arroyo Grande, to implement this 1,550 AFY desalination plant increase moderately over the original project alternative which includes the Oceano CSD. The City of Arroyo Grande could expect to see rate increases ranging from 22 to 41 percent (18 to 34 percent based on original project), while the City of Grover Beach could see rate increases of 73 to 133 percent (61 to 113 percent based on original project).

CHAPTER 1

INTRODUCTION

Three agencies, the City of Arroyo Grande, the City of Grover Beach, and the Oceano Community Services District (Agencies), have come together to participate in the evaluation of a potential drought-proof water supply, seawater desalination, to supplement their existing potable water sources. Currently, all three Agencies receive water from various sources, including: the California State Water Project, Lopez Lake Reservoir, and groundwater from the Arroyo Grande Plain/Tri-Cities Mesa Groundwater Basin.

These agencies are the same three agencies that comprise the South San Luis Obispo County Sanitation District (SSLOCSD), cooperatively providing wastewater conveyance and treatment services under a joint power authority (JPA) Agreement.

1.1 Background

According to recent water master plan documents for the Agencies, the allotment of water from existing sources is not sufficient to meet existing planned build-out water demand, therefore alternative water supply sources must be evaluated. Previous reports including: Water Supply Alternatives (August 2004), Water Supply Study: Nacimiento Pipeline Extension (February 2006), and Water Supply Study: Desalination (February 2006), have been prepared to evaluate various alternatives for potential water supply to meet the deficiency. Each report has discussed the potential for seawater desalination to some degree, however a more in-depth evaluation of the feasibility and cost of such facility was necessary before proceeding with design.

The February 2006 Desalination Study formed the basis for this focused feasibility and funding study. Successfully siting a new desalination plant must minimize environmental concerns associates with development of a new facility in the Coastal Zone, and must carefully consider alternatives and constraints with raw water supply and brine disposal. Key aspects of the 2006 study are as follows:

- Siting the new desalination facility at the Agencies' existing wastewater plant has merits from an environmental perspective, and there is land space available to develop such a facility.
- Siting the desalination facility at the existing wastewater plant also makes use of the existing ocean outfall to facilitate brine disposal.
- It was determined that beach well intake facilities would provide the most viable means of collect ocean water for desalination, mitigating the major impingement concerns associated with an open ocean water intake.

Thus, the 2006 study concluded that the most viable desalination facility would be one that further considers the above elements.

1-1.1 Desalination Water Capacity Allocations
Each Agency identified their desired allocation of produce water from the desalination facility. The total capacity of the desalination plant will be 2,300 acre-feet per year (AFY), with each agency's share in the plant capacity as follows:

- City of Arroyo Grande, 750 AFY
- City of Grover Beach, 800 AFY
- Oceano CSD, 750 AFY

1-1.2 Funding
In conjunction with the 2006 Desalination Study, the Agencies, with support and assistance from Wallace Group, successfully applied for and received a $50,000 Proposition 50 grant from the State Department of Water Resources to conduct this feasibility and funding study. This grant requires the District to provide matching funds dollar for dollar.

1.2 AUTHORIZATION AND SCOPE OF SERVICES

On October 26, 2007 The City of Arroyo Grande entered into a contract with Wallace Group for the following scope of services:

- Preliminary Design - Provide overall preliminary design criteria for all components of the desalination plant, including:

  - Hydrogeologic Assessment – Identify the quantity and quality of available source water for the proposed facility.

  - Seawater Intake Facility – Evaluate alternatives for intake source water methods and provide preliminary design of a seawater beach well gallery intake facility.

  - RO Filter System – Provide evaluation of the proposed filter system, including percent recovery, brine rejection rates and concentrations, pre and post treatment and other process considerations.

  - Ocean Outfall & Brine Disposal System – Provide detailed analysis of the capacity constraints, impacts to permitted dilution ratios, and assessment for need of a brine equalization tank.

  - Product Water Distribution – Outline location for each agency to receive desalination product water. This task will also include the cost-benefit analysis of distributing water directly to each agency or extending product water piping to the closest water storage reservoir.

  - Site Analysis – Outline the specific requirements for the planning, design, and construction issues in order to obtain a construction/building permit for the desal plant at the SSLOCSD WWTP location.

- Regulations & Permitting – This study will define and identify the specific requirements needed to obtain regulatory permits pertinent to the construction, installation, and operation of a seawater desalination plant on the California coast.

- Cost and Funding Update – This study will include a life-cycle cost analysis for the capital and operations and maintenance costs of the project. In addition, an approximate schedule and timeframe of major project milestones will be included. An identification of potential funding opportunities will also be included. Once the life-cycle cost analysis has been established, this report will evaluate the potential increase in monthly water rates for each Agency's water customers.

1.3 ACKNOWLEDGMENTS

This Desalination Funding Study was a collaborative effort between the Agencies and the consulting team comprised of Wallace Group, Boyle Engineering, Fugro West, Inc., Denise Duffy & Associates, and Tuckfield Associates.

The following agencies and key staff are acknowledged for their assistance and support in developing this Report:

- Don Spagnolo, Public Works Director, City of Arroyo Grande
- Steve Adams, City Manager, City of Arroyo Grande
- Tony Ferrara, Mayor, City of Arroyo Grande
- Bob Perrault, City Manager, City of Grover Beach
- Mike Ford, Public Works Supervisor, City of Grover Beach
- Pat O'Reilly, General Manager, Oceano CSD
- Phil Davis, Utility Supervisor, Oceano CSD

The following consultant team members are acknowledge for their participation in developing this study:

- Steven G. Tanaka, PE, Wallace Group
- Shannon Peterson, Wallace Group
- Michael Nunley, PE, Boyle Engineering
- Malcolm McEwen, PE, Boyle Engineering
- Ernie Kartinen, PE, Boyle Engineering
- David Gardner, RG, Fugro West, Inc.
- Denise Duffy, Denise Duffy & Associates
- Alison Imamura, Denise Duffy & Associates
- Clayton Tuckfield, MBA, Tuckfield & Associates

1-3.1 Consultant Team Roles and Responsibilities

The following defines the specific roles of each consultant team member in preparing this study:

Wallace Group –provided overall project management and coordination, review if WWTP siting constraints, raw water collection and conveyance, brine storage and disposal, product water delivery to Agencies, coordination with the County Planning Department and California Coastal Commission.

Boyle Engineering – provided detailed evaluation of the desalination process, coordinated with Wallace Group on desalination plant siting issues and brine storage. Assisted with facilitating discussions with the County Planning Department.

Fugro West, Inc. – provided detailed evaluation of alternatives for developing ocean water intake to supply the desalination facility.

Denise Duffy & Associates – provided evaluation of the environmental considerations for the entire desalination process, from raw water intake/conveyance, to the desalination facility, and produce water delivery to the Agencies. Also provided detailed evaluation of the permitting considerations with the various federal, state and local agencies.

Tuckfield & Associates – provided the detailed financial feasibility analysis to fund the desalination facility, including review of existing rate structures of each agency, required customer rate increases to fund the Project, and a review of potential grant/loan funding opportunities to assist the Agencies from a financial perspective.

CHAPTER 2

DESALINATION FACILITY SOURCE WATER

This chapter presents a summary of the hydrogeologic evaluation that was performed to help determine the feasibility and most efficient method of securing and withdrawing salt water from the ocean to feed the desalination facility. Using the recommended source water location and withdraw method, alignment alternatives for the raw water pipeline that will convey source water to the treatment facility were evaluated and compared. Recommendations for further hydrogeologic evaluations are also included at the end of this chapter.

2-1 Initial Hydrogeologic Study

A preliminary evaluation of the potential subsurface saline water intake wells was performed by Fugro West, Inc (Appendix A). As part of their source water evaluation, Fugro used readily available hydrogeologic data encompassing the coastal fringe in the vicinity of the SSLOCSD WWTP. Because the success of subsurface intake systems to collect saline water is directly dependent on the availability of the subsurface system to achieve and maintain a hydraulic connection to the ocean, the study area was generally that of the immediate coastline.

The desired quantity of product water is 2300 AFY, and the reverse osmosis treatment process will produce 60% product water from the saline source. Thus, the quantity of saline water intake volume will be approximately 3,830 AFY or 2,375 gallons per minute (gpm).

General findings from available hydrogeologic data within the study area indicate the following:

- Multiple unconfined and confined aquifers exist in the immediate coastal fringe and extend offshore.
- Within the area of study, there is no indication of a significant subsurface canyon offshore, or evidence of major fault barriers, that would limit the seaward extent of fresh water outflow or, conversely, the landward migration of seawater onshore.
- The aquifer in the study area slopes gently offshore. Seafloor data would suggest that the Paso Robles formation extends many miles offshore and contains significant volumes of fresh water in storage.
- Evidence of seawater intrusion in the study area appears to be limited to the very shallow terrace and dune sand deposits in the Pismo Beach area. For the most part, water levels in the shallow and deeper aquifers at the coast were above sea level, implying a component of fresh water subsurface underflow offshore.

2-1.1 Beach Wells

Fugro's report concludes that the most appropriate subsurface saline water intake system to consider for the South County desal facility is shallow vertical beach wells. Deeper aquifers in the study area (below 100 feet) are thought to contain fresh water, both at the coastline and to a considerable distance offshore. Deeper wells, while likely much more productive, would not be able to establish a hydraulic connection to saline water and would compete with the use of ground water onshore.

Conventional vertical beach wells would need to be placed as close to the ocean as possible, preferably within 50 feet of the mean high tide line. It is estimated that the wells would need to be approximately 75 feet deep, and constructed of 10-inch diameter fiberglass or PVC casing. The well spacing, based on aquifer tests and ground water flow modeling of various beach wells, would need to be approximately 100 feet on center to prevent the wells going dry. To obtain the desired saline water volume of 2,375 gpm, approximately 20 to 25 beach wells would be required. The actual number of wells required would be determined after test wells are installed to verify the actual individual well yields.

While Fugro provides an estimate of between 50 and 100 gpm per vertical beach well, variability in flow rates from a series of beach wells should also be considered during the design phase. As noted in the Fugro report "Instantaneous well production rates would vary daily depending on tidal conditions."

NOAA predicts the "Spring Range" (i.e., the mean difference between high and low tidal levels during "spring tides") at Port San Luis to be 5.33 feet. Spring tides are periods of increased tidal range which occur around the dates of the full moon and the new moon. Assuming a 75-foot deep well that encounters water at a depth of 10 feet, a 5.33-foot variation in water depth could translate into an 8% variation in wetted depth (5.33-ft over 65-ft) This variation may need to be considered when designing the intake facilities.

Another significant concern with the vertical beach wells is minimizing the visual impact of the proposed intake facilities on the beach. County Planning and Coastal Commission staff have expressed this concern to the Project Team. The Cities and District should consider installing a boardwalk or public access area over and around these wells in order to shield them from public view while still allowing access for maintenance. Secure, lockable access hatches could be designed into the boardwalk or walkway for maintenance and monitoring of the well facilities.

2-2 Raw Water Supply Pipeline

To achieve a product water goal of 2300 AFY, approximately 3,830 AFY of raw water will be required to be delivered to the desalination plant. The following design criteria were used to determine the appropriate diameter for the raw water supply pipeline:

- Design Velocity, 5 ft/s maximum
- Raw Water Delivery, 24 hours/day, 365 days/year
- Design Operating Pressure, 40 psi

The design velocity of 5 ft/s was used to balance energy headloss with minimizing pipe size/diameter. Furthermore, the operation parameter of delivering water "around the clock" also minimizes facility sizing requirements. The resulting pipeline diameter for the raw water feed supply line is 14 to 16 inch diameter.

2-2.1 Pipeline Material
For the range of diameter required, several pipeline materials are available, including:

- C905 PVC
- HDPE
- Ductile Iron
- Steel

Given the nature of the raw sea water, it is recommended that metal pipe (ductile iron and steel) not be considered. For the purposes of this feasibility study, high density polyethylene (HDPE) or PVC are both considered viable material choices. HDPE pipe is joined by thermal butt welding, and thus may be more desirable from the standpoint of minimizing pipe leakage. HDPE could also be installed by trenchless technologies, in particular, directional drilling. However, hydraulically speaking, in order to achieve the same hydraulic flow area, HDPE pipe outside diameter will be greater than PVC pipe for the equivalent hydraulic carrying capacity. This results in greater excavation and installation costs relative to PVC pipe.

2-2.2 Routing Alternatives
Routing of the raw water supply pipeline is the most critical element to the feasibility of providing this raw water supply pipeline. Material selection and detailed pipeline sizing can be handled during detailed design to refine the general recommendations outlined in this report. Figure 2-1 depicts the proposed locations for the network of raw water extraction beach wells. The beach well manifold system will convey raw water to a central location, and then the raw water supply pipeline will need to be routed to the SSLOCSD WWTP site, and to the head of the desalination plant. The three feasible routing alternatives, shown in Figure 2-1, are described as follows:

- **Alignment Option 1, Arroyo Grande Creek Levee**. From the beach well gallery, the raw water pipeline would extend from the beach onto the north bank/levee of Arroyo Grande Creek, entering the south side of the SSLOCSD WWTP to the desalination plant. The total length of Option 1 is 1,800 lineal feet (lf).

- **Alignment Option 2, Slough Undercrossing**. From the beach well gallery, the raw water supply pipeline would cross through the residential neighborhood adjacent to the beach, along Utah Avenue, utilizing standard open-trench construction (500 lf). The pipeline would then cross under the slough, utilizing trenchless technology, to an adjacent residential neighborhood near the plant. The directional drilling portion of the pipeline would be approximately 300 lf. From the receiving pit, this option would follow residential streets to the SSLOCSD WWTP entrance (800 lf). Total length of pipeline for Option 2 is 1,600 lf.

- **Alignment Option 3, State Beach Ramp**. From the beach well gallery, the raw water supply pipeline would extend north on the State Beach to the Oceano Beach vehicle access ramp. From Pier Avenue, the alignment would head east to Lakeside Avenue and then to the SSLOCSD WWTP. Total length of Option 3 is 3,000 lf.

The three alternatives each have pros and cons. Each alternative was evaluated based a number of criteria including:

- Environmental Impacts
- Construction Impacts
- Constructibility
- Easements and Access Rights
- Maintenance and Safety Considerations

Alignment Option 1:

- Environmental Impacts. The alignment along the northern levee/embankment of the Arroyo Grande Creek includes significant vegetation along the creek side, and the northern slope of the levee. The levee itself is devoid of vegetation, and used for vehicle access and walking along the levee. The pipeline would be routed and installed in the levee itself, and would have minimal impacts to vegetation and biota. A short segment of pipeline would be installed from the levee to the WWTP; however, it is expected that any sensitive plant species can be avoided.
- Construction Impacts. The levee alignment alternative would have little impact to the surrounding community. The alignment will not disrupt traffic or beach access.
- Constructibility. The construction of the pipeline can be accomplished by traditional open-cut methods. It is expected that trenching can be easily be accomplished, even within the levee. Pipeline cover can be maintained at approximately 3 to 4 feet cover, thus minimizing trench depth.
- Easements and Access Rights. The levee and creek are under the control of the County Flood Control District Zone 3. Further research into easements will need to be conducted if this alignment option is developed further.
- Maintenance and Safety Considerations. Based on discussions with plant staff, the levee ruptured in the 1990s during a severe wet weather event. The levee also may be subject to liquefaction during a seismic event, and fissures did develop during the 2003 San Simeon earthquake. Placing the pipeline in the levee would require careful consideration of how to safeguard the supply pipeline to resist the inherent dangers of levee failure.

Alignment Option 2:

- Environmental Impacts. Trenchless construction will cause minimal surface disruption along the pipe route. However, the possibility of release of drilling fluids, termed "frac-outs", could pose significant impacts if released into the lagoon. Although the drilling fluids consist of inert materials, release of such materials to the environment would have considerable impairment to the water body.

- Construction Impacts. The construction of the pipeline would have significant impacts on the local residents. The insertion pit, drilling equipment, and drilling fluid operations will need to be within existing residential roadways to avoid sensitive habitat areas.
- Constructibility. The pipeline would need to be constructed by directional drilling, directly under the slough. The total length of direction drilling would be approximately 300 feet, and this distance of installation is relative short and commonplace.
- Easements and Access Rights. The pipeline would be in public right-of-way in the residential areas, but will also cross beneath the Lagoon. The crossing will require an easement for the pipeline.
- Maintenance and Safety Considerations. Once installed, the raw water pipeline will require little to no maintenance. Flexible connections at the beach well gallery and at the WWTP can be incorporated into the design to minimize potential for seismic disruption.

Alignment Option 3:

- Environmental Impacts. The majority of alignment Option 3 would require standard open trench construction along mostly county right-of-way roads. Initial meetings with the County indicate that open trench construction would need to be monitored for archaeologically sensitive areas in the Oceano area. Beach access may be impacted during construction of the pipeline near the beach ramp area and along Pier Avenue.
- Construction Impacts. Since this alternative traverses residential roads, traffic control would need to be carefully considered.
- Constructibility. One obstacle with this alignment alternative is the water-body crossing along Lakeside Avenue. While an existing road-bridge may be utilized for the raw water pipeline, adequate support and available capacity along the bridge would need to be further evaluated to determine the feasibility of utilizing the existing structure. Based on recent discussions with the County, they do not recommend utilizing this bridge for another pipeline crossing. The County is in the process of upgrading the bridge on Airpark Road; however, any alignment of a new pipeline across this bridge would require access through the Airport property to the wastewater treatment plant site in addition to the route being substantially longer.
- Easements and Access Rights. A portion of this alignment runs parallel to the coastline, within a section of beach owned by the State. The proper permits for construction and future easements along the beach would need to be secured through the State and through the County for installation of pipelines along this section of the coastline.
- Maintenance and Safety Considerations. Similar to Option 2, little maintenance would be required after installation.

Alternative 2 appears to be the most viable water supply pipeline routing alternative of the three alternatives considered.

Figure 2-1 Raw Water Alignment Alternatives

2-3 Detailed Hydrogeologic Study

While an initial hydrogeologic evaluation using record data on file has already been prepared as part of this funding study, it is recommended that a more detailed hydrogeologic feasibility study be conducted. The detailed hydrogeologic feasibility study would establish the most feasible intake design and would likely be conducted in two phases:

Phase 1 - The purpose of the Phase 1 hydrogeologic feasibility study is to determine the geologic characteristics of the proposed sites and to identify a preferred location for the pilot-scale subsurface intake facilities.

The Phase 1 goals of this study are:

- Determine the lithology of the sites.
- Estimate the permeability of the geologic layers encountered.
- Describe the hydrogeologic relationships between the site geology and the regional aquifers.

- Estimate the hydraulic connectivity between the aquifers of interest (beach sands, alluvial deposits, Paso Robles formation) and the ocean.
- Install monitoring wells that can be used to calibrate the groundwater model and to monitor changes to the aquifers during pilot phase production and during full scale production.
- Collect sufficient information to select a preferred location and technology for the pilot scale subsurface intake facilities.

Phase 2 - The purpose of the Phase 2 hydrogeologic feasibility study is to assess whether the aquifer(s) at the selected location could support a subsurface intake system.

The Phase 2 goals of this study are:

- Determine formation and aquifer hydraulic properties;
- Estimate the potential yield from a subsurface intake system and its configuration; and
- Assess potential basin water supply benefits and impacts.

2-3.1 Phase 1 Work Plan

Phase 1 work will occur before installation of the pilot-scale intake facilities.

1. Review existing hydrogeologic data and estimate the number of test boreholes and monitoring wells which will be needed to assess aquifer materials at the proposed intake and discharge locations.

2. Obtain permits and comply with conditions imposed by regulatory agencies for the proposed field study. These permits/approvals are expected to include:

    - Regional Board
    - US Army Corps of Engineers
    - California Coastal Commission
    - State Lands Commission
    - State Parks
    - San Luis Obispo County
    - Landowner Approval

3. Drill the test boreholes and install monitoring wells. During the drilling operations, run geophysical logs and collect lithologic samples and water quality samples from the boreholes.

4. In the laboratory, estimate hydraulic conductivities of lithologic samples using a permeameter, sieve the lithologic samples, and estimate the hydraulic conductivities based on grain size analyses.

5. Prepare a report to document the hydrogeologic field study findings.

2-3.2 Phase 2 Work Plan

Phase 2 work will occur after installation of the pilot-scale intake and discharge facilities.

1. Conduct one or more pump tests to estimate pertinent hydrogeologic parameters of the aquifer (such as transmissivity, storativity, and leakance).

2. Utilize the results of the pump test and related geological information to develop a three dimensional groundwater flow and variable density solute model of the proposed subsurface intake facilities.

3. Use the model to estimate impacts to the aquifer(s) and to the ocean environment of long-term operation of the proposed desalination plant.

CHAPTER 3

DESALINATION TREATMENT SYSTEM

The following chapter describes the facility equipment and processes that will be necessary to the treatment portion of the desalination project. As described in the introduction of this report, the majority of this chapter was prepared by Boyle Engineering. Boyle Engineering has extensive expertise with desalination treatment processes and technologies.

3-1 Preliminary Water Quality Review

The existing water quality information from the City of Arroyo Grande, City of Grover Beach, and Oceano Community Services District was reviewed to establish water quality goals for the treatment facility which are compatible with those agencies' current water supplies. This preliminary evaluation is based on a review of the most recent Consumer Confidence Reports.

3-1.1 Grover Beach Water Quality

The City of Grover Beach receives its water from two local aquifers, and surface water from Lopez Lake. The groundwater comes from either the deep Careaga formation or from the shallow Paso Robles formation. Groundwater is chloraminated and pumped directly to customers. Water from Lopez Lake is filtered and disinfected before delivery to the City. A single pipe is used to deliver water from Lopez Lake and water from the Central Coast Water Authority (CCWA) to multiple customers. The City does not purchase water from the CCWA, but because of the Lopez Lake water delivery system, it receives a mixture of Lopez Lake water and CCWA water. The CCWA water comes from the California State Water Project Aqueduct which receives water from a number of sources in northern California.

3-1.2 City of Arroyo Grande Water Quality

The City of Arroyo Grande receives its water from local aquifers and from Lopez Lake. Groundwater is disinfected with chloramines before delivery to customers. Like Grover Beach, the City of Arroyo Grande does not purchase water from the CCWA, but receives a mixture of filtered, disinfected Lopez Lake water and "State water", delivered through the Lopez Lake pipeline.

3-1.3 Oceano CSD Water Quality

The District receives its water supply from four wells in the Arroyo Grande basin, from Lopez Lake and from the CCWA aqueduct. The Oceano CSD disinfects its well water using tablet chlorinators. Boyle notes that mixing chlorinated water with chloraminated water is generally not good practice; however, with the cooler climate of Oceano, the Oceano CSD has not had any water quality problems as a result of this. As opportunity arises, Oceano CSD should consider avoiding blending of chlorinated and chloraminated waters.

3-1.4 Key Water Quality Considerations

The three owners of the future desalination plant use a mixture of water sources: Lopez Reservoir, State Water delivered via the CCWA aqueduct, and local groundwater. Key water quality aspects of these sources are summarized in Table 3-1:

Table 3-1 Water Quality of Existing Systems

Source	State Water	Local Surface	Groundwater			Drinking Water Standard	Type of Standard
	CCWA Aqueduct (a)	Lopez (a)	Arroyo Grande (a)	Grover Beach (b)	Oceano CSD (c)		
TDS (mg/l)	97 - 326	430 - 460	410 - 640	330 - 630	610 - 750	1,000 (d) 500 (e)	Secondary MCL
Turbidity (NTU)	0.03 – 0.26	0.04 – 0.48	0.1 – 0.5	0.1 – 1.3	0.1 – 6.7**	0.3 and 1.0	Perfor-mance Std.
Chlorides (ppm)	21 – 125	22 – 23	27 - 120	31 - 43	26 - 47	500 (d) 250 (e)	Secondary MCL
Hardness (ppm)	42 - 120	320 - 350	240 - 510	180 - 480	480 - 550	n/a	none
Nitrite as N (ppb)	370 (avg)	ND	500 – 13,000	ND		10,000	Primary MCL
Nitrate as NO_3 (ppm)	1.6	ND	ND - 66	ND - 24	ND - 18	45	Primary MCL
pH	6.9 – 8.9	7.1 – 7.9	7.4 – 8.0	6.2 - 7.9	7.9 – 8.01	6.5 – 8.5	none
Total Trihalo-methanes (ppb)	25 – 47	39.5 – 94.5	9.0 – 103.8*	ND - 88.8	ND	80 - RAA	Primary MCL
Disinfectant	Chlora-mines	Chlora-mines	Chlora-mines	Chlorine	Chlorine		
Total Organic Carbon (ppm)	1.3 – 2.6	4.5 – 5.4					TT
Corrosivity (LI)	Non-corrosive	0.5 – 0.6	Non-corrosive	11.23 – 12.20	0.3 – 1.22		

Notes:
(a) City of Arroyo Grande 2006 Water Quality Report
(b) Grover Beach 2006 Water Quality Report
(c) Oceano CSD 2006 Water Quality Report
(d) California Upper Secondary MCL
(e) California Recommended Secondary MCL
* sampled in distribution system
** High turbidity measured in water from Well #6 in 2005. Well water is pumped to a storage reservoir. Solids causing turbidity settle out in the tank.
Primary MCL = Primary Maximum Contaminant Levels - the highest level allowed in drinking water. Primary MCLs are set as close as possible to the levels below which there is no known or expected risk to health.
Secondary MCL = Secondary Maximum Contaminant Level. Secondary MCLs are set to protect the taste, odor, and appearance of drinking water.
Turbidity Performance Standards are set to measure the performance of the filtration system for surface waters. Turbidity must be lower than 0.3 NTU in 95% of samples, and shall not exceed 1.0 NTU for more than 8 consecutive hours.
RAA = Running Annual Average of quarterly samples.
TT = Treatment technique. Organic carbon can combine with chlorine to produce trihalomethanes.

3-2 Treated Water Quality Goals

Product water from the desalination facility must meet all State and Federal drinking water regulations, similar to any potable water supply. Water quality goals are established for constituents for which Secondary Drinking Water Regulations (SDWR) are established. SDWRs are non-enforceable guidelines regarding cosmetic or aesthetic effects of drinking water.

- The TDS concentration of the ocean water should be reduced to below the Federal SDWR level of 500 mg/L.

- While there is currently no regulatory standard for sodium, the U.S. Environmental Protection Agency (EPA) issued an advisory to limit sodium to 30 to 60 mg/L based on aesthetic effects. Similarly, the World Health Organization (WHO) has established a drinking water guideline of 200 mg/L of sodium based on aesthetic considerations. For the purposes of this report, it was assumed that the treated water would fall within the range of the EPA advisory limit and the WHO drinking water guideline for sodium.

- There is no standard for hardness in water because the constituents that contribute to hardness (generally calcium and magnesium ions) do not cause harmful health effects. Instead, there is a generally accepted division of water into categories of soft, moderately hard, hard, and very hard. A goal of 100 mg/l will produce water that is considered "moderately hard" (USGS, 1975.)

- Alkalinity is a measure of the presence of bicarbonate, carbonate or hydroxide constituents and indicates the water's ability to resist changes in pH, or acidity. Waters with low alkalinity may be corrosive to metal fittings. Waters with high alkalinity may deposit scale on the interior surfaces of water heaters. Concentrations less than 100 mg/l (as $CaCO_3$) are desirable for domestic water supplies (IDPH, 2008.)

- Chloride concentration should be reduced to levels below the Federal SDWR level of 250 mg/l.

Table 3-2 lists the finished water quality goals for some of the key water quality constituents.

3-3 Raw Water Quality

The majority of the raw water delivered to the treatment plant will be seawater, although it is expected that some fresh water will be drawn into the beach wells. The expected quality of this water is summarized in Table 3-3.

Table 3-2 Finished Water Quality Goals

Constituent	Water Quality Goal
TDS (mg/L)	500
Hardness as $CaCO_3$ (mg/L)	100
Alkalinity as $CaCO_3$ (mg/L)	100
Sodium (mg/L)	60 to 200
Chloride (mg/L)	250

Table 3-3 Assumed Composition of Source Water

Constituent	Typical Ocean Water (mg/L)
pH	8.0 to 8.5
Temperature, °F	50 to 70
Ca^{2+}	400
K^{+}	380
Mg^{2+}	1,300
Na^{+}	10,600
Si^{4+}	15
Sr^{2+}	13
Br^{-2+}	68
Cl^{-}	19,000
SO_4^{2-}	2,700
HCO_3^{-}	140
F^{-}	1.3
B^{-}	4.6
Total TDS (mg/L)	35,000

It should be noted that the constituents listed in this table are for raw water. As discussed below, the beach wells will draw ocean water through the sand which will act as a filter, reducing levels of solids that are typically suspended in the water column. Also, while the zone of influence for the intake is expected to be primarily anoxic, minor biochemical reactions may occur. If these reactions do occur, levels of certain constituents could change as the water moves from the ocean to the desalination plant.

In the "Preliminary Subsurface Intake System Feasibility Analysis" by Fugro dated 12-6-2007, shallow vertical beach wells were recommended as the preferred intake system based on limited information. As noted in that report, a similar vertical beach well located in Marina, California, provides water with a water quality "essentially that of seawater, but there is a small percentage of fresh water outflow to the ocean that is captured by the intake well (about 10 percent)." Also noted was the possibility that locating the intake structures "near points of stream discharge at the ocean such as Arroyo Grande Creek could significantly affect water quality stability."

Therefore, the pretreatment system should be designed to accommodate a mixture of seawater, groundwater, and stream discharge. Additional investigations (i.e., a pilot pumping and treatment project, possibly with additional groundwater/seawater/surface water modeling) will be required to accurately estimate typical water quality in the intake water, and its variability.

In the absence of this additional information, some preliminary estimates of the range of dissolved solids in the feed water to the desalination facility can be calculated, assuming 10% groundwater, 10% surface water, and 80% seawater:

Seawater TDS in nearshore environment = 34,500 mg/L	x 0.8 = 27,600 mg/L
Groundwater minimum TDS = 330 mg/L (from Grover Beach 2006 Water Quality report)	x 0.1 = 33 mg/L
Surface water minimum TDS = 430 mg/L (Lopez reservoir–City of AG 2006 Water Quality report)	x 0.1 = 43 mg/L
Intake mixture minimum TDS	x 1.0= 27,676 mg/L

Therefore, at this level of planning, the desalination system should be capable of treating intake water with TDS range of approximately 27,000-35,000 mg/L.

3-3.1 Xenobiotics

The fate, transport, and effects of xenobiotics is an emerging field of interest to water quality professionals. Xenobiotic is a term that has been coined to collectively aggregate pharmaceuticals and drug metabolites, personal care products, hormones, plasticizers, pesticides (including many that have been banned for decades), petrochemical byproducts and metabolites, and other potential endocrine disrupting chemicals. These compounds could be present in the ocean, as a result of wastewater treatment plant discharges. (A xenobiotic is a chemical which is found in an organism but which is not normally produced or expected to be present in it. Specifically, drugs such as antibiotics are xenobiotics in humans because the human body does not produce them itself nor would they be expected to be present as part of a normal diet. However, the term is also used in the context of pollutants such as dioxins and polychlorinated biphenyls and their effect on the biota.)

Treating for removal/destruction of xenobiotics is in its infancy. RO membranes remove some xenobiotics. Other potential treatment processes include carbon adsorption, ultraviolet light, and electron beam irradiation.

3-3.2 Algal Toxins

Oceanic algal blooms can produce toxins that can cause illness and death in birds, sea mammals, and humans through the consumption of contaminated seafood (NOAA, 2008). Within the recent past the number of algal blooms has increased so that now all coastal regions in the U.S. have reported major blooms (CSCOR, 2008). These blooms are caused by the rapid growth of marine phytoplankton including blue-green algae, diatoms, and dinoflagellates.

These algal blooms produce toxins that may enter a seawater desalination facility. Of particular interest is domoic acid, an organic acid produced by marine diatoms of the genus *Pseudo-nitzschia*. Domoic acid accumulates in filter-feeding organisms, such as clams and mussels. The Federal Food and Drug Administration has determined that domoic acid at levels above 20 parts per million in shellfish tissue can be harmful to humans (Washington Department of Fish and Wildlife, 2008.) In El Segundo, California, domoic acid reached levels of 2 µg/L in untreated seawater during times of algal blooms in 2005 (Lauri, 2007, and Loveland, 2006). In May and June 2007 domoic acid was undetected (at a detection limit of 10 µg/L) in raw seawater at Long Beach, California (Tseng, 2007).

While it is not known at what level domoic acid in drinking water is harmful to humans, and no drinking water standards have been set, recent pilot tests have shown that treatment of raw seawater with ultrafiltration, followed by reverse osmosis, reduced domoic acid from 2 µg/L to less than 0.015 µg/L (Loveland, 2006). This result is consistent with the fact that reverse osmosis removes contaminants down to the ionic range (0.0001 µm), which will effectively remove algal toxins such as domoic acid (Monterey County, 2003).

3-3.3 Disinfection Byproduct Precursors

DBP precursor concentrations in ocean water tend to be relatively low, with the exception of bromine (Br) which can promote formation of bromate and brominated DBPs. Treatment by the RO system will remove the majority of any organic DBP precursors, as well as almost all of the bromine.

3.4 Treatment Process Assumptions

3-4.1 Pretreatment Approaches

Membrane filtration of the seawater is recommended as a pretreatment step ahead of RO membranes to prevent solids from reaching the RO membranes and damaging or destroying them. As a pretreatment step, membrane filtration is recommended in lieu of conventional filtration because experience has shown that membrane filtration provides much better quality water on a consistent basis. This better quality water is reflected in easier and less expensive operation and maintenance including less frequent RO membrane replacement.

3-4.2 Assumptions

The design criteria presented below are based on an assumption of a steady flow rate capable of delivering 2300 AFY if the plant were to be run continuously.
Assumptions made in developing the conceptual treatment process approach are listed below:

1. Desalination plant will be built in three phases with an ultimate firm capacity of 2,300 AFY (2.1 MGD--24 hours per day, 365 days per year);
2. Overall WTP operating availability will be 95% which results in an instantaneous plant design capacity of 2400 AFY (2.14 MGD). That is, periods when production is less than 2.14 MGD will be no more than the equivalent of 18 days per year resulting in desalted water production = 2300 AFY.
3. The desalting plant will be built in three phases,

a. Phase I--design capacity = 0.71 MGD = 800 AFY,
b. Phase II--design capacity = 1.42 MGD = 1600 AFY, and,
c. Phase III--design capacity = 2.14 MGD = 2400 AFY.

4. Water supply from the plant will come from wells producing 50 to 100 gpm each;
5. Well availability will be 95%--downtime of not more than 18 days per year;
6. The well water will be pre-treated using membrane filtration (MF);
7. The filtered water will be desalted using reverse osmosis (RO);
8. The desalted water will be post-treated using lime and carbon dioxide;
9. Primary disinfection will be accomplished using UV;
10. Secondary (residual disinfection) will be by chloramination;
11. Post-treated and disinfected desalted water will be pumped directly to customers as it is produced;
12. Microfiltration (MF) will be used for pretreatment. MF recovery will be 90%;
13. Reverse osmosis (RO) will be used for salt removal. RO recovery will be 60%;
14. MF backwash water will be treated by dissolved air flotation (DAF).
    a. The clarified effluent will be returned to the front end of the MF.
    b. DAF recovery will be 95%.
    c. The sludge would be sent to the headworks of the WWTP.
15. As an alternative, the sludge could be treated with a centrifuge.
    a. The centrifuge would produce a moist cake for disposal to a landfill.
    b. The centrate will be returned to the front end of the MF process.
    c. Centrate recovery will be approximately 90%.
16. RO concentrate will be discharged to a holding tank and discharged to the ocean via the WWTP ocean outfall during periods of low wastewater effluent flow;
17. MF and RO spent cleaning solutions will be pH neutralized and sent to the headworks of the WWTP for treatment and discharge to the ocean;
18. Due to the limited available outfall capacity, ½ day's MF backwash and RO concentrate will be stored on site and pumped into the WWTP ocean outfall at times of low WWTP effluent flow.
19. The well water TDS will vary between about 27,000 mg/L and 35,000 mg/L;
20. There will be no organic or inorganic substances in the well water that will require treatment processes other than those listed in this memorandum;
21. The plant will be built at the South San Luis Obispo County Sanitation District site adjacent to the Oceano airport;
22. The site, presently planted in turf, covers about 0.6 acres, but 0.75 acres could be available.

3-4.3 Well Production Rate and TDS
Based on the report by Fugro (discussed previously), it is expected that the production rate for the desalting plant supply wells will be in the range of 50 to 100 gpm each (0.072 to 0.144 MGD) unless cluster wells are developed. Annual production would be 80 AFY to 160 AFY (75 AFY to 10 AFY at 95% well availability) per well.

As noted below, at the ultimate desalted water production of 2300 AFY, well production = 4000 AFY which means that at least 25 wells and perhaps as many as 50 wells will be needed for the desalting plant to produce 2300 AFY. As discussed previously, other intake designs will be considered during the detailed hydrogeologic feasibility study.

The TDS of the well water is expected to range from about 27,000 mg/L to 35,000 mg/L. After each well is constructed, the production rate will be tested and the water quality analyzed. The complete suite of Title 22 water analyses should be run for each well to ascertain whether or not there are constituents in the water of sufficient concentration to be a public health hazard and/or that might hinder the operation of the MF and/or RO. Some particular constituents of concern are iron, manganese, silica, barium, total organic carbon (TOC), synthetic organics, oil, grease, and MTBE.

The variation in TDS is significant because osmotic pressure is related to TDS. Sea water osmotic pressure is 370 psi at a TDS concentration of 35,000 mg/L. At a TDS concentration of 27,000 mg/L, the osmotic pressure is 300 psi. The RO system design will need to be designed to handle the expected range of TDS.

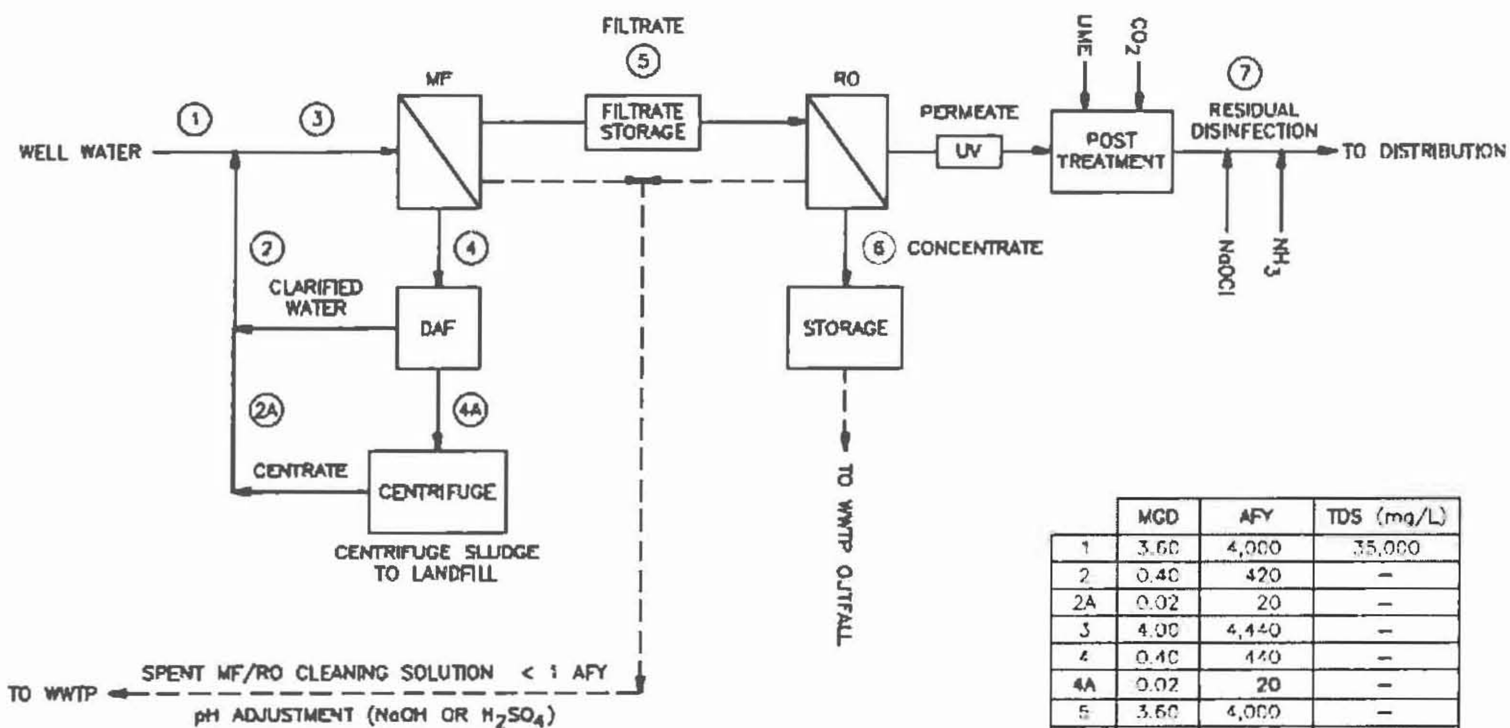
3-5 Conceptual Treatment Process

Figure 3-1 shows the process flowrates assuming the plant is producing desalted water at its ultimate rate of 2400 AFY (x 95% plant availability = 2300 AFY). The proposed process includes the following steps:

3-5.1 Membrane Filtration
4000 AFY of well water will enter the desalting plant and be mixed with 440 AFY of recovered MF backwash water and centrate (see below) for a total feed water supply to the MF of 4440 AFY. The MF process will recover at least 90% of the feed water as filtrate (4000 AFY) which will flow to the RO process. The MF filtrate (440 AFY) will be sent to the RO process.

3-5.2 MF Backwash Water Recovery
The MF backwash water (approximately 440 AFY) will be treated with a dissolved flotation (DAF) process. Coagulant will be added to the backwash water ahead of the DAF process. About 95% (420 AFY) of the backwash water will be returned to the front end of the MF process as clarified water. The remaining 5%, containing the solids, will be processed by a centrifuge. The centrate (water) from the centrifuge will be recycled to the front end of the MF process. The sludge from the centrifuge will be transported to a landfill for disposal. Recovering the backwash water (approximately 20 AFY) will reduce the number of wells needed to supply water to the plant by at least four (at 100 gpm per well) or eight (at 50 gpm per well).

Figure 3-1. Conceptual Desalting Process



	MGD	AFY	TDS (mg/L)
1	3.60	4,000	35,000
2	0.40	420	–
2A	0.02	20	–
3	4.00	4,440	–
4	0.40	440	–
4A	0.02	20	–
5	3.60	4,000	–
6	1.40	1,600	87,000
7	2.10	2,400	<500

NOTE: FLOW RATE ASSUMES 2300 AFY PRODUCTION AT 95% PLANT AVAILABILITY

3-5.3 MF Filtrate Storage

It will probably be necessary to include an MF filtrate storage tank between the MF equipment and the RO feed pumps to accommodate fluctuations in filtrate production and RO feed water flowrate. The tank should be as small as practical to minimize the chances of biological growth contaminating the filtrate. A tank volume of about 30 minutes of filtrate production (approximately 75,000 gallons) is proposed.

3-5.4 RO Desalting

The RO process will recover 60% (2400 AFY) of the MF filtrate feed water (4000 AFY) as permeate (desalted water). The remaining 1600 AFY (RO concentrate) will be discharged to the ocean with effluent from the WWTP. The concentrate will accumulate in a storage tank for discharge to the ocean at times when WWTP effluent discharge is low.

Depending on the pilot study results, water quality projections, and final membrane selection, recovery could change. Operating parameters such as flow rate, pH, and TDS concentrations of major streams in the RO process are given in the block flow diagram presented in Figure 3-1.

Over the last few years, improvements in RO membrane technology, reductions in the cost of membranes, and increases in energy costs have opened up new possibilities for configuring RO systems. Reductions in membrane cost coupled with increased energy cost tend to drive the process design to lower fluxes, which require more membrane area but reduce pressure (and energy) requirements. Lower flux also tends to improve fouling performance. However, lower flux also tends to increase salt passage, which could increase the required capacity of a second pass RO unit in order to meet water quality targets. Optimization of membrane performance is, then, a process of economic evaluation to determine the best combination of flux and water quality. This optimization should be performed during the preliminary design process and be based on information developed during pilot testing.

It should be noted that a wide variety of RO membrane manufacturers and organizations are developing more efficient RO membranes for ocean water desalination. As part of the pilot testing phase of the project, it is recommended that these products be evaluated to establish which specific membranes will be used for pilot testing and ultimately considered for the full-scale facility.

It should also be noted that several utilities are considering two-pass RO process layouts to reduce levels of boron in the treated water. When using this process, caustic soda is added upstream of the first and/or second pass (depending on site-specific seawater quality and treated water quality objectives) for pH adjustment. High pH is necessary to obtain high boron removal. Recently, several membrane manufacturers have developed high boron rejection membranes. It is expected development efforts related to boron rejection will continue and multiple-pass layouts with pH adjustment will not be required for the sole purpose of boron removal.

As previously mentioned, development, pilot testing, and implementation of an innovative RO membrane is currently under development by UCLA. This RO membrane integrates nano-particles into the membrane material. While this new RO membrane is currently under commercialized development by NanoH_2O, LLC, in association with UCLA, tests indicate that it can improve water quality, reduce fouling potential, and reduce energy demand and operating costs compared to more traditional ocean water RO membranes. Development of this product suggests that a single-pass configuration would be used at the full-scale.

In order to control scaling and fouling, chemicals such as acid and/or anti-scalants are added upstream of the desalination process to allow higher recovery and reduce fouling or scaling rates. Typical seawater RO systems do not use acid but often do use anti-scalants. Because site-specific feedwater quality data is not available at this time, this evaluation assumes use of anti-scalants but not acid for pretreatment

3-5.5 Post-Treatment

The permeate (the desalted water) will be low in dissolved solids (which will consist primarily of sodium and chloride), have a low pH, and will have essentially no hardness or alkalinity. Consequently, the water will be highly corrosive. If it were delivered to the distribution system without additional treatment, aesthetic issues related to the taste of the water would develop.

At this conceptual design level, it was assumed that the post-treatment would consist of the use of lime and carbon dioxide to adjust the pH and alkalinity of the treated water. The design of the post-treatment system should take into consideration several issues including availability and cost of chemicals, and quality of the water in the distribution system with which the desalinated water blends. These issues should be evaluated further following pilot testing (or as part of the pilot testing).

3-5.6 Primary Disinfection

The California Department of Public Health (CDPH) will require disinfection of the post-treated permeate before it is delivered to customers. Primary disinfection to satisfy expected CDPH requirements of 0.5 log giardia inactivation and 2.0 log inactivation of viruses could be accomplished using chlorine or ultraviolet (UV) light.

If chlorine is used, chlorine contact time of about 30 minutes will be needed. This time could be provided in a contact tank or in a pipeline. At the ultimate, instantaneous production of 2.2 MGD, 30 minutes of contact time is equivalent to about 46,000 gallons. If a contact tank is used, it should be baffled to increase the T_{10}/T and minimize the tank volume. Typically, the CDPH assigns $T_{10}/T = 0.1$ for unbaffled tanks. A contact tank water volume of at least 0.5 MG would be needed unless a higher T_{10}/T value can be proven to CDPH's satisfaction. An alternative to a contact tank would be a pipeline that provides "plug flow". 2,000 feet of 24 inch diameter pipe could provide 30 minutes of contact time.

The UV alternative would take up considerably less room on the site. The construction cost might be less than if chlorination were used for primary disinfection. However, the O&M costs will likely be higher.

It was assumed for purposes of this report that UV would be used for primary disinfection because of the severe site constraints.

3-5.7 Secondary Disinfection

After the UV process, residual disinfection will need to be provided. Because the participants in the project use chloraminated water from the State Water Project and

Lopez Water Treatment Plant, we propose to use chloramines to provide the residual disinfectant chemical in the desalted water.

3-5.8 Membrane Cleaning

The MF and RO membranes will require chemical cleaning on occasion. The frequency of the cleaning depends of the quality of the water and how the plant is operated. It is expected that the total volume of water required for chemical cleaning would be no more than 1 AFY. The spent cleaning solution will be pH neutralized and sent to the front end of the WWTP with ultimate disposal to the ocean.

3-6 Chemical Requirements

A preliminary estimate of the types and quantities of chemicals that will be required includes:

4. **Post-RO** -- Lime and carbon dioxide will be added to the water to provide hardness and alkalinity and reduce corrosivity

5. **Disinfection** -- The water will be subjected to UV for primary disinfection and then sodium hypochlorite and ammonia added to provide a chloramine disinfectant chemical residual prior to discharging the water into the distribution system.

6. **Membrane Cleaning Chemicals** -- Caustic soda (sodium hydroxide), citric acid, surfactant (detergent), and, perhaps, proprietary membrane cleaning chemicals, will be used, depending on the membrane systems suppliers.

Preliminary estimates of the annual quantities of the chemicals (at 2300 AFY production of desalted water) that will be used are:

1. Chlorine- 28,000 pounds per year;
2. Sodium Bisulfite- 13,000 pounds per year;
3. Lime- 125,000 pounds per year;
4. Carbon dioxide- 140,000 pounds per year;
5. Ammonia- 3,200 pounds per year;
6. Membrane cleaning- 2,000 pounds per year.

3-7 Power Consumption

Desalting plants are relatively large electric power consumers. To minimize power consumption, energy recovery will be included in the RO equipment design. At the assumed 60% RO recovery, 60% of the RO feed water exits the RO process as permeate and 40% exits as concentrate. The RO feed water pressure will be on the order of 1100 psi. Assuming RO feed pump efficiency of 75% at a flow of 4400 AFY of RO feed water, the RO feed pumps will consume about 14,000,000 KWHr per year.

The concentrate exits the RO system at about 20 psi less than the RO feed water pressure. Essentially, 40% of the energy input to the feed water exits the desalting process in the concentrate. Modern energy recovery devices used on RO plants can have efficiencies of 90% or more. Assuming that the energy recovery devices employed at the desalting plant recover 90% of the energy, about 5,500,000 KWHr per year of RO feed pump energy input will be recovered.

Therefore, the RO desalting process will consume about 8,500,000 KWHr per year. This is equivalent to about 3700 KWHr per AF of desalted water produced.

The total power consumption for the desalting plant will be approximately:

Membrane filtration	500 KWHr per AF
Reverse osmosis desalting	3,700
UV disinfection	400
Miscellaneous (lights, instrumentation/controls, etc.)	700
Total Estimated Power Consumption	5,300 KWHr per AF

The total instantaneous power demand, at a production rate of 2.2 MGD (6.75 AFD), will be about 1,500 KW.

The demand and consumption figures above do not include power for the wells or the treated water pump station.

3-7.1 Minimizing Energy Consumption

Reverse Osmosis (RO) desalting is energy intensive. There are several potential opportunities for minimizing energy consumption of the desalting project. These include careful attention to details such as minimizing hydraulic losses through piping and valving, selection of efficient pumps, etc. In addition, four opportunities could reduce energy consumption significantly. These include:

- Reducing RO membrane flux (or flow rate per unit area of filter) below typical values. Seawater RO plants typically operate at fluxes of 8 or 9 gallons per square foot (of membrane area) per day (gfd). Reducing flux can significantly reduce costs. For example, Boyle recently provided "value engineering" services to the Honolulu Water Supply Board regarding the design of the Kalaeloa 5 MGD seawater desalting plant. The designers initial used a design flux value of 9.5 gfd. Boyle calculated that reducing the average flux to 6.1 gfd would increase construction costs by $1,500,000 but save $500,000 per year in O&M costs. This additional $1,500,000 in construction cost includes additional RO membranes and pressure vessels. The O&M cost savings comes from power cost savings (at $0.10/KWHr) which are somewhat offset by higher membrane replacement costs.

- Feed pump selection is critical to designing an energy-efficient RO facility. Positive displacement (piston) type pumps should be considered instead of centrifugal pumps. They offer several distinct advantages including:

1. Piston pumps operate at a constant speed and flowrate, but variable pressure whereas vertical turbine pumps need to be equipped with variable frequency drives (VFD) so the pump speed can be adjusted to provide the flow and pressure required.
2. Piston pumps operate in the range of 300 RPM whereas centrifugal pumps for seawater RO plants operate at about 3000 RPM.
3. The life-cycle cost for piston pumps is typically less than for centrifugal pumps.
4. Piston pumps are typically at least 15% more efficient than centrifugal pumps.

3-8 Treatment Plant Layout

The proposed site at the South San Luis Obispo WWTP is irregularly shaped and covers about 0.6 acres, as shown below.

Figure 3-2. Proposed Desalination Plant Site

This is a very small site. The site may be adequate but will require a multi-story facility and construction will be more expensive per square foot than for a 1-story facility. One potential arrangement would be to construct a multiple-story structure covering about 10,000 square feet (100 feet square, for example):

3. **Bottom floor** --brine storage (1 MG--approximately one-half day concentrate production at the peak desalted water production rate of 2.2 MGD);
4. **Second floor**--Membrane filtration, and reverse osmosis desalting.

This building, with working clearances from the access road, would probably take up most of the site. Room on the site would be needed for chemical storage, parking, access to and around structures and equipment, treated water pump station, etc. There would be no room for a treated water (or chlorine contact) tank on the site of any significant volume.

The MF filtrate storage tank and RO feed pumps would likely be placed outside of the building. The storage tank would weigh (when filled with water) almost 500 tons. A conceptual building plan is shown in Figure 3-2. Note that this conceptual plan will be adjusted to accommodate site constraints and process needs, and is provided here to indicate the scale of the facilities that will be needed for the proposed plant.

Other Considerations. The plant site includes several utilities in the area, including one major pipeline, the Pismo Beach effluent pipeline. This pipeline would need to be relocated as part of the desalination plant construction effort, particularly with underground brine storage. This is further discussed in the following Section.

CHAPTER 4

OUTFALL AND BRINE DISPOSAL

The South San Luis Obispo Sanitation District's existing ocean outfall is shared with the City of Pismo Beach (Pismo). According to the agreement between the City of Pismo Beach and SSLOCSD, the total capacity of the outfall line is contractually defined as follows:

Pismo Beach	44%
SSLOCSD	56%

According to Kennedy Jenks, the engineering firm who originally designed the outfall line, the exact capacity of the outfall line is not known. However, recent upgrades to the Pismo WWTP spurred an evaluation of the existing pipeline capacity. According to the recent analysis, the total capacity of the pipeline is estimated at 16 MGD. Therefore, utilizing the percentages listed above, the SSLOCSD portion of the total estimated outfall capacity is approximately 9 MGD.

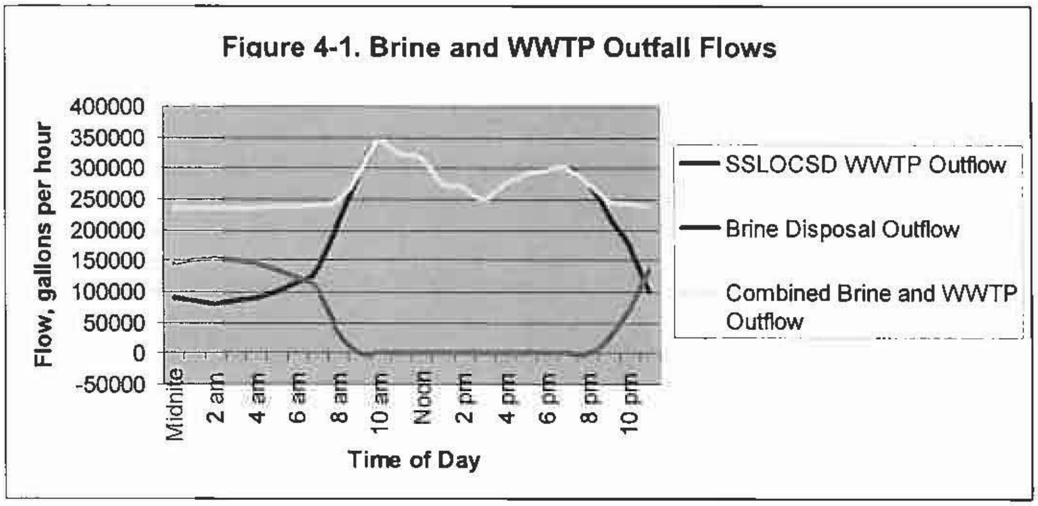
The permitted average and peak flow for the SSLOCSD WWTP is 5 MGD and 9 MGD, respectively. Thus, during periods of high flow through the WWTP, capacity will temporarily not be available in the existing outfall configuration for brine disposal from the proposed desalination plant. Therefore, brine storage will likely be necessary at the desalination plant site to account for management of brine disposal through the outfall line.

As discussed, the assumed recovery rate through the RO membrane filters is approximately 60%. Using the proposed product water goal of 2,300 AFY, the required quantity of brine to be disposed of from the treatment process will be approximately 1.4 MGD. To accommodate daily storage of brine on-site, it is recommended that some storage capacity be included in the desalination facility site plan. Figure 4-1 depicts the operational scenario for discharge of brine and WWTP flows on a typical daily basis. During periods of extreme weather events, brine discharge may not be allowed at all, and if the brine storage tank is full, desalination operations would need to be curtailed during high wet weather flow events.

4-1 Brine Storage Capacity

Constructing a brine storage facility will provide a means for managing disposal of brine into the existing ocean outfall. Because the estimated remaining hydraulic capacity in the SSLOCSD portion of the outfall line fluctuates throughout the day and night, brine from the desalination plant may need to be stored on-site and disposed of during periods of low-flow through the outfall.

Due to site constraints (outlined below), it will be important to minimize the required brine storage facility. In order to minimize brine storage, an evaluation of the diurnal flow through the existing wastewater treatment plant was calculated. A spreadsheet model was prepared to simulate disposal of brine from the desalination plant in conjunction with the average daily effluent flow from the SSLOCSD WWTP. To be conservative, it was assumed that the outfall available capacity would be limited to 6 mgd, to allow for buffer



and the uncertain capacity of the outfall. Results from the water balance model indicate that approximately 750,000 gallons of brine storage capacity will be necessary on-site.

The entire area designated for the desalination plant is approximately 10,000 sf in size. The proposed desalination plant equipment, including pre and post treatment, will consume the majority of this designated footprint. Therefore, it is likely the brine storage will need to be constructed as an underground reservoir. Some concerns with constructing the brine storage underground include: high groundwater, large capacity, high cost, conflicts with miscellaneous yard piping for the existing wastewater treatment plant.

- Preliminary analysis of the area indicates the likelihood of encountering high groundwater in the vicinity of the proposed desalination plant site. Therefore, minimizing the depth of an underground facility will be a key component in the design of the storage facility dimensions. The tank will also need to be carefully designed to prevent hydraulic uplift of the concrete reservoir.

- Capping the total depth of the storage tank at 10 feet in height results in a total square footage area of 9,500sf to meet the estimated 750,000 gallon required capacity. As noted above, the entire designated area for the plant is only 10,000 sf, therefore the underground brine storage would encompass the majority of the designated area for the desalination plant.

- Yard piping plans indicate few existing utilities within the designated desalination plant area, however the main effluent line from Pismo Beach WWTP transverses the lawn area directly below the proposed desalination plant. It will be important to consider impacts on the Pismo Beach effluent line during detailed design of the brine storage facility.

<u>4-1.1 Possible Reductions in Required Brine Storage</u>

Under the baseline assumption, the desalting plant operates on a steady-state basis. If the ability of the existing outfall to dispose of brine constrains the operation to less than 2300 AFY, then design modifications will be needed. These changes may include:

- Increasing the desalting plant's capacity and then modifying its operational schedule to allow more desalted water (and brine) to be produced during off-peak wastewater disposal hours. This will drive up the cost of the Project, and increase the beach well intake requirements accordingly.
- Building additional brine storage facilities at the desalination site.
- Utilizing the existing outfall pumps on a routine basis, to increase hydraulic capacity of the outfall. Review of the hydraulic conditions and layout of the outfall, existing outfall pumps and chlorine contact chamber reveals that use of the existing outfall pumps is not feasible. These existing pumps pressurize effluent directly from the chlorine contact chamber, and brine could not be introduced into the chlorine contact chamber. This would require a separate pumping station dedicated to brine disposal. Further study would be required to determine the viability of having dual outfall pumping stations controlling effluent discharge through the outfall.

It is recommended that storage of brine at the facility be required as part of this Project, to account for planned shutdowns and unanticipated disruptions in the disposal facilities. If site size or other considerations restrict the amount of brine storage available, then the desalination plant design criteria may need to be changed as follows:

- The system will need to be designed to handle a wide range of flows and be able to quickly change flow rates. This is not very practical from an operational standpoint.
- The system could be redesigned to generate a smaller volume of brine. For example a higher recovery rate could be utilized in order to reduce the volume of wasted brine, however the trade off would be significantly higher energy costs.

4-2 Brine Disposal Alignment

Brine from the desalination plant will be gravity fed to the SSLOCSD outfall line at the southern edge of the property. Based on the configuration of the existing effluent line, the desalination brine line will likely tie in at the junction box where the Pismo Beach effluent is introduced into the system. Because the introduction of brine from the desalination plant will be downstream of the SSLOCSD effluent pump station, in the event of high tide and high flow, the existing effluent pumps at the SSLOCSD plant will need to assist in pumping effluent as well as the flow from the brine storage out the ocean outfall. However, with the proposed brine pumping program (that is, pumping brine off-peak), the pumping capacity of the existing effluent pump station should not be impacted by the desalination plant brine disposal operations.

CHAPTER 5

PRODUCT WATER DELIVERY

Following discussions with the water system operators from each of the three agencies, product water will be delivered from the desalination plant to the agencies along the route depicted in Figure 5-1. Although other routing alternatives may be available, the depicted routing was the most direct, cost-effective and viable routing that would serve all three agencies.

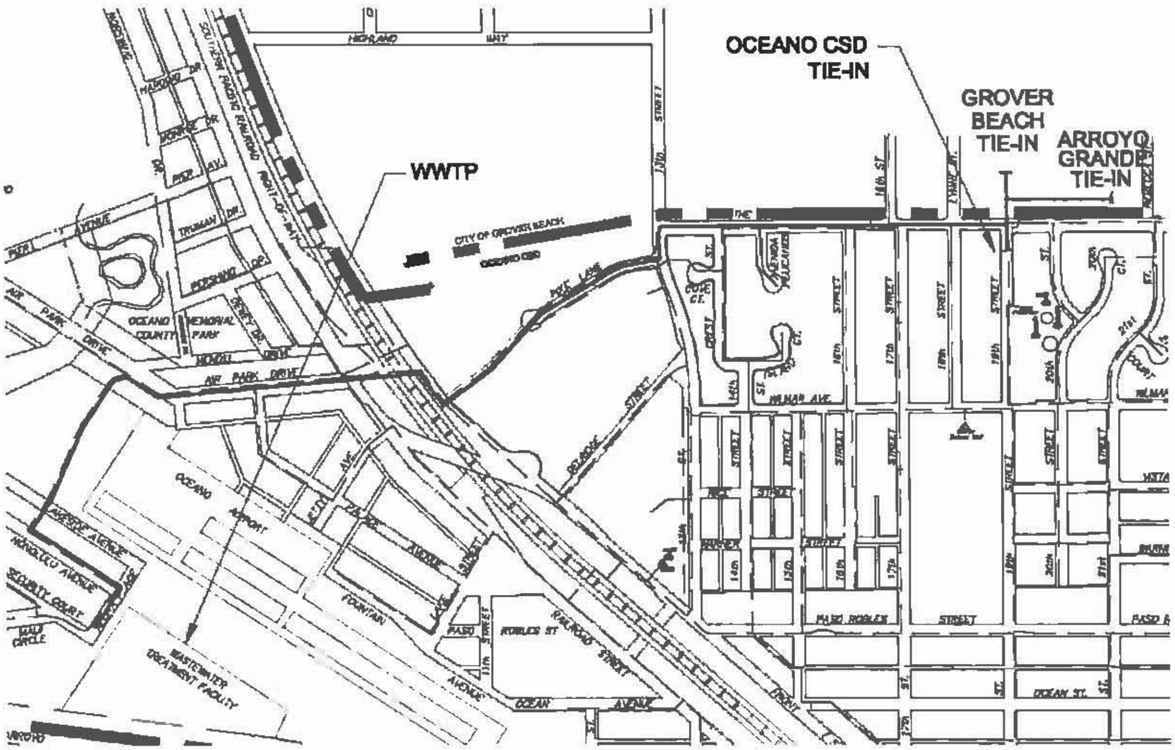


Figure 5-1. Product Water Alignment Options

The main route from the treatment plant will traverse along existing Oceano CSD water line routes, utilizing existing utility easements under the airport property, Highway 1, and the railroad. The shared pipeline would terminate near the intersection of 19th Street and The Pike, in Oceano. From this location, the shared pipeline would divert in three different directions: to Oceano's reservoir on 19th Street, and to individually owned booster pump stations for Grover Beach and Arroyo Grande. The pressure from the main pipeline would need to be sufficient to convey product water to Oceano's reservoir, while the two booster pump stations would be used to pump water into the higher pressure distribution systems for Grover Beach and Arroyo Grande.

Other alternatives for product water delivery included delivering all the product water to Oceano in lieu of pumping rights from the groundwater basin or Lopez water. Several problems were discovered with this alternative, including the fact that the product water from the desalination plant is more than double the quantity of water the Oceano has available to "trade".

Another alternative was to deliver all the desalination product water into Oceano's distribution system with Grover Beach and Arroyo Grande utilizing new inter-tie stations to take water directly from the Oceano system. The main concern with this alternative was the fact that all three water agencies would then be hydraulically connected. With each water agency needing to be permitted through CDHS, complications may arise in obtaining new permits if all three water agencies were connected. The inter-tie approach would also require pressure regulation, and booster pumps to match system operating pressures between the differing agency water systems and pressure zones.

5-1 Preliminary Delivery Piping Sizes

Based on delivery of 2,300 AFY of product water, on a continual basis, the first segment of water main (delivering water to all three agencies) will need to be 12-inch diameter. After delivery of water to Oceano, a secondary booster station will be required to pump approximately 1,500 AFY of water to the City of Grover Beach and City of Arroyo Grande. Immediately downstream of this secondary booster station, discharge piping should remain 12-inch diameter, then each respective branch to the two cities can be reduced to 8-inch diameter.

CHAPTER 6

ENVIRONMENTAL REVIEW AND PERMITTING CONSIDERATIONS

This section addresses the various environmental constraints and issues identified as part of this Study, and the anticipated permitting requirements of the various local, State and Federal agencies.

6-1 Environmental Review

The following provides a summary of the potential issues that will be evaluated as part of the required future environmental review process for the project. The potentially significant issues are identified with particular emphasis on the key environmental issues. This environmental screening assessment can be used as a tool for scoping the project-level environmental document in accordance with the California Environmental Quality Act (CEQA). However, the emphasis of this environmental screening is to identify major scoping issues and to confirm that the documentation appropriate for the future CEQA compliance in an Environmental Impact Report (EIR). The appropriate analysis and documentation for these issues must be included in the future EIR for the project, should the Lead Agency and the other partners proceed.

6-1.1 Water Quality and Hydrology

The proposed desalination plant and distribution system could affect hydrology and water quality in the area. The discharge of reject brine could affect water quality in the marine environment depending upon the method and dilution properties of the discharge. Compliance with applicable Regional Water Quality Control Board (RWQCB) NPDES permit and Waste Discharge Requirements, Title 22 of the California Code of Regulations, and the San Luis Obispo County Department of Health Services requirements would minimize potentially significant water quality and hydrology impacts. Construction and operation of the intake wells could adversely affect local hydrogeologic conditions. Construction activities could adversely affect water quality due to soil/ground, wetland and drainage disturbance; however, temporary impacts related to construction activities can typically be mitigated with Best Management Practices. As noted in previous correspondence, trenchless construction proposed for Alignment Alternative Two (refer to Figure 2-1, Chapter 2) of the intake system pipeline, will cause minimal surface disruption along the pipe route. However, the possibility of release of drilling fluids, termed "frac-outs", could pose significant impacts if released into the lagoon. Although the drilling fluids consist of inert materials, release of such materials to the environment would have considerable impairment to the water body due to turbidity and pH changes to the water quality in the lagoon. This may be considered a significant and unavoidable (albeit temporary) impact on Water Quality. Other water quality issues, such as product and source water quality (State Department of Public Health issues) are discussed later in this chapter.

6-1.2 Vegetation and Wildlife

In accordance with CEQA and State CEQA Guidelines, project impacts on vegetation and wildlife would normally be considered significant if development substantially effects a rare or endangered species of plant or animal or the habitat of the species; interferes substantially with the movement of any resident or migratory fish or wildlife species; or substantially diminish habitat for fish, wildlife or plants.

The open dunes and dune scrub habitats, central fore dunes, and central dune scrub (described as dense coastal scrub communities of scattered shrubs, sub shrubs, and herbs generally less than 1 meter tall and often developing considerable cover) can be found in the Arroyo Grande Lagoon Area along the immediate vicinity of the project components. These vegetation types provide potential habitat for several rare plants including surf thistle, branching beach aster, dune larkspur, beach spectaclepod, Blochman's leafy daisy, Nipomo Mesa lupine, crisp monardella, San Luis Obispo monardella, and blackflowered figwort. These species have potential to occur in the dune complexes and dune scrub habitat in the westernmost portion of the Arroyo Grande Creek.

In some back dune areas, there are dune lakes (also called dune slack ponds). These unique and rare wetland habitats provide potential habitat for several rare plants including marsh sandwort, La Grasiosa thistle, and Gambel's watercress. Most recorded occurrences for these species in the region are around the dune lakes a few miles south of Arroyo Grande Creek such as Jack Lake, Lettuce Lake, Oso Flaco Lake, Black Lake, and others. The dune ponds and lakes immediately north and south of Arroyo Grande Creek appear to be artificially created or enhanced by levees, but provide low to moderate potential habitat for these rare plants.

The Arroyo Grande Creek and Oceano Lagoon area supports a uniquely different suite of plants than the dunes surrounding it. Dominated mainly by riparian species including bull rush and arroyo willows. The Arroyo Grande Creek is in an arid region with highly variable rainfall, precipitation and stormwater runoff. Anadromous steelhead inhabit Arroyo Grande Creek for spawning and egg incubation and as a juvenile rearing habitat. The federally listed California red-legged frog has been observed along the Arroyo Grande Creek.

Arroyo Grande Creek area supports a diverse assemblage of wildlife species. Wildlife species in the area, particularly in the less developed upper watershed, include mule deer, coyote, gray fox, striped skunk, raccoon, and bobcat, cottontail rabbit, dusky-footed wood rat, deer mouse, and California pocket mouse. Other species in upland areas near Lopez Lake include California quail, California towhee, California thrasher, and wren tit, western toad, coastal western whiptail, California horned lizard, and California legless lizard. Oak woodlands in the area provide habitat for salamanders, Pacific tree frogs, acorn woodpecker, western scrub jay, house wren, red-tailed hawk, red-shouldered hawk, Cooper's hawk, and American kestrel. Pocket gophers and ground squirrels are common in surrounding grasslands.

Significant biological resources within the study area are associated with the Arroyo Grande Creek and Oceano Lagoon. The source water pipeline and wells located along Pismo Beach, Arroyo Creek and Oceano Lagoon area are likely to impact habitat with the potential to support four federally- or state-listed wildlife species, including steelhead (Onchorhynchus mykiss irideus), snowy plover (Charadrius alexandrinus nivosus), California red-legged frog (Rana aurora draytonii) and tidewater goby (Eucyclogobius newberryi).

In addition, several California Native Plant Society list 1.B plants have the potential to occur within or in the immediate vicinity of the Arroyo Grande Creek and Oceano Lagoon area including San Luis Obispo monardella (Monardella frutscens) and La Graciosa thistle (Cirsium loncholepis).

All source water pipeline alignment alternatives have the possibility to impact these resources. All three source water alignments alternatives have the potential to impact sensitive resources and/or habitats within the Oceano Lagoon area. Alignment Alternative 1 includes a pipeline along the dirt road on top of the north bank/levee of Arroyo Grande Creek through the Oceano Lagoon area. Alignment alternative 1 has the potential to impact sensitive habitats on either side of the levee during construction of the pipeline. Alignment Alternative 2 has the potential for impact as the directional drilling could result in a "frac-out" within sensitive habitat. Impacts for this alternative would also depend on the location of the drilling area and staging of pipes. To minimize impacts all disturbance from the drilling area should occur outside of any riparian or lagoon wetland habitat. Permits for the project, including the Streambed Alteration Agreement from California Department of Fish and Game (Fish and Game Code section 1603), would require a plan for addressing a potential "frac-out" event. Alternative 3 appears to have the least potential for impacting natural resources as most trenching would occur within public roadways. The two impact areas for Alternative 3 would be construction of the pipeline attached to the bridge over the lagoon and connection of the intake wells to the Oceano beach ramp. The methodology of construction for each would have to be disclosed and considered in the EIR and all three alternatives would require localized surveys to determine presence of special-status species before all impacts could be fully identified and evaluated.

Mitigation for each of these impacts might require plant or animal relocation and mitigative planting from local seed depending on the result of the localized surveys. Also it is likely that construction phase monitoring would be required for all three source water pipeline alignment alternatives. With these mitigation techniques it is likely that all impacts could be reduced to a less-than-significant level.

6-1.3 Marine Resources

The proposed project could result in (or be perceived to result in) significant impacts to marine resources related to the addition of chemical additives and byproducts to the source water, an increase in salinity and/or temperature, and erosion, frac-out or other construction-related pollutant releases to the lagoon or ocean environment.

All chemical additives and/or byproducts must be neutralized during the desalination process or collected in a separate collection sump and subsequently taken by tanker truck to an appropriate off-site disposal site. Although extensive studies on the affect of saline and temperature variations do not exist along the coast of California, impacts of the proposed project from salinity or temperature variations related to the desalination brine discharge are not anticipated to be significant. This is based on the anticipation that the brine added to treated wastewater would increase the salinity and maintain adequate temperatures to enhance or maintain the existing dilution conditions of the discharge. Studies may be required as a part of the approval process to ensure the discharge is in compliance with the South San Luis Obispo Sanitation District (SSLOCSD) Waste Water Treatment Plant (WWTP) existing discharge permits or to substantiate lack of impacts due to any proposed changes to discharge limits. Brine accumulated during the desalination process is proposed to be stored on site until the existing outfall associated with the SSLOCSD WWTP and the City of Pismo Beach reaches the flow necessary to facilitate use by the desalination plant. The California Regional Water Quality Control Board (RWQCB), Central Coast Region, is the agency responsible for the protection of near-shore water quality. The RWQCB regulates discharges to the ocean in accordance with the Water Quality Control Plan for Ocean Waters of California, usually referred to as the "Ocean Plan" (Calif. State WRCB, 1990). Brine discharges must not affect water quality or marine life; must avoid areas of special biological significance; and must provide sufficient initial dilution so as to not alter marine water quality.

The use of shallow vertical beach wells and/or collector (i.e., vertical shaft with horizontal wells) beach wells would eliminate impingement and entrainment of sea life (a well-documented impact of open ocean intake systems), because the intake of seawater would occur entirely beneath the substrate and no pressure or flow gradient would result in the open ocean.

6-1.4 Geology, Soils, and Seismicity

As described in the CEQA Guidelines, a project would normally have a significant geologic effect on the environment if it were to cause substantial erosion or siltation, or expose people or structures to major geologic hazards. In addition, for the purposes of this initial screening, conditions that resulted in subsurface project components being exposed by coastal erosion would be considered potentially significant because of potential public health hazards and aesthetic concerns.

Implementation of the proposed project would subject property to potential geologic hazards. Facilities would not cross any active or potentially active fault zones, although there are some inactive fault zones in the immediate vicinity of the project. During the life of the project, all three pipeline alignment alternatives and the desalination facility may be subjected to seismic hazards such as liquefaction, as the entire area is rated at least medium or highly susceptible to liquefaction. However, while liquefaction ratings are high, landslide susceptibility has been rated low in all areas of potential development. Although the project site is not subject to severe beach sand erosion, this may be considered a significant issue for which mitigation may not be available. The long-term viability of the beach wells, pipelines and the plant could be jeopardized, should sea levels rise due to global climate change or other natural phenomenon (such as tsunami, seiche, tidal wave, etc.)

6-1.5 Public Health and Safety

This section deals with the potential effects on public safety that could result from the construction and operation of the proposed project. The proposed project could affect public health in two ways: 1) any change in drinking water source has the potential to affect public health; and 2) construction of the project and treatment of water involves the generation and use of chemicals, some of which are hazardous. The EIR will need to confirm that there would be no significant public health and safety impacts and define how the project will comply with Federal requirements for drinking water, including compliance with Title 22 of California Code of Regulations. See Boyle Engineering (July 2008) for more information on drinking water quality (i.e., source water feeding into, and product water produced by, the desalination facility) and hazardous materials use during operation. The future project would be required to conform to all federal, state, and local laws for facility design, storage requirements, spill prevention procedures, emergency response and contingency plans, risk management, and employee training procedures.

6-1.6 Cultural Resources

In accordance with State CEQA Guidelines, significant impacts on archaeological resources are those actions that would result in disruption of, or have an adverse effect on, a prehistoric or historic archaeological site, a property of historical or cultural significance to a community, ethnic or social group, or a local landmark of cultural importance. Ground disturbing activity for any of the components potentially may result in the alteration or destruction of identified or undiscovered prehistoric, ethnographic, and historic archaeological resources. No facilities will be sited on areas with known cultural resources. Trench construction for all possible source water pipeline alignment alternatives may require extensive monitoring in the Oceano Area due to the possible presence of archeologically sensitive material. Further studies will be needed once preliminary construction drawings have been prepared to document any known resources through a surface reconnaissance and research of existing information. Standard mitigation measures would be required, even if no resources are known to exist in the project area.

6-1.7 Air Quality

In accordance with the State CEQA Guidelines, a significant adverse air quality impact would result if a project releases emissions that exceed specified thresholds; would result in a violation of ambient air quality standards; is inconsistent with adopted air quality plans and projections; exposes sensitive receptors to substantial pollutant concentrations; releases toxic or hazardous pollutants; or causes odors or other nuisances impacting a considerable number of people.

Project related air quality impacts fall into three categories: construction, traffic (indirect), and operations (direct). Construction-related impacts include the generation of temporary, intermittent localized increases in windborne dust, and toxic air contaminants, while clearing and grading operations occur.

The air pollution impact of a fugitive dust source depends on the quantity and drift potential of the dust particles injected into the air. In addition to large dust particles that settle out, considerable amounts of fine particles are also emitted and dispersed over much greater distance from the source. For all alternatives, there would be significant construction-related short-term impacts related to PM10 levels. Implementation of the mitigation measures would reduce construction-related fugitive PM10 emissions by 50 percent or greater. However, resultant emissions from proposed construction activities may remain above the applicable San Luis Obispo Air Pollution Control District (SLOAPCD) PM10 threshold. In addition, the project construction equipment and vehicles would emit regional pollutants and pollutant precursors and toxic air contaminants. The EIR must evaluate whether these emissions would constitute a significant impact and for each significant impact, the EIR must identify mitigation.

Traffic generated during construction of the proposed project would temporarily increase regional ozone precursor emissions in the air basin. Traffic generated by construction includes the temporary use of heavy equipment during grading and site preparation and trucks and automobiles transporting building materials and employees to the site. Therefore, this impact may be considered a significant short-term impact. The project may also require a permit to operate from the San Luis Obispo Air Pollution Control District (SLOAPCD) for any potential operational equipment (such as fossil fuel generators) that may be required for the project. Compliance with permit requirements/conditions would ensure that operational impacts remain less-than-significant.

6-1.8 Energy/Global Climate Change

The assessment of energy impacts are also addressed in the California Environmental Quality Act (CEQA), and requires that EIRs identify the possible mitigation measures "to reduce wasteful, inefficient, and unnecessary consumption of energy." In accordance with State CEQA Guidelines, a project would be considered significant if it would result in the use of large amounts of fuel or energy; if it would use fuel or energy in a wasteful manner; or if the energy supplier cannot meet the project's energy needs with existing and planned energy capacity.

Seawater desalination is considered to be an energy intensive operation, and the project would potentially result in significant cumulative impacts on global climate change due to greenhouse gas emissions associated with high energy use. The production of electricity from fossil fuel sources emits carbon dioxide, methane and other greenhouse gases. Electricity demands of this type of desalination facility are provided in the Chapter 4 of this Report. The project's emissions of greenhouse gasses must be quantified and a determination of significance of those emissions shall be made consistent with local, regional, and state guidance and thresholds, if available, appropriate methodologies for quantifying the emissions, and mitigation measures to reduce emissions. Chapter 4 of this Report documents some potential measures for reducing the electricity requirements of the project.

In addition, the project may be subject to impacts due to global climate change; specifically, sea level rise may result in beach sand erosion or inundation of project components. This may result in a disruption in essential services (i.e., if the desalination plant is a needed water supply). This impact may be mitigated by development of a shoreline recession management plan, since the sea level rise (and beach sand erosion) would occur gradually over many years.

6-1.9 Visual Quality

According to the State CEQA Guidelines, aesthetic impacts are defined as "having a substantial, demonstrable negative aesthetic effect." Potential visual impacts are considered significant if the existing visual quality of the area would be substantially degraded. Furthermore, significant impacts would occur if the project were to conflict with aesthetic principles or policies of the area's governing jurisdictions.

Construction of the desalination plant would alter the visual setting of the project area, however, the area of the plant site is already disturbed and is located at the WWTP site. The desalination plant would be constructed within the WWTP site in an area that is not highly visible to area residents. Therefore, the construction of the desalination plant itself is not considered to have the potential for significant impacts.

In addition, these impacts are mitigable through standard buffers and design techniques. The beach wells may require some permanent above-ground structures to be located on the beach within the Coastal Zone. This visual impact may be considered to be significant and it is unknown whether mitigation measures are available for that impact to reduce the significance to below acceptable thresholds. As noted in Chapter 3, "The Cities and District should consider installing a boardwalk or public access area over and around these wells in order to shield them from public view while still allowing access for maintenance. Secure lockable access hatches could be designed into the boardwalk or walkway for maintenance and monitoring of the well facilities." Construction activities could have short-term impacts but construction impacts are temporary in nature and therefore, can be considered to be less-than significant, or mitigated to a less-than-significant level.

6-1.10 Land Use, Planning, and Zoning

The source water pipeline alignments require use permits and/or easements through relevant jurisdictions (including, at a minimum, State Parks and San Luis Obispo County) depending on which alternative alignment is selected. The source water pipeline alignment will also require the acquisition of several permits through local, state and federal regulatory agencies which oversee the various resources potentially impacted by the project. The desalination facility will require the acquisition of a conditional use permit from San Luis Obispo County. See Table 6-1 for more information on permits required. This memorandum further discusses the project's consistency with relevant policies that may apply and provides a matrix of future permit considerations/requirements.

6-1.11 Noise

CEQA Guidelines indicate that a project would normally result in a significant adverse impact if it caused a substantial increase in the ambient noise level in the vicinity of sensitive receptors adjacent to the project site. Sensitive receptors are land uses where the members of the population spend a substantial amount of time, e.g., residences, schools, hospitals and convalescent homes. The potential for significant impacts also exists where land use compatibility standards for community noise, as defined by the State of California and local jurisdictions, are exceeded.

Project construction would result in a temporary increase in noise adjacent to the residential properties in the vicinity. These noise increases could impact residents and people visiting the State Beach.

Construction of the project would cause short-term noise increases. The project may result in short-term impacts to sensitive receptors including nearby residences due to noise from construction equipment and activities. These impacts from noise can be reduced with Best Management Practices; however, depending upon the type of construction equipment to be used and the length of time, these impacts may be considered significant and unavoidable.

Operation of a desalination plant and associated intake wells could also impact residents in the area depending upon the potential increase in ambient noise levels in the vicinity of the site.

Depending upon the location of pumps associated with the project (including on the beach or at the WWTP), operational noise levels may cause exceedance of noise standard or nuisance impacts. Mitigation such as enclosing the pumps in sound-proof buildings would most likely reduce these operational impacts to a less-than-significant level.

6-1.12 Growth Inducement Potential

CEQA requires that any growth inducing aspect of a project be discussed in an EIR. This discussion should include consideration of ways in which the project could indirectly foster economic or population growth in a surrounding area. Projects that could remove obstacles to population growth (such as a major public service expansion) must also be considered in this discussion. In accordance with CEQA, the future project EIR will need to assess the direct and indirect ways that the proposed desalination project could affect future growth in the area. The analysis should examine the potential growth due to an increase of up to 2,300 acre-feet of potable water produced from the proposed desalination plant and the potential for long-term growth if the proposed plant capacity is expanded in the future. A key consideration in this analysis would be whether the capacity of the desalination facility would allow for growth beyond the growth projections in each local general plan for the cities and County of San Luis Obispo.

6-1.13 Mitigation

As defined by CEQA Guidelines (Section 15370), mitigation measures either avoid the identified impact; minimize the impact by limiting the degree or magnitude of the action and its implementation; rectify the impact by repairing, rehabilitating, or restoring the affected environment; reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action; or compensate for the impact by replacing or providing substitute resources or environments.

At this time, it is anticipated that mitigation measures are available for some but not all of the potentially significant environmental impacts associate with the proposed project. As indicated above, there is also the potential for some environmental impacts to remain significant and unavoidable. This determination cannot be made without further analysis.

6-1.14 Summary of Environmental Review

The proposed project may have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment and an EIR is required in accordance with CEQA.

The above discussion provides a preliminary screening discussion of the environmental impacts. An Initial Study checklist during scoping or when the project is more fully defined, would identify all of the issues of concern, technical studies required and issues that would not require further analysis.

Table 6-1
POTENTIAL PERMITS AND APPROVALS FOR THE PROJECT

Agency of Department	Permit of Approval	Required for
FEDERAL AGENCIES		
U.S. Fish and Wildlife Service (USFWS)	Endangered Species Act compliance (ESA Section 7/10 consultation)	Incidental take of federally listed species
	Fish and Wildlife Coordination Act (16 U.S.C. 661-667e; the Act of March 10, 1934; ch. 55; 38 stat. 401)	Provide comments to prevent loss of and damage to wildlife resources.
National Oceanic & Atmospheric Administration (NOAA) – Fisheries	Endangered Species Act compliance (ESA Section 7/10 consultation)	Incidental take of federally listed species
Army Corps of Engineers (Corps)	Nationwide Section 404 Permit (CWA, 33 USC 1341)	Discharge of dredge/fill into Waters of the United States, including wetlands
	Section 10, Rivers and Harbors Act Permit (33 U.S.C. 403)	Activities, including the placement of structures, affecting navigable waters
U.S. Coast Guard	Federal Consultation	Coastal Commission CDP and ACOE Section 10 Permit
STATE AGENCIES		
State Water Resources Control Board, Regional Water Quality Control Board	General Construction Activity Storm Water Permit (WQO99-08-DWQ)	Storm water discharges associated with construction activity
	401 Water Quality Certification (CWA Section 401)	Discharge into waters and wetlands (see USACE Section 404 Permit)
	National Pollutant Discharge Elimination System (NPDES) Permit (CWA Section 402)(Amendment)	Discharge into waters and wetlands
California State Lands Commission	Right-of-Way Permit (Land Use Lease) (California Public Resource Code Section 1900)	Insurance of a grant of right-of-way across state lines potential
California Department of Fish and Game (CDFG)	Incidental Take Permits (CESA Title 14, Section 783.2)	Activity where a State-listed candidate, threatened, or endangered species under California ESA may be present in the project area and a State agency is acting as lead agency for CEQA compliance.
	Lake/Streambed Alteration Agreement (California Fish and Game Code Section 1601)	Change in natural state of river, steam, lake (includes road or land construction across a natural streambed)
California Coastal Commission (CCC)	Coastal Development Permit. (Public Resources Code 30000 et seq.)	Development of desalination facility within the Coastal Zone
California Department of Parks and Recreation (CDPR)	Land Conveyance/sale lease and/or easement	Overall project approval and CEQA review (potentially)
	Right-of-Way Permit (Public Resource Code Section 5012)	Access across State park property

Table 6-1 POTENTIAL PERMITS AND APPROVALS FOR THE PROJECT		
Agency of Department	**Permit of Approval**	**Required for**
California Department of Health Services (CDOHS)	Permit to Operate a Public Water System (California Health and Safety Code Section 116525)	Operation of a public water system.
California Department of Transportation (Caltrans)	Encroachment Permit (streets and Highway Code Section 660)	Encroachments on State highway rights-of way distribution pipelines
California State Historic Preservation Officer (SHPO)	Section 106 Consultation, National Historic Preservation Act (16 USC 470)	Consult regarding activities potentially affecting cultural resources.
LOCAL AGENCIES		
San Luis Obispo County Public Works Department	Encroachment Permit (San Luis Obispo County Code (SLOCC) Title 13 Chapter 13.08	Activities within County right-of-way.
San Luis Obispo County Health Department, Environmental Health Division	Well Construction Permit (SLOCC, Title 8 Chapter 8.40)	Construction of new water supply wells.
	Hazardous Materials Business Plan (Health and Safety Code Chapter 6.95)	Handling of hazardous materials in quantities equal to or greater than threshold quantities.
	Hazardous Materials Inventory (Health and Safety Code Chapter 6.95)	Handling of hazardous materials in quantities equal to or greater than threshold quantities.
San Luis Obispo County Planning and Building Inspection Department	Development Plan approval (SLBAP/C Chapter 8), Site Plan Approval and/or Use Permit (SLOCC Coastal Zone Land Use Title 23)	Activities whose use is conditional in a particular zone
	Coastal Development Permit (Public Resources Code 30000 et seq.)	Development within the Coastal Zone where County has jurisdiction through existing Local Coastal Plans
	Grading Permit (SLOCC, Title 19, Chapter 19.04 and 23.05)	Excavation and fill activities
San Luis Obispo Air Pollution Control District (SLOAPCD)	Authority To Construct. (Local district rules, per Health and Safety Code 42300 et seq.)	Constructing, modifying, or operating a stationary source facility or equipment that might emit pollutants.
	Permit to Operate. (Local district rules)	Operating stationary source equipment that might emit pollutants.

6-2 Overview of DHS Regulatory Jurisdiction

The California Department of Health (DHS) was established to protect and improve the health of all Californians. The DHS was recently reorganized into the California Department of Health Care Services and the Department of Public Health (DPH). California DPH's Drinking Water Program (DWP) is within the Division of Drinking Water and Environmental Management. DWP regulates public drinking water systems.

In particular, the California DPH implements and enforces Title 17 and 22 of the California Code of Regulations, which includes regulations on recycled and drinking water. The California DPH establishes regulations such as maximum contaminant levels, etc., in an effort to protect human health.

The proposed project would be required to submit a permit application and technical report to the DPH (California Health and Safety Code, Section 116525, et seq.).

The technical report is the heart of the application and would need to contain general water system information (number and type of connections, number and type of users, period of use, and a map of the facilities), source water information (a description of the source, associated water rights, quantity of water available, an assessment of vulnerability to contamination, and a source water quality analysis), treatment and design information (description and layout, design capacities, well construction, treatment chemicals, disinfection facilities), distribution system information (location, water mains, pumping stations and storage tanks, distribution pressure) and operational plans (water quality monitoring, water system operations, and disaster/emergency response plans).

DPH will incorporate the Drinking Water Source Assessment and Protection (DWSAP) procedures into the permit application for this new drinking water source. The required components of that assessment are discussed briefly below.

6-2.1 DWSAP Assessment Procedures

The Drinking Water Source Assessment and Protection (DWSAP) program has established procedures for assessing the vulnerability of drinking water sources. The DWSAP assessment consists of a 3-step process: (1) delineation of the area subject to assessment, (2) identification of possible contaminating activities, and (3) a vulnerability assessment.

6-2.2 Delineation of Source Areas and Protection Zones

A key aspect of the source assessment will be the delineation of "source areas" and "protection zones". The water extracted from the proposed beach wells are likely to be classified as ground water under the direct influence of surface water (GWUDI). As such, its assessment will include study components applicable to both groundwater and surface water sources.

Existing regulations require water purveyors to survey the entire watershed. However, guidelines allow proponents to establish distinct "protection zones" within the source area. (Recent conversations with local DPH staff indicate that establishing distinct "protection zones" within the source area would be acceptable.) If protection zones are established, DPH is likely to allow a less detailed review on portions of the watershed outside the zones. In the subsequent vulnerability analysis (see below), it will be reasonable to assign less risk to possible contaminating activities (PCAs) located in the source area, but outside of the zones.

Possible surface water protection zones for the proposed project are listed below:

Table 6-2. Possible Surface Water Protection Zones

Source Area	Watersheds draining to the Pacific Ocean
Protection Zone A	400-ft from primary streams (Arroyo Grande Creek, and Meadow Creek, and Oceano Lagoon) and 200-ft from tributaries
Protection Zone B	2500-ft from intakes (distance depends on results of flow/transport models)
Protection Zone C	Remainder of watersheds draining to Arroyo Grande Creek and Meadow Creek

Several groundwater zones will be delineated to assess the source, based primarily on expected travel time. Guidance regarding these groundwater source zones (CDPH, 2000) is listed below:

Table 6-3. Guidance Regarding Groundwater Protection Zones

Well Site Control Zone	The area immediately surrounding the well. The purpose of this zone is to provide protection from vandalism, tampering, or other threats at the well site. DPH recommends a minimum radius of 50 feet for well site control zones for all public water systems in the state.
Protection Zone A - Microbial/Direct Chemical Contamination Zone	The purpose of this zone is to protect the drinking water supply from viral, microbial and direct chemical contamination. The zone is defined by the surface area overlying the portion of the aquifer that contributes water to the well within a two-year time-of-travel.
Protection Zone B5	Zone B5 encompasses the area between the two- and five-year time-of-travel.
Protection Zone B10	Zone B10 encompasses the area between the five- and ten-year time-of-travel. The purpose of Zones B5 and B10 is to prevent chemical contamination of the water supply, and to protect the drinking water source for the long term.
Buffer Zone—Additional Zone, If Needed	The purpose of this zone is to provide added protection for drinking water sources.

The delineation process for groundwater protection zones can make use of a number of methods, including an arbitrary fixed radius, a calculated fixed radius, a modified calculated fixed radius, analytical methods, hydrogeologic mapping, or numerical flow/transport models.

6-2.3 Inventory of Possible Contaminating Activities (PCAs)

Possible contaminating activities (PCAs) are identified within the water source area and its protection zones. PCAs include activities associated with both microbiological and chemical contaminants that could have adverse effects upon human health. The inventory is conducted by (1) developing an initial list of types of PCAs of concern, (2) preparing a PCA inventory form, and (3) conducting the PCA inventory within the source area and/or protection zones.

The resulting inventory will be a list of PCAs and the associated risk rankings. The risk ranking for a type of PCA is based on the relative risk to the drinking water supply, and it depends on the zone in which the PCA occurs. For example, PCAs associated with microbiological contamination (septic systems, animal facilities, sewer lines) are a very high risk if located within Zone A. Outside of this area they are considered less of a risk because the bacteria and viruses die off over time (DPH, 2000).

6-2.4 Vulnerability of Drinking Water Sources to Contamination

After the initial inventory of Possible Contaminating Activities (PCAs) has been completed, a vulnerability analysis is conducted to determine the types of PCAs to which the drinking water source is most vulnerable.

The first step in the analysis is to determine the Physical Barrier Effectiveness (PBE) for the drinking water source. The PBE is essentially an estimate of the ability of the natural geologic materials, hydraulic conditions, and construction features of the well or intake to prevent the movement of contaminants to the drinking water source. The PBE is determined using site-specific information on hydrogeology, hydrology and soils.

The vulnerability analysis uses the PCA inventory and the Physical Barrier Effectiveness determination to prioritize the list of types of PCAs in order to determine to which the drinking water source is most vulnerable.

The completed DWSAP report will contain the following elements:

- Location of the Drinking Water Source.
- Delineation of Source Areas and Protection Zones.
- Inventory of Possible Contaminating Activities (PCAs).
- Physical Barrier Effectiveness Checklist.
- Completed DWSAP Report
- Vulnerability Ranking – Prioritized Listing of PCAs.
- Assessment Map.
- Drinking Water Source Assessment Checklist.

Figure 6-1. Sampling Stations

6-3 Readily Available Ocean Water Quality Data

San Luis Obispo County's Health Agency operates a Recreational Water Program (SLO County, 2008). Environmental Health Services takes grab samples on a weekly basis at 20 sampling locations along the coast. The Public Health Laboratory is a state certified lab that performs analyses for total coliform and E. coli (used as an indicator for fecal coliform). Sampling records date back to 2000. Weekly sampling of sites year round began in 2001 (Amundson, 2008). Sampling sites OCB12 and OCB11 are located north and south of the proposed beach wells, respectively, as shown in the figure to the right. Such data will be useful during the assessment process.

6-4 Timeline & Implementation

An approximate timeline and implementation schedule was prepared in the previous study, Water Supply: Desalination (Wallace Group, 2006). That timeline and implementation plan is again presented here for reference. The following is a list of key project tasks, listed in the order they would most likely occur. Some of these tasks will overlap during the implementation phase.

- Feasibility Study (Water Supply: Desalination by Wallace Group, 2006)
- **Funding Study – (this report)**
- Agency Agreements – 3 months
- Environmental Impact Review (EIR) – 24 months
- Detailed Design – 10 to 12 months (including Pilot Study)
- Permitting (12 to 24 months, in part, concurrent with design)
- Bid Phase – 4 months
- Construction – 12 months

6-4.1 Agency Agreements

In conjunction with the funding study, the participating agencies will need to formalize inter-agency agreements for this project. The estimated time required for the agencies to formulate Agreements (or an amendment to existing JPA) to authorize this supplemental water project is 3 to 6 months.

6-4.2 CEQA/Environmental Review

Following approval of this Desal Funding Study, the environmental review process can begin. Since the project elements could change during the review process, it is advisable to begin the environmental review process after concurrence from project participants that the project description outlined in the Desal Funding Study is firm.

Based on conversations with San Luis Obispo County and other agencies, and given the complexity of issues surrounding the Coastal Commission review process, Regional Board permit issues and an updated NPDES Permit, this process is anticipated to take a minimum of 24 months to complete.

6-4.3 Detailed Design

The detailed design task for this project is anticipated to require approximately 8 months, following notice to proceed to a qualified consultant. Given that the plant site would be located on the SSLOCSD WWTP property, there are no right-of-way acquisition issues associated with the project. Thus, the first order of business would be the survey and geotechnical tasks for design, followed by utility collection/verification, followed by the process design for the RO plant, supply pipeline and beach well component, brine line and connection to the outfall, and all other plant design related matters. With consultant RFPs and the selection process, the entire design phase is anticipated to take 12 months. It is also recommended that the detailed design phase not commence until such time that the environmental review process is completed.

6-4.4 Permitting

Permitting for the Desalination facility is anticipated to be relatively extensive, and complex. The permitting process will include the following, at a minimum:

- Updated NPDES Permit from Regional Water Quality Control Board. This process will take a minimum of 6 months to complete, following preparation and receipt of a Report of Waste Discharge to the Regional Board. It is anticipated that this will require 6 to 9 months to complete.

- Coastal Commission Permit. Although the Commission has indicated a 30-day turn-around for review and comment on a permit application for such a project, it is anticipated that the Coastal Commission Permit process will take up to 6 months, following adoption of the Regional Board updated NPDES Permit.

- There will likely be a number of other permits required for a desalination project of this nature, including possibly the California Department of Fish & Game, US Fish & Wildlife Service, US Army Corps of Engineers, State Department of Public Health, County of San Luis Obispo, and others. Specific permitting requirements of each and every agency was beyond the scope of this feasibility study; however, planning for a project of this nature should take into account some schedule buffer to allow for permitting delays and unanticipated permit requirements from various agencies.

Given the complexity of the permitting process, it is anticipated that 12 to 24 months following design completion, would be required to complete the permitting process for a desalination plant.

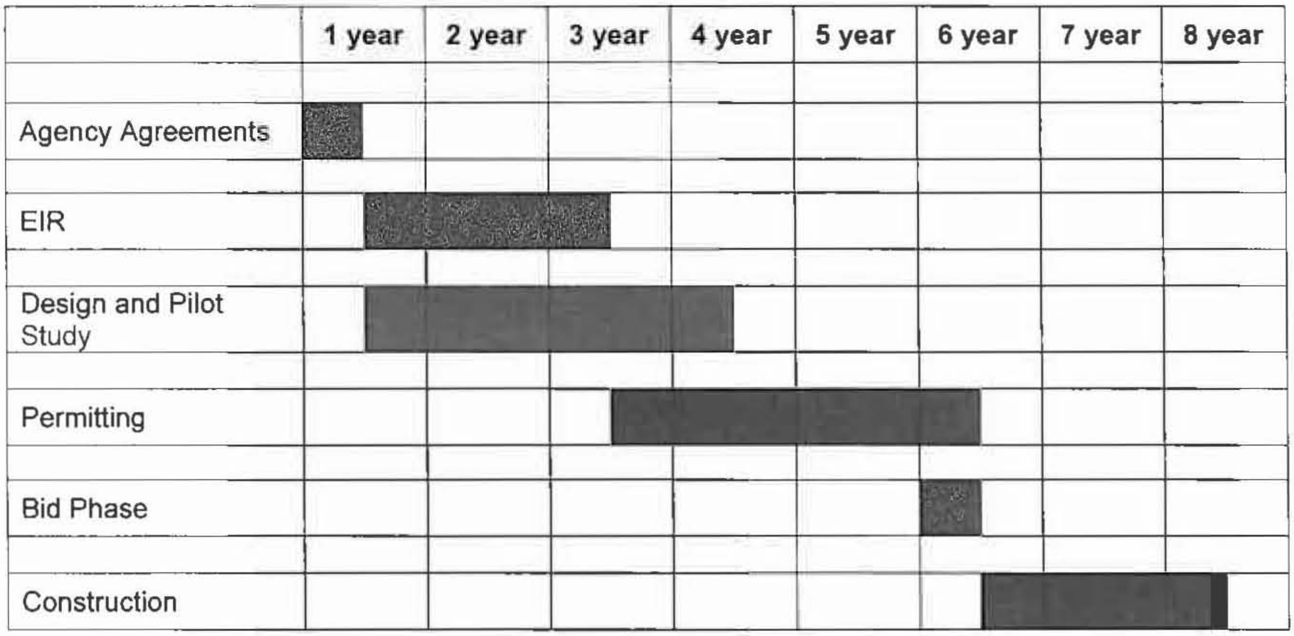
6-4.5 Bid Phase and Construction

Once the design phase is complete, and all permits/approvals have been received, the project may be sent out for contractor bids, and then construction may begin. The bidding process, from bid advertisement to bid evaluation and award of contract, generally requires 3 to 4 months.

Construction of the Desalination project, including pipelines, intake structure and all other related improvements, is anticipated to require a construction window of 12 to 18 months, to allow for contractor mobilization, inclement weather and unforeseen delays, equipment procurement, project construction wrap-up of punch list items, and start-up and testing.

Since an exact "start" time is not known for this project, we have prepared an overview of the project timeline based on number of months following completion of this funding study. The anticipated timeline is portrayed in Figure 6-2.

Figure 6-2. Proposed Timeline



Based on Figure 6-2, it is anticipated that this Project would require a minimum of 7 to 8 years to complete, and possibly longer, factoring in the variability in permitting and environmental issues associated with the project.

CHAPTER 7

PROJECT COST ANALYSIS

The February 22, 2006 Water Supply-Desalination Study prepared by Wallace Group included a preliminary opinion of capital and operation and maintenance (O&M) costs to implement a 2,300 AFY desalination plant. Current estimates of costs have been prepared by Wallace Group and Boyle Engineering, based on updated information, and further detailed understanding of the desalination project requirements.

At the time of the 2006 capital cost estimate, the current Engineering News Record (ENR) cost index (December 2005) was 7647. The April 2008 ENR cost index is 8126. Based on this, "today's capital cost" of the desalination plant would have been $18.7 million, based on the 2006 Wallace Group estimate of capital costs.

This feasibility study identified additional items not anticipated as part of the initial study including the type and requirement of pre-treatment required, membrane costs and efficiencies, and other factors. In addition, storage costs for brine were not included in the original cost estimate. Tables 7-1 and 7-2 summarize the project "hard" and "soft" costs based on implementation of the project as a whole, and phased in three phases. As can be seen by Table 7-2, there is still a significant cost impact as part of Phase 1 to get the initial plant into production. A number of components to this system need to be built initially, including the raw water feed pipeline, brine storage, building pad, site utilities, and product water delivery system to Oceano.

7-1 Rate Study Analysis

Using the cost estimate values from above, an analysis was prepared by Tuckfield & Associates (Appendix B) to determine the impact to monthly water bills for each project participant of the Desal Project. The impact was determined for a High Cost and Low Cost alternative that includes a maximum and a minimum impact to monthly water bills for each alternative based on the available financing choices of the facilities. In addition, several funding options were evaluated for financing the proposed project. An outline of the possible funding sources is included in Appendix B.

7-1.1 Project Cost Alternatives

Based on the cost estimate presented in Tables 8-1 and 8-2 above, two project cost alternatives were identified. The alternatives include a High Cost scenario (constructing the entire project in three phases, Phases 1 through 3) and a Low Cost scenario (Phase 1 only). For each of the High Cost and Low Cost alternatives, a maximum and minimum annual capital cost assumption was chosen for comparison based on the certain requirements of the loan portion of the funding source.

The maximum annual capital cost assumes the project would be financed with Certificates of Participation (COPs). This is generally a more expensive option, however is commonly used when forming a Joint Powers Authority for financing facilities used by several different agencies. The minimum annual capital cost assumes the project would be a mix of the least expensive financing sources available, typically low interest loans. The result of this analysis is a range of maximum and minimum annual capital cost that

Table 7-1. Overall Cost Summary

CAPITAL COSTS

Item	Description	Quantity	Unit	Amount
1	Raw Water Delivery System	1	EA	$2,700,000
2	Desalination Facility	1	EA	$24,500,000
3	Product Water Delivery System	1	EA	$2,100,000
	Sub Total Construction			**$29,300,000**
4	*Permitting*	1	LS	$200,000
5	*Environmental Impact Report*	1	LS	$300,000
6	*Design Services*	1	LS	$3,250,000
7	*Construction Management*	1	LS	$3,000,000
8	*Administration*	1	LS	$1,500,000
	Subtotal - "Soft Costs"			**$8,250,000**
	TOTAL CAPITAL COSTS			**$37,550,000**

ANNUAL O&M COSTS

Item	Description	Quantity	Unit	Amount
1	Raw Water and Product Water Systems	1	EA	$600,000
2	Desalination Facility	1	EA	$3,900,000
	Total Annual O&M Costs			**$4,500,000**

Table 7-2. Overall Cost Summary – Phased Approach

CAPITAL COSTS

Item	Description	Phase 1	Phase 2	Phase 3
1	Raw Water Delivery System	1,214,000	959,000	$0
2	Desalination Facility	13,716,667	3,266,667	$3,266,667
3	Product Water Delivery System	1,225,000	350,000	$200,000
	Sub Total Construction	**$16,155,667**	**$4,575,667**	**$3,466,667**
	Contingency@30%	**$4,846,700**	**$1,372,700**	**$1,040,000**
	TOTAL CONSTRUCTION COSTS	**$21,002,367**	**$5,948,367**	**$4,506,667**
4	*Permitting*	150,000	100,000	$75,000
5	*Environmental Impact Report*	300,000	0	$0
6	*Design Services*	1,750,000	600,000	$450,000
7	*Construction Management*	1,750,000	500,000	$400,000
8	*Administration*	1,000,000	500,000	$400,000
	Subtotal - "Soft Costs"	**$4,950,000**	**$1,700,000**	**$1,325,000**
	TOTAL CAPITAL COSTS	**$26,000,000**	**$7,700,000**	**$5,900,000**

would be required under each of the High Cost and Low Cost Project alternatives (see Table 3 in Appendix B).

7-1.2 Impact on Monthly Water Bills

In order to compare the Desal Project's impact on monthly water bills, Project costs must be expressed in terms consistent with common billing methods. For this study, Project costs will be expressed in terms of volume charge based on each Project participant's metered water volume charge, and expressed as a fixed monthly charge per single family dwelling unit equivalent (SFDUE). The impact to the monthly water bill for each project participant is outlined in Table 7-3. The monthly impact is determined for each

Table 7-3

South SLO County Desalination Project

Impact of Desalination Project to Participants

Agency	High Cost Alternative		Low Cost Alternative	
	Max	Min	Max	Min
Arroyo Grande				
Annualized Capital Cost [1]	$958,985	$767,393	$629,318	$472,274
Annual OM&R [2]	$1,414,600	$1,414,600	$802,500	$802,500
Total Annual Cost	$2,373,585	$2,181,993	$1,431,818	$1,274,774
Metered Water Sales Volume [3]	1,413,700	1,413,700	1,413,700	1,413,700
Charge per Ccf	**$1.68**	**$1.54**	**$1.01**	**$0.90**
SFDUE [3]	7,854	7,854	7,854	7,854
Cost per SFDUE per month	**$25.18**	**$23.15**	**$15.19**	**$13.53**
Grover Beach				
Annualized Capital Cost [1]	$1,022,035	$828,607	$671,271	$503,758
Annual OM&R [2]	$1,523,900	$1,523,900	$862,200	$862,200
Total Annual Cost	$2,545,935	$2,352,507	$1,533,471	$1,365,958
Metered Water Sales Volume [3]	790,400	790,400	790,400	790,400
Charge per Ccf	**$3.22**	**$2.98**	**$1.94**	**$1.73**
SFDUE [3]	5,489	5,489	5,489	5,489
Cost per SFDUE per month	**$38.65**	**$35.72**	**$23.28**	**$20.74**
Oceano CSD				
Annualized Capital Cost [1]	$945,980	$706,400	$629,311	$472,268
Annual OM&R [2]	$1,561,500	$1,561,500	$854,700	$854,700
Total Annual Cost	$2,507,480	$2,267,900	$1,484,011	$1,326,968
Metered Water Sales Volume [3]	380,500	380,500	380,500	380,500
Charge per Ccf	**$6.59**	**$5.96**	**$3.90**	**$3.49**
SFDUE [3]	2,439	2,439	2,439	2,439
Cost per SFDUE per month	**$85.67**	**$77.49**	**$50.70**	**$45.34**

[1] From Table 3, Summary of Annual Capital Cost.
[2] From Table 2, Summary of Allocation of Desalination Project Costs.
[3] From Table 4, Determination of Single Family Dwelling Unit Equivalents.

Table 7-4

South SLO County Desalination Project

Single Family Monthly Water Service Bills

For Selected Cities and Districts Within San Luis Obispo County
at 12 Ccf Monthly Consumption

Agency		Existing Rates in Effect July 2008: Service Charge 3/4" Meter	Existing Rates in Effect July 2008: Commodity Charge [1] @ 12 Ccf	Existing Rates in Effect July 2008: Monthly Bill	Desalination Project Additional Monthly Cost [2]: High Cost Alt Max	High Cost Alt Min	Low Cost Alt Max	Low Cost Alt Min	Total Monthly Bill: High Cost Alt Max	High Cost Alt Min	Low Cost Alt Max	Low Cost Alt Min
Arroyo Grande	[3]	$44.94	$13.92	$58.86	$20.15	$18.52	$12.15	$10.82	$79.01	$77.38	$71.01	$69.68
Grover Beach		$6.75	$27.36	$34.11	$38.65	$35.72	$23.28	$20.74	$72.76	$69.83	$57.39	$54.85
Oceano CSD	[6][7]	$11.97	$33.93	$45.90	$79.08	$71.52	$46.80	$41.85	$124.98	$117.42	$92.70	$87.75
Morro Bay		$0.00	$67.55	$67.55					$67.55	$67.55	$67.55	$67.55
Nipomo CSD	[5][6]	$14.52	$18.24	$32.76					$32.76	$32.76	$32.76	$32.76
Paso Robles	[5][8]	$18.00	$15.36	$33.36					$33.36	$33.36	$33.36	$33.36
Pismo Beach	[5][9]	$20.50	$24.30	$44.80					$44.80	$44.80	$44.80	$44.80
San Luis Obispo	[5]	$0.00	$60.26	$60.26					$60.26	$60.26	$60.26	$60.26

[1] Used as an example of average monthly consumption for a single family residential customer.
[2] Cost per Ccf from Table 5 multiplied by 12 Ccf.
[3] Includes Lopez Meter Charge.
[5] Billed bimonthly.
[6] Includes monthly Litigation Charge.
[7] Includes Lopez consumption charge.
[8] Includes monthly Nadmiento charge.
[9] Includes annual Water Tax Fund charge divided by 12 for payment of State Water.and Lopez fixed charges.

High and Low Cost alternative, while also providing a range in dollar terms of what the impact may be based on the combination of minimum and maximum financing options.

The summarized comparison in Table 7-4 shows that a single-family Arroyo Grande customer could experience an increase in their monthly bill between $10.82 and $20.15 per month. For a single-family Grover Beach customer, the monthly bill could increase between $20.74 and $38.65 per month. Oceano's single family customers could see an increase between $41.85 and $79.08 per month.

Escalation to Midpoint of Construction. Since the project will take some 6 to 8 years to implement, current day costs provided in this report will need to be escalated to future years to anticipate true costs. Since the existing water rate structures will also increase in future years, irrespective of the desalination project, it is recommended that the Agencies utilize the current-day costs presented in this report, and use recent historical trends of the Engineering News Record (ENR) indices as a means of forecasting to future year costs. Although actual water rates in future years cannot be projected, it is expected that the percentage rate increases described in Table 7-4, due to the desalination plant project, will be similar.

The September 2000 ENR index was 6228, and the September 2008 ENR index is 8557. The ratio of these numbers shows a 37% increase in costs in the past 8 years. With current economic trends, it is not expected that another 37% increase will be realized in the next 8 years, however, the Agencies should anticipate a 25% to 30% increase in overall project costs in the next 6 to 8 years.

7-2 Possible Cost Reductions

7-2.1 Omit Brine Storage Tank

It may be possible to reduce construction costs if the brine storage tank is omitted. Recall that this tank is needed to coordinate brine discharge with wastewater plant discharge through the existing ocean outfall. According to analyses conducted by the Wallace Group, when the wastewater plant is operating at its build out capacity of 5 MGD, the desalination plant can produce 1100 AFY of product water without a brine storage tank. To produce more than 1100 AFY of product water, on-site brine storage will be needed (Peterson, 2008).

Therefore, eliminating the brine storage tank is not recommended, because by doing so the plant will eventually be limited to producing less than half of its design flow. However, the brine storage tank may not be needed for initial phases of the facility at production less than 1100 AFY. However, if the brine storage must be installed subgrade, it would be prudent to construction as part of the Phase 1 project, since the desalination plant structure and equipment would need to be installed above the tank.

7-2.2 Coordinate with SSLOCSD Master Plan

Fitting the required facilities into the site constraints shown in Figure 3-2 will be challenging. The wastewater treatment plant owners are updating its master plan. Figure 7-1 shows it may be possible to increase the space available to 0.75 acres without conflict with the ongoing master-plan update. With greater coordination of WWTF and desalination facilities, it may be possible to site an above-ground brine storage tank on site. Clearly, the agencies proposing the desalination plant are the same "owners" of the SSLOCSD Wastewater Plant.

Figure 7:1 Proposed Site Layout

7-2.3 Oceano CSD Does Not Participate in the Project.

The Oceano CSD's existing and future water supply is more favorable than that of the Cities of Grover Beach and Arroyo Grande. The agencies requested that a scenario be evaluated to determine project cost impacts should Oceano CSD choose not to participate in the desalination project. The following changes would occur to the Project Description as follows:

- Total production goal reduces to 1,550 AFY (800 AFY Grover Beach, 750 AFY Arroyo Grande);
- Raw water intake would reduce from 3,830 AFY to 2,720 AFY;
- Number of beach wells required would reduce from 20-25, to 14 to 17;
- Seawater supply pipeline diameter reduces from 16" diameter, to 12" diameter;
- RO building footprint would reduce slightly from 15,000 SF to 14,000 SF;
- Brine storage requirements reduce from 750,000 gallons to 500,000 gallons;
- Product water deliver pipeline would reduce from 12" diameter to 10" diameter, and a single booster station at the desalination plant would deliver water (in lieu of secondary pump station near Oceano's water storage tank).

With the above changes, the overall project costs only reduce marginally compared to the reduction in size of the project. With Oceano CSD excluded from the Project, the plant production reduces from 2,300 AFY to 1,550 AFY, or 33 percent. The Project capital cost to implant this scaled down alternative, however, reduces only by 7 to 8 percent. The updated financial tables reflecting this modified project scenario, are included in Appendix C.

Table 7-5 presents the revised overall project costs, for the "high cost alternative", that is, the full project implementation with Oceano CSD's component excluded. Table 7-6 presents the revised project costs based on phasing of the Project.

The cost impacts to the City of Grover Beach and Arroyo Grande, to implement this 1,550 AFY desalination plant increase moderately over the original project alternative which includes the Oceano CSD. The City of Arroyo Grande could expect to see rate increases ranging from 22 to 41 percent (18 to 34 percent based on original project), while the City of Grover Beach could see rate increases of 73 to 133 percent (61 to 113 percent based on original project). Table 7-7 presents the expected water service bills to Arroyo Grande and Grover Beach residents to fund the 1,550 AFY desalination project. Figure 7-2 presents an overview of single-family monthly water bills in the central coast area, compared to needed water rates for the Cities of Arroyo Grande and Grover Beach to fund this desalination project.

Table 7-5. Overall Cost Summary – 1,550 AFY Desalination Plant

CAPITAL COSTS

Item	Description	Quantity	Unit	Amount
1	Raw Water Delivery System	1	EA	$2,300,000
2	Desalination Facility	1	EA	$20,300,000
3	Product Water Delivery System	1	EA	$1,700,000
	Sub Total Construction			**$24,300,000**
4	*Permitting*	1	LS	$200,000
5	*Environmental Impact Report*	1	LS	$300,000
6	*Design Services*	1	LS	$3,000,000
7	*Construction Management*	1	LS	$2,750,000
8	*Administration*	1	LS	$1,500,000
	Subtotal - "Soft Costs"			**$7,750,000**
	TOTAL CAPITAL COSTS			**$32,050,000**

ANNUAL O&M COSTS

Item	Description	Quantity	Unit	Amount
1	Raw Water and Product Water Systems	1	EA	$500,000
2	Desalination Facility	1	EA	$2,900,000
	Total Annual O&M Costs			**$3,400,000**

Table 7-6. Overall Cost Summary – Phased 1,550 AFY Desalination Plant

CAPITAL COSTS

Item	Description	Phase 1	Phase 2	Phase 3
1	Raw Water Delivery System	1,181,500	959,000	$0
2	Desalination Facility	10,903,333	3,000,000	$3,000,000
3	Product Water Delivery System	1,050,000	200,000	$200,000
	Sub Total Construction	$13,134,833	**$4,159,000**	**$3,200,000**
	Contingency@30%	**$3,940,450**	$1,247,700	**$960,000**
	TOTAL CONSTRUCTION COSTS	**$17,075,283**	**$5,406,700**	**$4,160,000**
4	*Permitting*	150,000	100,000	$75,000
5	*Environmental Impact Report*	300,000	0	$0
6	*Design Services*	1,750,000	600,000	$450,000
7	*Construction Management*	1,750,000	500,000	$400,000
8	*Administration*	1,000,000	500,000	$400,000
	Subtotal - "Soft Costs"	**$4,950,000**	**$1,700,000**	**$1,325,000**
	TOTAL CAPITAL COSTS	**$22,100,000**	**$7,200,000**	**$5,500,000**

Table 7-7. Single Family Monthly Water Service Bills

Agency	High Cost Alternative Max	High Cost Alternative Min	Low Cost Alternative Max	Low Cost Alternative Min
Arroyo Grande				
Annualized Capital Cost [1]	$1,250,139	$1,050,147	$793,738	$607,726
Annual OM&R [2]	$1,645,200	$1,645,200	$963,500	$963,500
Total Annual Cost	$2,895,339	$2,695,347	$1,757,238	$1,571,226
Metered Water Sales Volume [3]	1,413,700	1,413,700	1,413,700	1,413,700
Charge per Ccf	**$2.05**	**$1.91**	**$1.24**	**$1.11**
SFDUE [3]	7,854	7,854	7,854	7,854
Cost per SFDUE per month	**$30.72**	**$28.60**	**$18.64**	**$16.67**
Grover Beach				
Annualized Capital Cost [1]	$1,332,961	$1,130,553	$846,662	$659,775
Annual OM&R [2]	$1,754,800	$1,754,800	$1,027,500	$1,027,500
Total Annual Cost	$3,087,761	$2,885,353	$1,874,162	$1,687,275
Metered Water Sales Volume [3]	790,400	790,400	790,400	790,400
Charge per Ccf	**$3.91**	**$3.65**	**$2.37**	**$2.13**
SFDUE [3]	5,489	5,489	5,489	5,489
Cost per SFDUE per month	**$46.88**	**$43.81**	**$28.45**	**$25.62**
Oceano CSD				
Annualized Capital Cost [1]	$0	$0	$0	$0
Annual OM&R [2]	$0	$0	$0	$0
Total Annual Cost	$0	$0	$0	$0
Metered Water Sales Volume [3]	380,500	380,500	380,500	380,500
Charge per Ccf	**$0.00**	**$0.00**	**$0.00**	**$0.00**
SFDUE [3]	2,439	2,439	2,439	2,439
Cost per SFDUE per month	**$0.00**	**$0.00**	**$0.00**	**$0.00**

[1] From Table 3, Summary of Annual Capital Cost.
[2] From Table 2, Summary of Allocation of Desalination Project Costs.
[3] From Table 4, Determination of Single Family Dwelling Unit Equivalents.

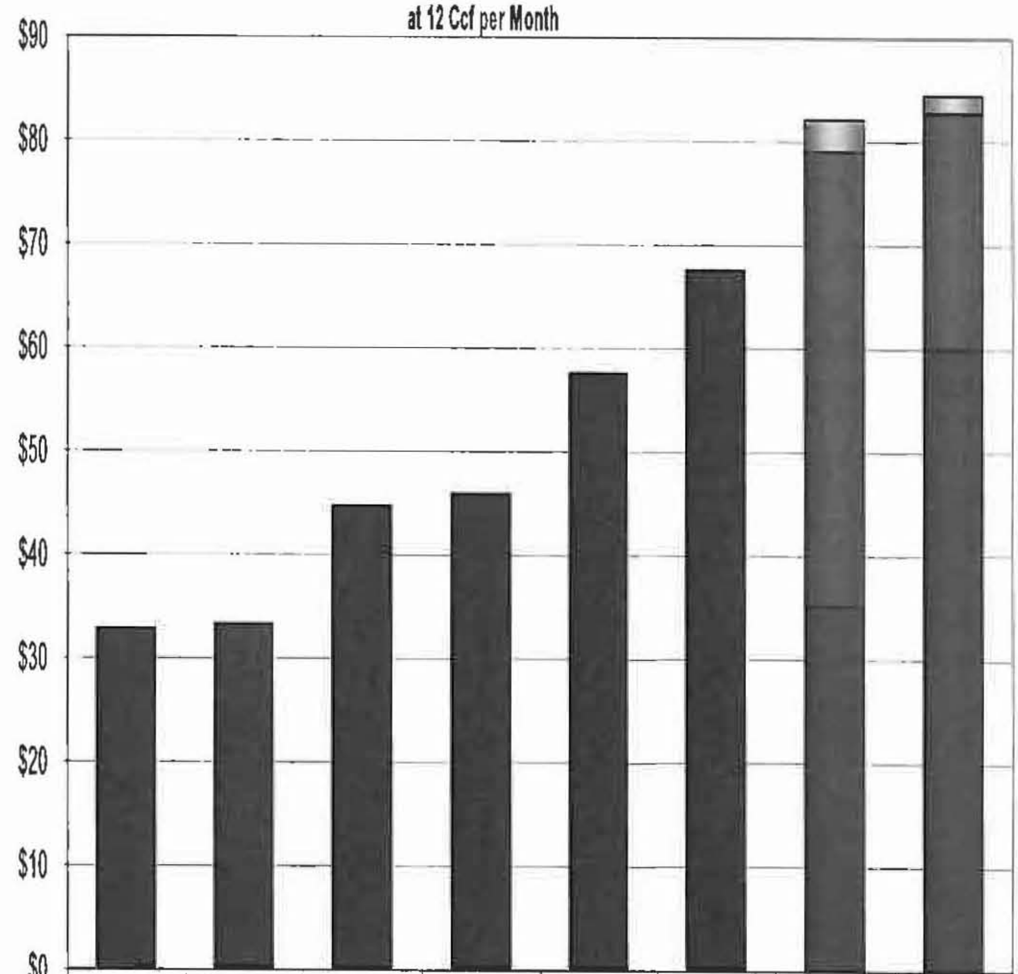
Figure 7-2

South SLO County Desalination Project

High Cost Alternative

Comparison of Single Family Residential Monthly Water Bills [1]

at 12 Ccf per Month



	Nipomo CSD	Paso Robles	Pismo Beach	Oceano CSD	San Luis Obispo	Morro Bay	Grover Beach	Arroyo Grande
High Cost Max							$3.12	$1.68
High Cost Min							$43.80	$22.92
Agency Mo. Bill							$35.23	$59.98
Monthly Bill	$32.76	$33.36	$44.80	$45.90	$57.63	$67.55		

[1] For rates in effect July 2008.

CHAPTER 8

CONCLUSIONS

In general, it appears technically feasible to construct a desalination plant at the SSLOCSD WWTP with 2300 AFY capacity. Key issues that may provoke concerns or may significantly limit the proposed project capacity include:

Intake System - Acceptability. The intake system that is selected will need to minimize site disturbance, environmental impacts, and visual impacts in order to be accepted by the public and by resource protection agencies.

Intake System – Capacity. The capacity of each intake well or other intake system is a critical factor. The lower the capacity of each intake, the more intakes will be required. Firm yield will need to be confirmed through pilot studies and actual pump tests.

Space Available. It is possible to fit the facility into the space currently set aside for this purpose, but higher construction costs are expected because the micro-filtration and RO facilities will need to be placed on top of the brine storage tank. The existing WWTP and future planned upgrade leave a very defined footprint for the desalination project.

Outfall Capacity. The capacity of the SSLOCSD WWTP outfall is a key constraint on the capacity of the desalination facility. If the outfall's permitted capacity can be increased, either through demonstration of existing hydraulic capacity or by improving the outfall, it may be possible to reduce the cost of some of the components of the proposed desalination facility (particularly brine storage).

There are several aspects of the proposed project that, while not only technically feasible, also meet one of the initial project goals of outlining a project that will provide a drought proof supplemental water supply to the three separate water agencies while minimizing environmental impacts.

Utilizing the existing wastewater treatment plant, which is not visible from the beach and is located within a highly developed area, helps to ensure the Oceano coastline will remain as pristine and beautiful as it is today. In addition, utilizing the existing wastewater treatment plant ocean outfall for disposal of rejected brine from the desalination treatment process not only minimizes environmental impacts of constructing a new brine outfall, but also reduces the overall cost of the project while providing a means for mixing the wastewater effluent with higher TDS brine water to produce a discharge that is closer in composition to that of the receiving water (the ocean).

While it is likely necessary that the source water intake infrastructure be located along the beach, measures can be made to ensure visibility, safety, and accessibility of the wells do not impede on current beach utilization and value. As noted above in Chapter 6, the raw water pipeline alignments have some, although not insurmountable, environmental concerns. The recommended mitigation measures for the pipeline alignments seem reasonable, and therefore do not present a "deal breaker" for the project as a whole.

Based on the cost estimates, and corresponding projected increase to monthly water bills for the proposed project, it is recommended that each agency carefully consider their need for water and, similarly, their need for this project. It is likely this project will require more than 8 years for final design, approval, and construction. However, the need for potable water in California is an ongoing concern, one that each water Agency should be prepared to deal with in the very near future. The proposed desalination project provides an independent drought proof water supply that will increase each Agency's potable water portfolio, and will help continue to support their respective communities with water at reasonably competitive rates in an unknown and ever-changing potable water market.

APPENDIX A

FUGRO HYDROGEOLOGIC STUDY

To view the Fugro Hydrogeologic Study, please download from the Wallace Group FTP site on the internet (see directions below):

Go to www.filestogo.com

Username: WallacegroupFTP
Password: Engineering

The report, uploaded on August 4, 2008 should be available for downloading. Please call Shannon Peterson (805) 544-4011 if you have trouble accessing this file.

APPENDIX B

TUCKFIELD RATE STUDY ANALYSIS

MEMORANDUM

Date: July 28, 2008

To: Mr. Steve Tanaka, PE

From: G. Clayton Tuckfield, Tuckfield & Associates

Subject: South San Luis Obispo County Desalination Funding Study

This memorandum presents the impact to monthly water bills for each project participant of the South San Luis Obispo County Desalination Project (Project). The impact is determined for a High Cost and Low Cost alternative that includes a maximum and a minimum impact to monthly water bills for each alternative based on the available financing choices of the facilities.

In evaluating the overall possible funding sources, it was assumed that the Project cost will become the responsibility of the water enterprise fund of each project participant, and therefore financing from the general fund has been excluded. It was further assumed that the Project would benefit each city or district in whole, and that creating assessment districts within a service area for the repayment of project costs has also been excluded from consideration.

Project Financing Options

There are several options that may be available to finance the Project. These potential funding sources include low interest loan and grant programs and traditional debt financing. The financing options identified could finance the Project in whole or in part. Each low interest loan and grant source were contacted to inquire about available financing under the various programs regarding the Project. The results of the inquiry is presented in Table 1 below, providing a list of the sources together with related financing information.

Table 1
South SLO County Desalination Project
Sources of Project Financing

			Funding Available		Loan Terms [1]				
Line No.	Financing Source	Acronym	Grant	Loan	Maximum Amount	Interest Rate	Term	Issuance Costs	Reserve Fund
1	United States Department of Agriculture [2] [3] [4]	USDA	No	Yes	[5]	3.75%	40	$50,000	Yes
2	Department of Water Resources [3]	DWR	No	Yes	$5,000,000	4.50%	20	$0	Yes
3	State Water Resources Control Board [3] [6] [7] [8]	SWRCB	No	No	$50,000,000	3.00%	20	$0	Yes
4	Department of Public Health [3] [8]	CDPH	No	No	$20,000,000	3.00%	20	$0	Yes
5	Department of Housing and Community Development [3]	CDBG	No	No				$0	No
6	California Infrastructure and Economic Development Bank [9] [10] [11]	CIEDP	No	Yes	$30,000,000	3.25%	30	0.85%	No
7	Revenue Bonds [12] [13] [14] [15]	REV	No	Yes	[15]	5.25%	30	1.0%	Yes
8	Certificates of Participation [12] [13] [14] [15]	COPs	No	Yes	[15]	5.50%	30	1.0%	Yes

[1] Reflects estimated interest rate and term as of the date of this report.
[2] Issuance costs include bond counsel costs estimated as shown.
[3] Reserve requirement can be funded over 10 years.
[4] Only Oceano CSD qualifies for any assistance (population less than 10,000). Loan may qualify for "intermediate" interest rate based on MHI. Current rate shown.
[5] No set maximum. Average project size is $3 to $5 million.
[6] Interest rate is set at half of state general obligation bond rate at time of loan.
[7] Standard Loan SRF terms shown.
[8] Funding from this source is not available for the desalination project.
[9] Issuance costs include loan origination fee of 0.85% of original loan amount or $10,000 whichever is greater.
An annual loan servicing fee of 0.3% on the outstanding loan balance is payable in arrears.
[10] Interest rate is 67% of similar "A" rated tax exempt bond. Estimate shown.
[11] Assumes that each participant of the desalination project has no outstanding rated debt of their water enterprise fund.
[12] Issuance costs are dependent upon the debt issue amount.
[13] Reserve requirement is funded with debt issue proceeds, effectively increasing the total debt issue amount.
[14] Assumes reserve fund is equal to one year's principal and interest payment and funded with debt issue proceeds.
[15] Limited by ability to meet debt service coverage ratio (among other requirements). Secured by a pledge of revenue by each agency's enterprise fund.

Funds from some of the sources may or may not be available at the time an application is submitted and approved, due to the limited amount of funds available and other projects competing for the same funds.

While there are more loan and grant programs available than are listed in Table 1, discussions with the various state agencies indicated that some program's funding had been fully committed, or the Project was not eligible. For example, funding from the Department of Water Resources under Proposition 50 had specifically identified desalination as an eligible project. However, all funding from this source is committed to projects and no further funding is expected.

Project Cost Alternatives

Two Project cost alternatives were identified from Table 2, page 23, of the May 9, 2008 Wallace Group Memorandum. The Project cost alternatives include a High Cost scenario that includes Phases 1 through 3 and a Low Cost scenario that includes Phase 1 costs only. Table 2 below provides a summary of the estimated OM&R and capital cost of each of these alternatives including the allocation of those costs to each project participant. The detailed allocation of the Project costs to each agency for the High Cost and Low Cost alternatives are presented in Tables A-1 and A-2 respectively in the appendix and is roughly based on the requested Project capacity of each agency.

For each of the High Cost and Low Cost alternatives, a Project financing assumption was developed from the possible financing choices from Table 1 that would produce the most expensive (maximum) annual capital cost and one that would provide the least expensive annual capital cost (minimum). Each funding source has certain requirements that affect the amount of the repayment of the loan portion of the funding. For each of the two alternatives, the estimated Project capital cost is annualized based on the requirements of each funding source.

Table 2
South SLO County Desalination Project
Summary of Allocation of Desalination Project Costs

Line No.	Description	Arroyo Grande	Grover Beach	Oceano CSD	Total
	High Cost Alternative				
1	Project Cost [1] [5]	$12,919,400	$13,768,800	$12,744,200	$39,432,400
2	Annual OM&R [2] [5]	$1,414,600	$1,523,900	$1,561,500	$4,500,000
	Low Cost Alternative				
3	Project Cost [3] [5]	$8,478,300	$9,043,500	$8,478,200	$26,000,000
4	Annual OM&R [4] [5]	$802,500	$862,200	$854,700	$2,519,400

[1] From May 9, 2008 Memorandum, page 23, Table 2, Phases 1 through 3.
[2] From May 9, 2008 Memorandum, Appendix A.
[3] From May 9, 2008 Memorandum, page 23, Table 2, Phase 1 only.
[4] Estimated from reduced production associated with Phase 1 assumptions.
[5] Detailed allocations are presented in Table A-1 and Table A-2.

The maximum annual capital cost assumes that the project would be financed with Certificates of Participation (COPs). This option is generally more expensive than revenue bonds, however is a readily available source to get the project financed and constructed. COPs are commonly used when forming a Joint Powers Authority for the purpose of financing various facilities for use by several agencies.

The minimum annual capital cost assumes an ideal mix of the least expensive financing sources available in Table 1. It assumes that an application for funding from those sources is approved and that the low interest loans are obtained.

The result of the analyses is a range of the maximum and minimum annual capital cost that would be required under each of the High Cost and Low Cost Project alternatives. Table 3 provides a summary of the annual capital cost for each of the High and Low Cost alternatives and for the maximum and minimum funding sources.

Table 3
South SLO County Desalination Project
Summary of Annual Capital Cost

Line No.		Arroyo Grande	Grover Beach	Oceano CSD	Total
	High Cost Alternative - Maximum Annual Cost				
	Financing Source				
1	COPs	12,919,400	13,768,800	12,744,200	39,432,400
2	***Annual Capital Cost***	$958,985	$1,022,035	$945,980	$2,927,000
	High Cost Alternative - Minimum Annual Cost				
	Financing Source				
3	USDA	[1]	[1]	$2,744,200	$2,744,200
4	CIEDB [2]	10,000,000	10,000,000	10,000,000	30,000,000
5	Revenue Bonds	2,919,400	3,768,800		6,688,200
6	Total	$12,919,400	$13,768,800	$12,744,200	$39,432,400
7	***Annual Capital Cost***	$767,393	$828,607	$706,400	$2,302,400
	Low Cost Alternative - Maximum Annual Cost				
	Financing Source				
8	COPs	$8,478,300	$9,043,500	$8,478,200	26,000,000
9	***Annual Capital Cost***	$629,318	$671,271	$629,311	$1,929,900
	Low Cost Alternative - Minimum Annual Cost				
	Financing Source				
10	CIEDB [2]	$8,478,300	$9,043,500	$8,478,200	26,000,000
11	***Annual Capital Cost***	$472,274	$503,758	$472,268	$1,448,300

[1] USDA financing not available for Arroyo Grande or Grover Beach.
[2] Maximim funding limited to $10 million for any one applicant.

Impact of Project on Monthly Water Bills

The impact to monthly water bills is determined for each alternative, recognizing the funding sources identified in Table 3. In order to provide a meaningful comparison of monthly water bills among the project participants and the surrounding communities, the Project costs need to be expressed in terms that are consistent with common billing methods. Two common methods include recovering the Project costs through (1) metered water sales volume, or through (2) a monthly fixed charge based upon a reasonable allocation method.

For this study, the Project costs will be expressed in terms of a volume charge based on each Project participant's metered water volume charge, and also expressed as a fixed monthly charge per single family dwelling unit equivalent (SFDUE). Table 4 provides the annual metered water sales volume for each project participant and also develops the total number of SFDUEs.

Table 4
South SLO County Desalination Project
Determination of Single Family Dwelling Unit Equivalents

Line No.	Agency	FY 2006-07 Annual Water Sales Volume	Average SFDU Monthly Consumption	SFDUE [1]
		Ccf		
1	Arroyo Grande	1,413,700	15	7,854
2	Grover Beach	790,400	12	5,489
3	Oceano CSD	380,500	13	2,439
4	Total	2,584,600		15,782

[1] Annual water sales volume divided by average SFDU monthly consumption divided by twelve.

The impact to the monthly water bill for each project participant is determined in Table 5. The monthly impact is determined for each alternative while also providing a range in dollar

Table 5
South SLO County Desalination Project

Impact of Desalination Project to Participants

Agency	High Cost Alternative Max	High Cost Alternative Min	Low Cost Alternative Max	Low Cost Alternative Min
Arroyo Grande				
Annualized Capital Cost [1]	$958,985	$767,393	$629,318	$472,274
Annual OM&R [2]	$1,414,600	$1,414,600	$802,500	$802,500
Total Annual Cost	$2,373,585	$2,181,993	$1,431,818	$1,274,774
Metered Water Sales Volume [3]	1,413,700	1,413,700	1,413,700	1,413,700
Charge per Ccf	**$1.68**	**$1.54**	**$1.01**	**$0.90**
SFDUE [3]	7,854	7,854	7,854	7,854
Cost per SFDUE per month	**$25.18**	**$23.15**	**$15.19**	**$13.53**
Grover Beach				
Annualized Capital Cost [1]	$1,022,035	$828,607	$671,271	$503,758
Annual OM&R [2]	$1,523,900	$1,523,900	$862,200	$862,200
Total Annual Cost	$2,545,935	$2,352,507	$1,533,471	$1,365,958
Metered Water Sales Volume [3]	790,400	790,400	790,400	790,400
Charge per Ccf	**$3.22**	**$2.98**	**$1.94**	**$1.73**
SFDUE [3]	5,489	5,489	5,489	5,489
Cost per SFDUE per month	**$38.65**	**$35.72**	**$23.28**	**$20.74**
Oceano CSD				
Annualized Capital Cost [1]	$945,980	$706,400	$629,311	$472,268
Annual OM&R [2]	$1,561,500	$1,561,500	$854,700	$854,700
Total Annual Cost	$2,507,480	$2,267,900	$1,484,011	$1,326,968
Metered Water Sales Volume [3]	380,500	380,500	380,500	380,500
Charge per Ccf	**$6.59**	**$5.96**	**$3.90**	**$3.49**
SFDUE [3]	2,439	2,439	2,439	2,439
Cost per SFDUE per month	**$85.67**	**$77.49**	**$50.70**	**$45.34**

[1] From Table 3, Summary of Annual Capital Cost.
[2] From Table 2, Summary of Allocation of Desalination Project Costs.
[3] From Table 4, Determination of Single Family Dwelling Unit Equivalents.

terms of what the impact may be, based on the combination of financing options provided in Table 3 that provides the maximum and minimum annual capital cost.

Comparison of Monthly Water Bills

A summary of the monthly water bills for each project participant is presented in Table 6. Each participant's total monthly bill has been calculated based on an average monthly consumption of 12 Ccf (hundred cubic feet) for a single-family customer for each alternative. The Project cost in terms of the charge per Ccf from Table 5 for each agency is multiplied by an assumed average monthly consumption of 12 Ccf, then added to each agency's existing water bill at 12 Ccf using their respective current water rates. The total monthly water bill is presented in the last four columns of Table 6.

Chart 1 and 2 have been prepared showing a comparison of the monthly water bills for the High Cost and Low Cost alternatives, respectively. The charts include the monthly water bills of the three project participants and for other local communities. Each bill of the Project participants consist of three parts that includes (1) the participant's monthly bill under their existing rates at 12 Ccf, (2) an additional amount for the minimum annual capital cost under an alternative, and (3) an additional amount for the maximum annual capital cost that is over the minimum annual capital cost from Table 5.

The information shows that a single-family Arroyo Grande customer could experience an increase in their monthly bill between $10.80 and $20.16 per month. For a single-family Grover Beach customer, the monthly bill could increase between $20.76 and $38.64 per month. And for a single-family Oceano CSD customer, the monthly bill could increase between $41.88 and $79.08 per month.

Table 6
South SLO County Desalination Project
Single Family Monthly Water Service Bills
For Selected Cities and Districts Within San Luis Obispo County at 12 Ccf Monthly Consumption

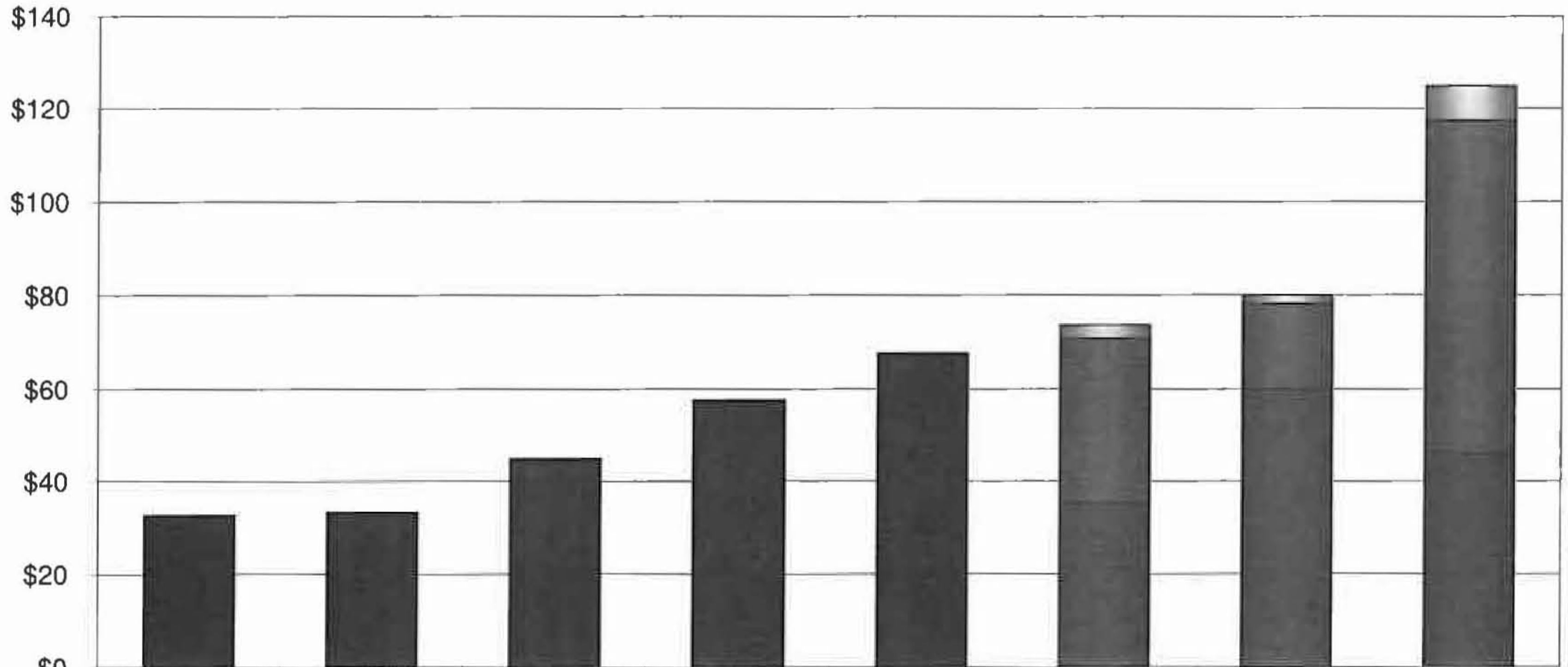
Agency		Existing Rates in Effect July 2008			Desalination Project Additional Monthly Cost [2]				Total Monthly Bill			
		Service Charge 3/4" Meter	Commodity Charge [1] @ 12 Ccf	Monthly Bill	High Cost Alt		Low Cost Alt		High Cost Alt		Low Cost Alt	
					Max	Min	Max	Min	Max	Min	Max	Min
Arroyo Grande	[3] [4]	$44.94	$15.04	$59.98	$20.16	$18.48	$12.12	$10.80	$80.14	$78.46	$72.10	$70.78
Grover Beach	[4]	$6.75	$28.48	$35.23	$38.64	$35.76	$23.28	$20.76	$73.87	$70.99	$58.51	$55.99
Oceano CSD	[4] [6]	$11.97	$33.93	$45.90	$79.08	$71.52	$46.80	$41.88	$124.98	$117.42	$92.70	$87.78
Morro Bay		$0.00	$67.55	$67.55					$67.55	$67.55	$67.55	$67.55
Nipomo CSD	[4] [5]	$14.52	$18.24	$32.76					$32.76	$32.76	$32.76	$32.76
Paso Robles	[4] [7]	$18.00	$15.36	$33.36					$33.36	$33.36	$33.36	$33.36
Pismo Beach	[4] [8]	$20.50	$24.30	$44.80					$44.80	$44.80	$44.80	$44.80
San Luis Obispo		$0.00	$57.63	$57.63					$57.63	$57.63	$57.63	$57.63

[1] Used as an example of average monthly consumption for a single family residential customer.
[2] Cost per Ccf from Table 5 multiplied by 12 Ccf.
[3] Includes Lopez Meter Charge.
[4] Billed bimonthly.
[5] Includes monthly Litigation Charge.
[6] Includes Lopez consumption charge.
[7] Includes monthly Nacimiento charge.
[8] Includes annual Water Tax Fund charge divided by 12 for payment of State Water.and Lopez fixed charges.

Chart 1
South SLO County Desalination Project
High Cost Alternative

Comparison of Single Family Residential Monthly Water Bills [1]

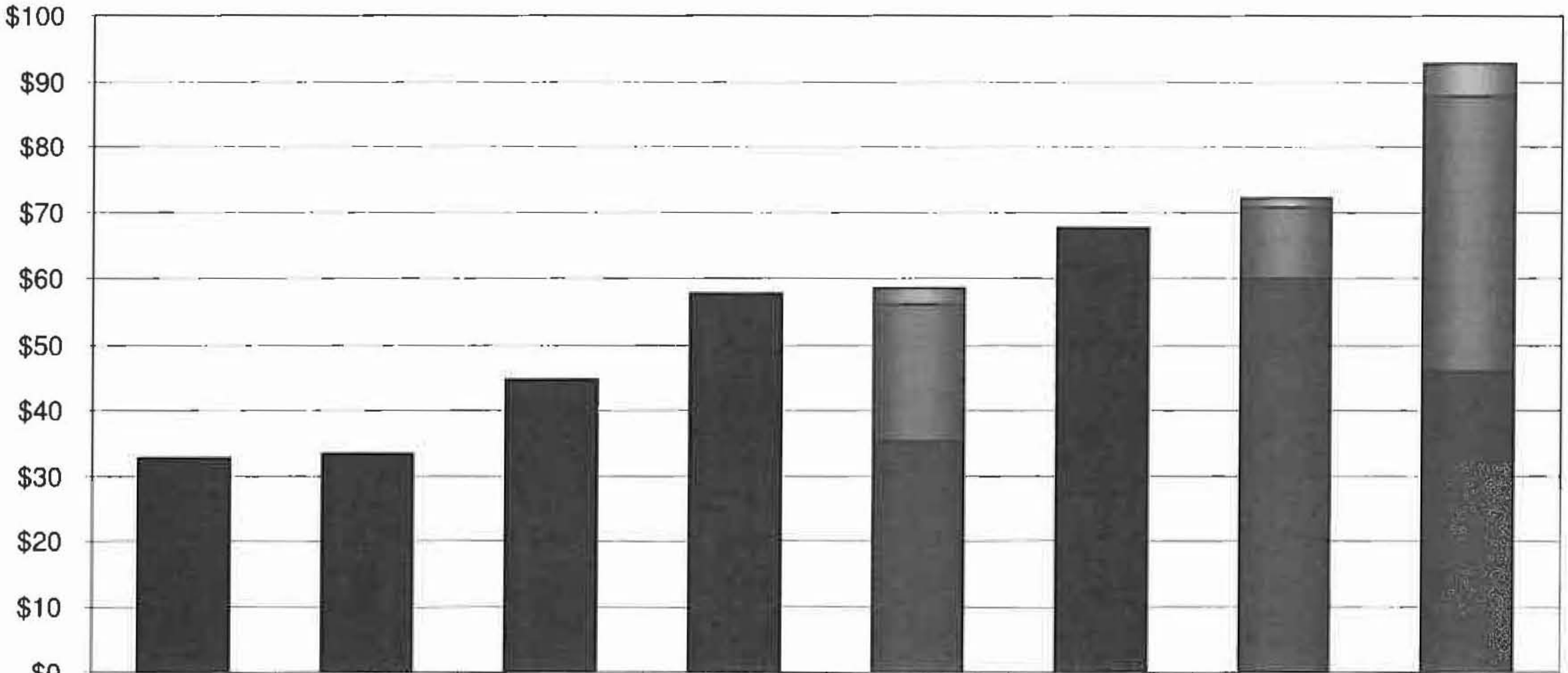
at 12 Ccf per Month



	Nipomo CSD	Paso Robles	Pismo Beach	San Luis Obispo	Morro Bay	Grover Beach	Arroyo Grande	Oceano CSD
High Cost Max						$2.88	$1.68	$7.56
High Cost Min						$35.76	$18.48	$71.52
Agency Mo. Bill						$35.23	$59.98	$45.90
Monthly Bill	$32.76	$33.36	$44.80	$57.63	$67.55			

[1] For rates in effect July 2008.

Chart 2
South SLO County Desalination Project
Low Cost Alternative
Comparison of Single Family Residential Monthly Water Bills [1]
at 12 Ccf per Month



	Nipomo CSD	Paso Robles	Pismo Beach	San Luis Obispo	Grover Beach	Morro Bay	Arroyo Grande	Oceano CSD
Low Cost Max					$2.52		$1.32	$4.92
Low Cost Min					$20.76		$10.80	$41.88
Agency Mo. Bill					$35.23		$59.98	$45.90
Monthly Bill	$32.76	$33.36	$44.80	$57.63		$67.55		

[1] For rates in effect July 2008.

APPENDIX

Table A-1
South SLO County Desalination Project
Allocation of Desalination Project Costs
High Cost Alternative

Line No.	Project Alternative	Arroyo Grande	Grover Beach	Oceano CSD	Total
1	Contract Capacity (ac-ft)	750	800	750	2,300
2	Percentage of Project	32.6%	34.8%	32.6%	100.0%
	Project Cost [1]				
3	Raw Water Supply [2]	$708,600	$755,800	$708,600	$2,173,000
4	Desalination Plant [2]	$6,603,200	$7,043,500	$6,603,300	$20,250,000
	Product Water Delivery				
5	Mobilization [2]	$97,900	$104,300	$97,800	$300,000
6	12" Pipe to Oceano [2]	$285,400	$304,300	$285,300	$875,000
7	8" Pipe to Grover Beach		$100,000		$100,000
8	8" Pipe to Arroyo Grande	$100,000			$100,000
9	Main Booster Sta. (plant) [2]	$81,500	$87,000	$81,500	$250,000
10	Intermediate Booster Sta.	$75,000	$75,000		$150,000
11	Contingency @ 15% [2]	$2,367,200	$2,525,000	$2,367,200	$7,259,400
12	Soft Costs [2]	$2,600,600	$2,773,900	$2,600,500	$7,975,000
13	Total Project Cost	$12,919,400	$13,768,800	$12,744,200	$39,432,400
	Annual OM&R [3]				
14	Desalination Facility [1]	$1,271,800	$1,356,500	$1,271,700	$3,900,000
	Raw Water and Product Delivery				
15	Power Raw Water Delivery [3]	$56,100	$59,800	$56,100	$172,000
16	Power Product Delivery [3]	$0	$15,000	$147,000	$162,000
17	Misc Maintenance [3]	$23,100	$24,700	$23,200	$71,000
18	Replacement Cost Funding [3]	$28,950	$30,900	$28,900	$88,750
19	Contingency @ 15% [3]	$34,650	$37,000	$34,600	$106,250
20	Total Annual OM&R	$1,414,600	$1,523,900	$1,561,500	$4,500,000

[1] From May 9, 2008 Memorandum, page 23, Table 2, Phases 1 through 3.
[2] Allocated to each Agency based on requested capacity.
[3] From May 9, 2008 Memorandum, Appendix A.

Table A-2
South SLO County Desalination Project
Allocation of Desalination Project Costs
Low Cost Alternative

Line No.	Project Alternative	Arroyo Grande	Grover Beach	Oceano CSD	Total
1	Contract Capacity (ac-ft)	750	800	750	2,300
2	Percentage of Project	32.6%	34.8%	32.6%	100.0%
	Project Cost [1]				
21	Raw Water Supply [2]	$395,800	$422,300	$395,900	$1,214,000
22	Desalination Plant [2]	$4,472,867	$4,771,000	$4,472,800	$13,716,667
	Product Water Delivery				
23	Mobilization [2]	$32,600	$34,800	$32,600	$100,000
24	12" Pipe to Oceano [2]	$285,400	$304,300	$285,300	$875,000
25	8" Pipe to Grover Beach		$0		
26	8" Pipe to Arroyo Grande	$0			
27	Main Booster Sta. (plant) [2]	$81,500	$87,000	$81,500	$250,000
28	Internediate Booster Sta.	$0	$0		
29	Contingency @ 15% [2]	$1,595,933	$1,702,400	$1,596,000	$4,894,333
30	Soft Costs [2]	$1,614,200	$1,721,700	$1,614,100	$4,950,000
31	Total Project Cost	$8,478,300	$9,043,500	$8,478,200	$26,000,000
	Annual OM&R [4]				
32	Desalination Facility [2] [4]	$717,400	$765,200	$717,400	$2,200,000
	Raw Water and Product Delivery				
33	Power Raw Water Delivery [3] [4]	$19,500	$20,900	$19,600	$60,000
34	Power Product Delivery [3] [4]	$0	$6,000	$52,000	$58,000
35	Misc Maintenance [3]	$23,100	$24,700	$23,200	$71,000
36	Replacement Cost Funding [3]	$28,950	$30,900	$28,900	$88,750
37	Contingency @ 15% [4]	$13,550	$14,500	$13,600	$41,650
38	Total Annual OM&R	$802,500	$862,200	$854,700	$2,519,400

[1] From May 9, 2008 Memorandum, page 23, Table 2, Phase 1 only.
[2] Allocated to each Agency based on requested capacity.
[3] From May 9, 2008 Memorandum, Appendix A.
[4] Estimated based on reduced production associated with Phase 1 assumptions.

APPENDIX C

REVISED FINANCIAL TABLES (1,550 AFY PLANT)

Table 1
South SLO County Desalination Project
Sources of Project Financing

Line No.	Financing Source	Acronym	Funding Available: Grant	Funding Available: Loan	Maximum Amount	Loan Terms[1]: Interest Rate	Loan Terms[1]: Term	Loan Terms[1]: Issuance Costs	Loan Terms[1]: Reserve Fund
1	United States Department of Agriculture [2] [3] [4]	USDA	No	Yes	[5]	3.75%	40	$50,000	Yes
2	Department of Water Resources [3]	DWR	No	Yes	$5,000,000	4.50%	20	$0	Yes
3	State Water Resources Control Board [3] [6] [7] [8]	SWRCB	No	No	$50,000,000	3.00%	20	$0	Yes
4	Department of Public Health [3] [8]	CDPH	No	No	$20,000,000	3.00%	20	$0	Yes
5	Department of Housing and Community Development [3]	CDBG	No	No				$0	No
6	California Infrastructure and Economic Development Bank [9] [10] [11]	CIEDP	No	Yes	$20,000,000	3.25%	30	0.85%	No
7	Revenue Bonds [12] [13] [14] [15]	REV	No	Yes	[15]	5.25%	30	1.0%	Yes
8	Certificates of Participation [12] [13] [14] [15]	COPs	No	Yes	[15]	5.50%	30	1.0%	Yes

[1] Reflects estimated interest rate and term as of the date of this report.
[2] Issuance costs include bond counsel costs estimated as shown.
[3] Reserve requirement can be funded over 10 years.
[4] Only Oceano CSD qualifies for any assistance (population less than 10,000). Loan may qualify for "intermediate" interest rate based on MHI. Current rate shown.
[5] No set maximum. Average project size is $3 to $5 million.
[6] Interest rate is set at half of state general obligation bond rate at time of loan.
[7] Standard Loan SRF terms shown.
[8] Funding from this source is not available for the desalination project.
[9] Issuance costs include loan origination fee of 0.85% of original loan amount or $10,000 whichever is greater.
An annual loan servicing fee of 0.3% on the outstanding loan balance is payable in arrears.
[10] Interest rate is 67% of similar "A" rated tax exempt bond. Estimate shown.
[11] Assumes that each participant of the desalination project has no outstanding rated debt of their water enterprise fund. Each participant is limited to $10,000,000.
[12] Issuance costs are dependent upon the debt issue amount.
[13] Reserve requirement is funded with debt issue proceeds, effectively increasing the total debt issue amount.
[14] Assumes reserve fund is equal to one year's principal and interest payment and funded with debt issue proceeds.
[15] Limited by ability to meet debt service coverage ratio (among other requirements). Secured by a pledge of revenue by each agency's enterprise fund.

Table 2

South SLO County Desalination Project

Summary of Allocation of Desalination Project Costs

Line No.	Description	Arroyo Grande	Grover Beach	Oceano CSD	Total
	High Cost Alternative				
1	Project Cost [1] [5]	$16,842,100	$17,957,900	$0	$34,800,000
2	Annual OM&R [2] [5]	$1,645,200	$1,754,800	$0	$3,400,000
	Low Cost Alternative				
3	Project Cost [3] [5]	$10,693,500	$11,406,500	$0	$22,100,000
4	Annual OM&R [4] [5]	$963,500	$1,027,500	$0	$1,991,000

[1] From updated tables of September 24, 2008, Phases 1 through 3 costs.

[2] From updated operation and maintenance costs of September 24, 2008.

[3] From updated tables of September 24, 2008, Phases 1 costs only.

[4] Estimated from reduced production associated with Phase 1 assumptions.

[5] Detailed allocations are presented in Appendix A, Table A-1 and Table A-2.

Table 3
South SLO County Desalination Project
Summary of Annual Capital Cost

Line No.		Arroyo Grande	Grover Beach	Oceano CSD	Total
	High Cost Alternative - Maximum Annual Cost				
	Financing Source				
1	COPs	16,842,100	17,957,900		34,800,000
2	***Annual Capital Cost***	$1,250,139	$1,332,961		$2,583,100
	High Cost Alternative - Minimum Annual Cost				
	Financing Source				
3	USDA	[1]	[1]		$0
4	CIEDB [2]	10,000,000	10,000,000		20,000,000
5	Revenue Bonds	6,842,100	7,957,900		14,800,000
6	Total	$16,842,100	$17,957,900	$0	$34,800,000
7	***Annual Capital Cost***	$1,050,147	$1,130,553		$2,180,700
	Low Cost Alternative - Maximum Annual Cost				
	Financing Source				
8	COPs	$10,693,500	$11,406,500		22,100,000
9	***Annual Capital Cost***	$793,738	$846,662		$1,640,400
	Low Cost Alternative - Minimum Annual Cost				
	Financing Source				
10	CIEDB [2]	$10,000,000	$10,000,000		20,000,000
11	Revenue Bonds	$693,500	$1,406,500		2,100,000
12	Total	$10,693,500	$11,406,500	$0	$22,100,000
13	***Annual Capital Cost***	$607,726	$659,775		$1,267,500

[1] USDA financing not available for Arroyo Grande or Grover Beach.

[2] Maximim funding limited to $10 million for any one applicant.

Table 4
South SLO County Desalination Project
Determination of Single Family Dwelling Unit Equivalents

Line No.	Agency	FY 2006-07 Annual Water Sales Volume	Average SFDU Monthly Consumption	SFDUE [1]
		Ccf		
1	Arroyo Grande	1,413,700	15	7,854
2	Grover Beach	790,400	12	5,489
3	Oceano CSD	380,500	13	2,439
4	Total	2,584,600		15,782

[1] Annual water sales volume divided by average SFDU monthly consumption divided by twelve.

Table 5

South SLO County Desalination Project

Impact of Desalination Project to Participants

Agency	High Cost Alternative Max	High Cost Alternative Min	Low Cost Alternative Max	Low Cost Alternative Min
Arroyo Grande				
Annualized Capital Cost [1]	$1,250,139	$1,050,147	$793,738	$607,726
Annual OM&R [2]	$1,645,200	$1,645,200	$963,500	$963,500
Total Annual Cost	$2,895,339	$2,695,347	$1,757,238	$1,571,226
Metered Water Sales Volume [3]	1,413,700	1,413,700	1,413,700	1,413,700
Charge per Ccf	**$2.05**	**$1.91**	**$1.24**	**$1.11**
SFDUE [3]	7,854	7,854	7,854	7,854
Cost per SFDUE per month	**$30.72**	**$28.60**	**$18.64**	**$16.67**
Grover Beach				
Annualized Capital Cost [1]	$1,332,961	$1,130,553	$846,662	$659,775
Annual OM&R [2]	$1,754,800	$1,754,800	$1,027,500	$1,027,500
Total Annual Cost	$3,087,761	$2,885,353	$1,874,162	$1,687,275
Metered Water Sales Volume [3]	790,400	790,400	790,400	790,400
Charge per Ccf	**$3.91**	**$3.65**	**$2.37**	**$2.13**
SFDUE [3]	5,489	5,489	5,489	5,489
Cost per SFDUE per month	**$46.88**	**$43.81**	**$28.45**	**$25.62**
Oceano CSD				
Annualized Capital Cost [1]	$0	$0	$0	$0
Annual OM&R [2]	$0	$0	$0	$0
Total Annual Cost	$0	$0	$0	$0
Metered Water Sales Volume [3]	380,500	380,500	380,500	380,500
Charge per Ccf	**$0.00**	**$0.00**	**$0.00**	**$0.00**
SFDUE [3]	2,439	2,439	2,439	2,439
Cost per SFDUE per month	**$0.00**	**$0.00**	**$0.00**	**$0.00**

[1] From Table 3, Summary of Annual Capital Cost.

[2] From Table 2, Summary of Allocation of Desalination Project Costs.

[3] From Table 4, Determination of Single Family Dwelling Unit Equivalents.

Table 6

South SLO County Desalination Project

Single Family Monthly Water Service Bills

For Selected Cities and Districts Within San Luis Obispo County at 12 Ccf Monthly Consumption

Agency		Existing Rates in Effect July 2008: Service Charge 3/4" Meter	Commodity Charge[1] @ 12 Ccf	Monthly Bill	Desalination Project Additional Monthly Cost[2]: High Cost Alt Max	High Cost Alt Min	Low Cost Alt Max	Low Cost Alt Min	Total Monthly Bill: High Cost Alt Max	High Cost Alt Min	Low Cost Alt Max	Low Cost Alt Min
Arroyo Grande	[3] [4]	$44.94	$15.04	$59.98	$24.60	$22.92	$14.88	$13.32	$84.58	$82.90	$74.86	$73.30
Grover Beach	[4]	$6.75	$28.48	$35.23	$46.92	$43.80	$28.44	$25.56	$82.15	$79.03	$63.67	$60.79
Oceano CSD	[4] [6]	$11.97	$33.93	$45.90	$0.00	$0.00	$0.00	$0.00	$45.90	$45.90	$45.90	$45.90
Morro Bay		$0.00	$67.55	$67.55					$67.55	$67.55	$67.55	$67.55
Nipomo CSD	[4] [5]	$14.52	$18.24	$32.76					$32.76	$32.76	$32.76	$32.76
Paso Robles	[4] [7]	$18.00	$15.36	$33.36					$33.36	$33.36	$33.36	$33.36
Pismo Beach	[4] [8]	$20.50	$24.30	$44.80					$44.80	$44.80	$44.80	$44.80
San Luis Obispo		$0.00	$57.63	$57.63					$57.63	$57.63	$57.63	$57.63

[1] Used as an example of average monthly consumption for a single family residential customer.

[2] Cost per Ccf from Table 5 multiplied by 12 Ccf.

[3] Includes Lopez Meter Charge.

[4] Billed bimonthly.

[5] Includes monthly Litigation Charge.

[6] Includes Lopez consumption charge.

[7] Includes monthly Nacimiento charge.

[8] Includes annual Water Tax Fund charge divided by 12 for payment of State Water.and Lopez fixed charges.

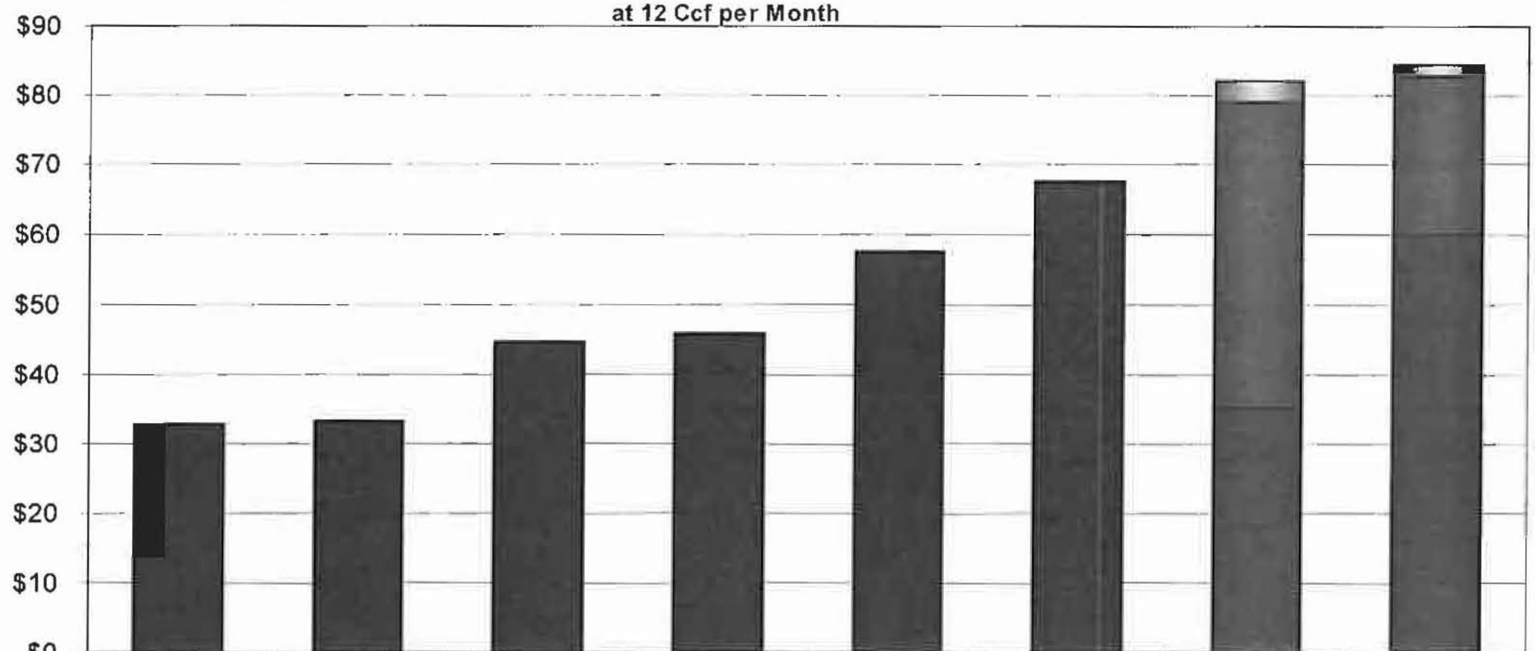
Chart 1

South SLO County Desalination Project

High Cost Alternative

Comparison of Single Family Residential Monthly Water Bills [1]

at 12 Ccf per Month



	Nipomo CSD	Paso Robles	Pismo Beach	Oceano CSD	San Luis Obispo	Morro Bay	Grover Beach	Arroyo Grande
High Cost Max							$3.12	$1.68
High Cost Min							$43.80	$22.92
Agency Mo. Bill							$35.23	$59.98
Monthly Bill	$32.76	$33.36	$44.80	$45.90	$57.63	$67.55		

[1] For rates in effect July 2008.

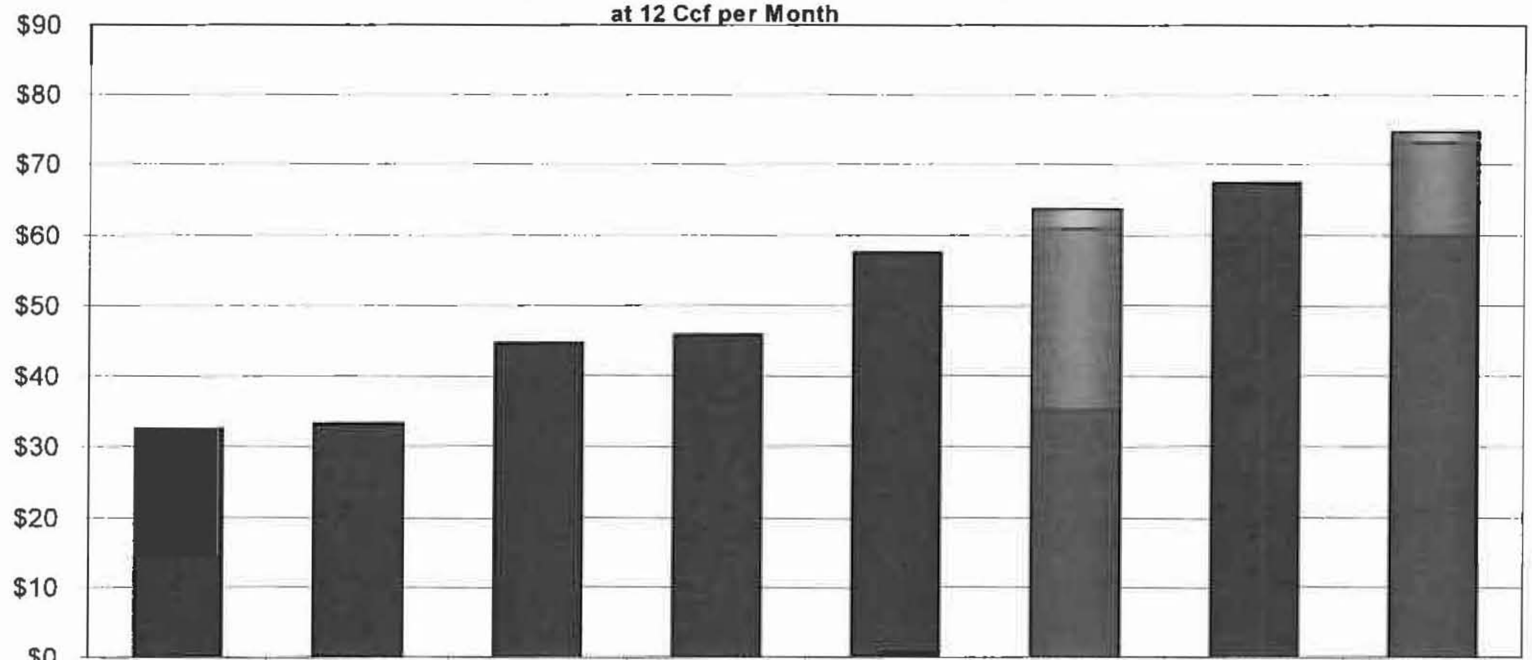
Chart 2

South SLO County Desalination Project

Low Cost Alternative

Comparison of Single Family Residential Monthly Water Bills [1]

at 12 Ccf per Month



	Nipomo CSD	Paso Robles	Pismo Beach	Oceano CSD	San Luis Obispo	Grover Beach	Morro Bay	Arroyo Grande
■ Low Cost Max						$2.88		$1.56
■ Low Cost Min						$25.56		$13.32
■ Agency Mo. Bill						$35.23		$59.98
■ Monthly Bill	$32.76	$33.36	$44.80	$45.90	$57.63		$67.55	

[1] For rates in effect July 2008.

Table A-1
South SLO County Desalination Project
Allocation of Desalination Project Costs
High Cost Alternative

Line No.	Project Alternative	Arroyo Grande	Grover Beach	Oceano CSD	Total
1	Contract Capacity (ac-ft)	750	800	0	1,550
2	Percentage of Project	48.4%	51.6%	0.0%	100.0%
	High Cost Alternative				
	Project Cost [1]				
3	Raw Water Supply [2]	$1,035,700	$1,104,800	$0	$2,140,500
4	Desalination Plant [2]	$8,179,400	$8,724,600	$0	$16,904,000
	Product Water Delivery				
5	Mobilization [2]	$145,200	$154,800	$0	$300,000
6	10" Pipe to Oceano [2]	$338,700	$361,300	$0	$700,000
7	8" Pipe to Grover Beach		$100,000		$100,000
8	8" Pipe to Arroyo Grande	$100,000			$100,000
9	Main Booster Sta. (plant) [2]	$121,000	$129,000	$0	$250,000
10	Intermediate Booster Sta.	$0	$0		$0
11	Contingency @ 30% [2]	$2,974,950	$3,173,200	$0	$6,148,150
12	Soft Costs [2]	$3,947,150	$4,210,200	$0	$8,157,350
13	Total Project Cost	$16,842,100	$17,957,900	$0	$34,800,000
	Annual OM&R [3]				
14	Desalination Facility [1]	$1,192,300	$1,271,800	$0	$2,464,100
	Raw Water and Product Delivery				
15	Power Raw Water Delivery [3]	$59,500	$63,500	$0	$123,000
16	Power Product Delivery [3]	$54,700	$58,300		$113,000
17	Misc Maintenance [3]	$34,400	$36,600	$0	$71,000
18	Replacement Cost Funding [3]	$42,950	$45,800	$0	$88,750
19	Contingency @ 15% [3]	$261,350	$278,800	$0	$540,150
20	Total Annual OM&R	$1,645,200	$1,754,800	$0	$3,400,000

[1] From updated tables of September 24, 2008, Phases 1 through 3 costs.
[2] Allocated to each Agency based on requested capacity.
[3] From updated operation and maintenance costs of September 24, 2008.

Table A-2

South SLO County Desalination Project

Allocation of Desalination Project Costs

Low Cost Alternative

Line No.	Project Alternative	Arroyo Grande	Grover Beach	Oceano CSD	Total
1	Contract Capacity (ac-ft)	750	800	0	1,550
2	Percentage of Project	48.4%	51.6%	0.0%	100.0%
	Project Cost [1]				
3	Raw Water Supply [2]	$571,700	$609,800	$0	$1,181,500
4	Desalination Plant [2]	$5,276,100	$5,627,900	$0	$10,904,000
	Product Water Delivery				
5	Mobilization [2]	$48,400	$51,600	$0	$100,000
6	12" Pipe to Oceano [2]	$338,700	$361,300	$0	$700,000
7	8" Pipe to Grover Beach		$0		
8	8" Pipe to Arroyo Grande	$0			
9	Main Booster Sta. (plant) [2]	$121,000	$129,000	$0	$250,000
10	Intermediate Booster Sta.	$0	$0		
11	Contingency @ 30% [2]	$1,906,750	$2,033,900	$0	$3,940,650
12	Soft Costs [2]	$2,430,850	$2,593,000	$0	$5,023,850
13	Total Project Cost	$10,693,500	$11,406,500	$0	$22,100,000
	Annual OM&R [4]				
14	Desalination Facility [2] [4]	$822,600	$877,400	$0	$1,700,000
	Raw Water and Product Delivery				
15	Power Raw Water Delivery [3] [4]	$19,400	$20,600	$0	$40,000
16	Power Product Delivery [3] [4]	$25,600	$27,400		$53,000
17	Misc Maintenance [3]	$34,400	$36,600	$0	$71,000
18	Replacement Cost Funding [3]	$42,950	$45,800	$0	$88,750
19	Contingency @ 15% [4]	$18,550	$19,700	$0	$38,250
20	Total Annual OM&R	$963,500	$1,027,500	$0	$1,991,000

[1] From updated tables of September 24, 2008, Phase 1 only.

[2] Allocated to each Agency based on requested capacity.

[3] From updated operation and maintenance costs of September 24, 2008.

[4] Estimated from reduced production associated with Phase 1 assumptions.