



## **4. Project Description**

## 4. PROJECT DESCRIPTION

### 4.1 Operational Phasing

The primary components necessary to construct and operate a desalination facility are: 1) a method to intake feed water, 2) a suitable treatment plant site, 3) a method to introduce product into the potable water distribution system, and 4) a method to dispose of residual concentrated seawater. Exhibit 3, PROJECT LOCATION AND LAYOUT, and Exhibit 4, INTAKE/OUTFALL TRANSMISSION LINE LOCATIONS, delineate the project location and site vicinity. To maximize reliability and operational flexibility, it was determined the following construction sequence would best meet the District's needs:

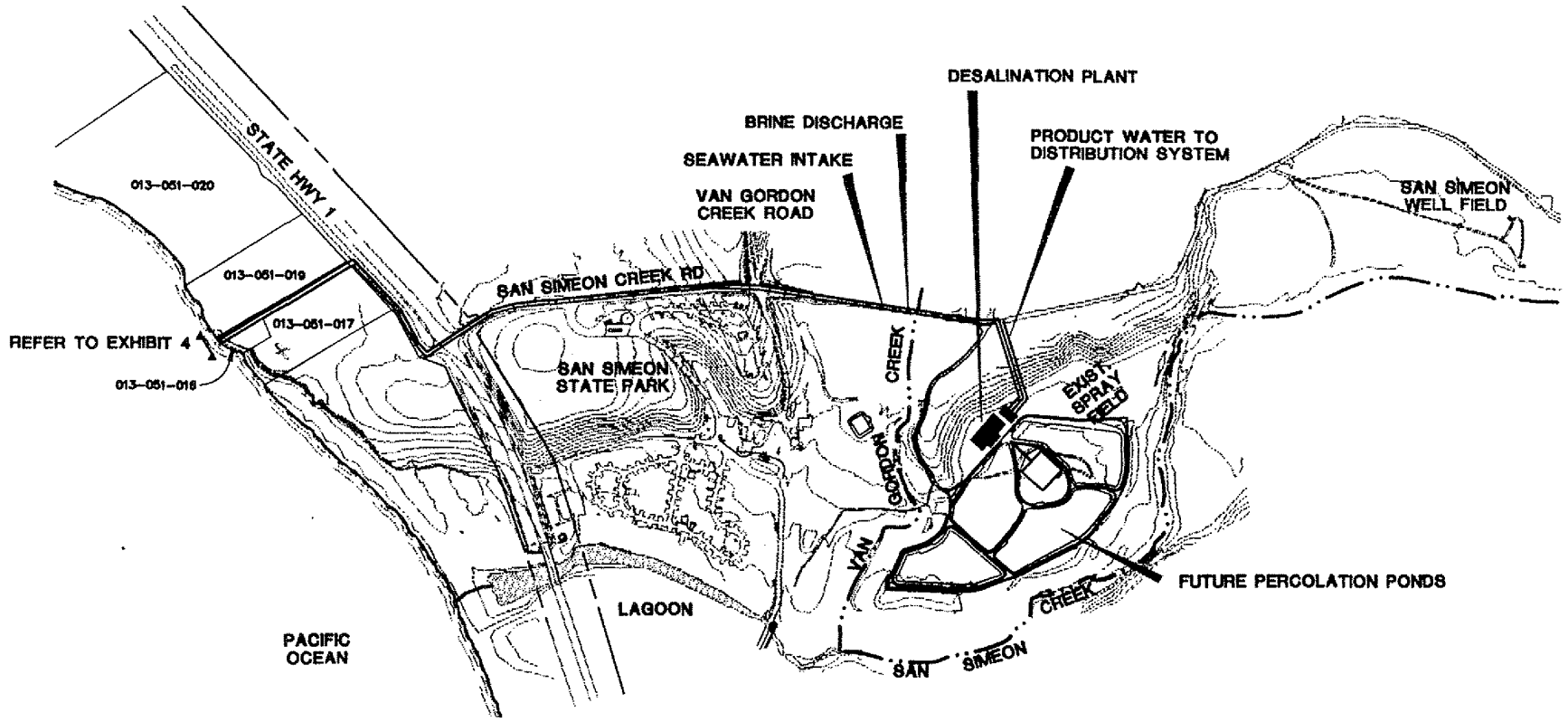
Phase 1:	2 trains of 100 gpm	=	200 gpm	=	288,000 gpd
Phase 2:	1 train of 250 gpm	=	250 gpm	=	360,000 gpd
Phase 3:	1 train of 250 gpm	=	250 gpm	=	360,000 gpd
	Maximum Capacity			=	1,008,000 gpd

(gpm = gallons per minute; gpd = gallons per day)

It should be noted that the flows indicated are expressed in terms of product water produced. The amount of feed water entering the Desalination Plant would be roughly twice the quantities listed. To increase reliability, the first phase consists of two processing trains. In this way at least some water can be produced (100 gpm = 144,000 gpd) while one of the trains is out of service for membrane cleaning or other maintenance. In later phases various combinations of 100 gpm and 250 gpm units can be activated to achieve a wide range of production capacities.

### 4.2 Desalination Plant Site

Exhibit 5, DESALINATION PLANT, shows the location and approximate layout of the Desalination Plant. The basic concept for designing the building to house the processing units is to pattern the building appearance after other structures visible in the area. Current sizing of the building is estimated to be approximately 15,000 square feet, not to exceed 20,000 square feet and will be constructed in the same style as an agricultural facility. For safety and operational purposes, the building will be a metal structure. However, metal components (walls, doors, trim) will be used to resemble nearby agricultural structures. Other architectural details and site design will be used to present the facility as an agricultural operation, in keeping with other agricultural facilities in the Cambria area.



Source: North Coast Engineering

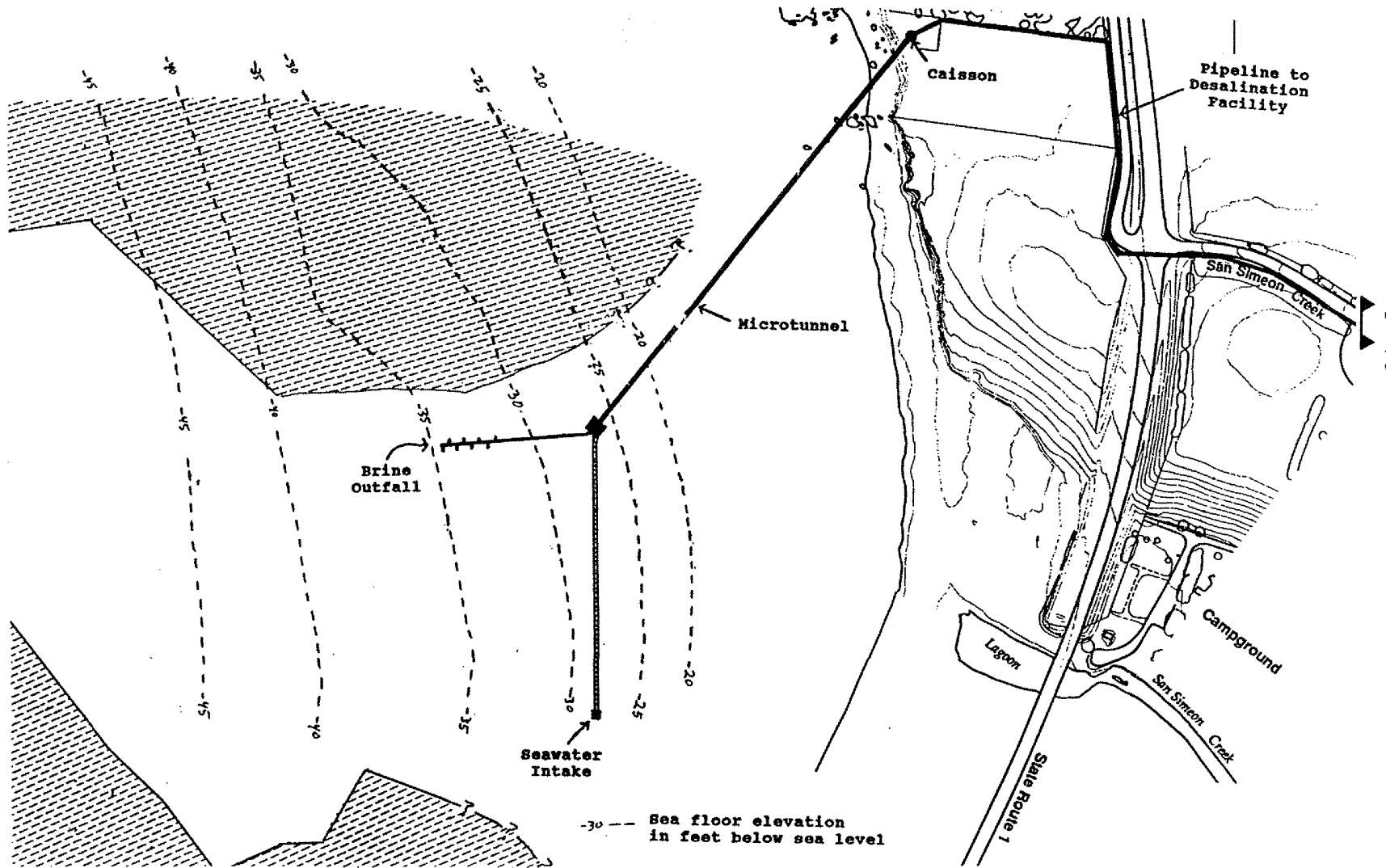





## CAMBRIA DESALINATION FACILITY Project Location and Layout

Exhibit 3

**RB** Robert Bein, William Frost & Associates  
7-94 JN 30175-4322

CCSD 002829



-  Kelp Beds
-  Transmission Facilities (approximate locations)
-  NTS

Source: Jones & Stokes

## CAMBRIA DESALINATION FACILITY Intake/Outfall Transmission Line Location

Exhibit 4



— A stilling well, or clear well, would also be constructed in the same vicinity as the Desalination Plant. This concrete tank would be approximately 120 feet long, 15 feet wide and 15 feet deep. A 3,600 square foot agricultural structure, similar in design to the Desalination Plant, will house the clear well. The desalination building would shield the adjacent building. All equipment would be enclosed inside the agricultural buildings, leaving no visible signs of industrial activity.

The clear well performs several functions. Basically, it is a 2,400 square foot concrete tank with a series of interior walls or baffles. The primary function of the tank is to allow the chemicals used for disinfection to thoroughly mix with product water from the reverse osmosis plant. It also provides sufficient detention time for the disinfectant to kill any pathogens prior to the water being introduced into the potable water distribution system. A second purpose of the clear well is to allow water pumped from the well field to be mixed with the product water. This reduces the potential for corrosion of the distribution pipes. The final purpose of the clear well is to provide a "wet well" or storage capacity for the pumps which deliver the water into the main potable water distribution system. This storage capacity is necessary to balance the flow of water being produced by the desalination plant and the rate water is pumped into the distribution system.

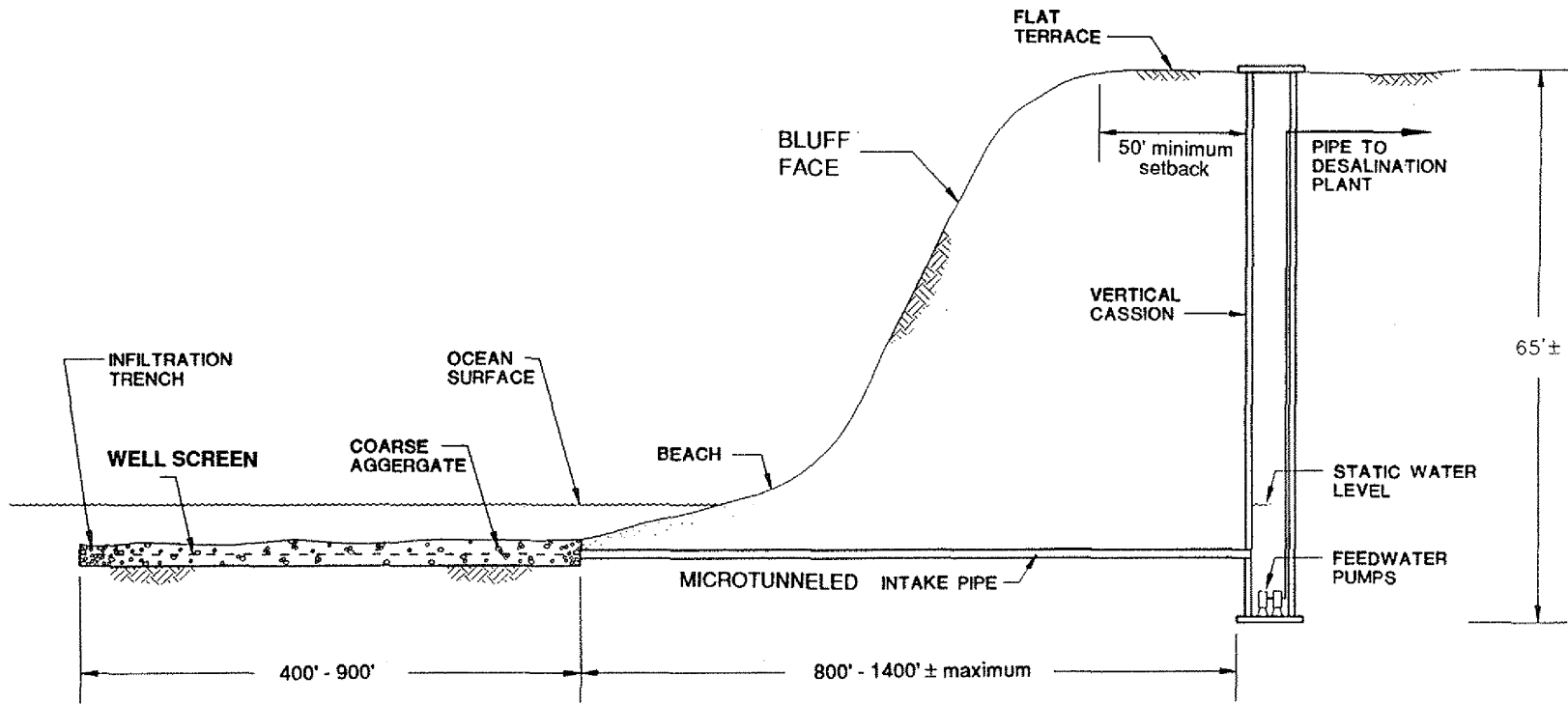
Asphalt pavement would surround the Desalination Plant building and the operator's vehicle may be visible from some view points. However, the plant would be designed in a manner where most operational activities are conducted on the north side of the building. Trees and shrubs would be used to judiciously landscape the site to screen the asphalt pavement and blend the plant site into the natural surroundings.

Other components within the building include electrical supply and process control units, including alarms and operator test equipment. Electrical supply lines will be underground.

### 4.3 Transmission Lines

Exhibit 6, SEAWATER INTAKE METHOD, shows the intake transmission facilities from the ocean to the vertical caisson located on a private, undeveloped bluff lot. The caisson would be constructed with sufficient setback from the bluff face to avoid potential damage from naturally occurring erosion of the bluff.

A 12-inch intake line and 8-inch outfall line would traverse parcel 013-051-0176, enter into the County right-of-way, with a lateral crossing at the intersection of Highway 1 and San Simeon Creek Road (refer to Exhibit 3, PROJECT LOCATION AND LAYOUT). An



Source: North Coast Engineering

CAMBRIA DESALINATION FACILITY  
**Seawater Intake Method**

Exhibit 6

**RB** Robert Bein, William Post & Associates  
 7-04 JN 30175-4322

CCSD 002833

encroachment permit would be required from the California Department of Transportation for this crossing. The transmission lines would continue east within the San Simeon Creek Road right-of-way, terminating at the CCSD property and ultimately connecting with the Desalination Plant. An existing potable water line along San Simeon Creek Road would be used to provide the Cambria service area with product water produced at the Desalination Plant.

#### 4.4 Seawater Intake

From the bottom of a 16-foot diameter shaft (known as a caisson), which is to be constructed to a depth of approximately 65 feet on the private "flag" lot, an 800 to 1400 foot horizontal pipeline would be constructed under the ocean floor using a construction technique called microtunneling. The depth of seawater would be approximately 15 feet deep at the point that the pipeline terminates, which would be outside the turbulent surf zone. The pipeline would be buried approximately five to ten feet below the ocean floor, below the depth of seasonal wave scour.

The microtunneling would terminate at a junction box where sand of sufficient thickness is first encountered. A vibracoring survey completed in May 1994, indicates that there is a swath of sand approximately 1,000 feet wide extending from the main San Simeon Beach area to a distance of at least 2,000 feet offshore. Presumably the sands were derived in large part from sediment discharged by San Simeon Creek. From the junction box, the intake line would extend across the sand swath parallel to the coastline and the brine disposal line would extend seaward along the sand swath.

The microtunnel would be approximately 24 inches in diameter and would have separate intake and brine pipes within it. This would allow the annulus of the tunnel to serve as a buffer to prevent direct contamination of the intake water in the unlikely event of a leak in the brine pipe. The intake pipe would be approximately 18 inches in diameter and the brine pipe would be approximately 8 inches in diameter. The annulus would be sealed at the caisson end and the offshore junction box end and could be pumped out to eliminate accumulated brine leakage, if necessary.

From the point at which the intake pipeline terminates, a buried infiltration gallery, up to 900 feet long, would be constructed. This would be accomplished by working from a barge on the ocean surface and using dredging/excavation equipment to excavate a trench. The trench would be approximately 10 to 20 feet wide, and five to ten feet deep. A layer of gravel would be placed in the trench as a foundation. A well screen pipe would be laid in

the trench and connected to the main pipeline, allowing seawater to flow into the on-shore vertical shaft. The trench containing the perforated pipe would be backfilled with native sandy material. A final layer of heavier rock may be used to cap the trench, insuring that ocean currents would not remove the sand covering the pipe.

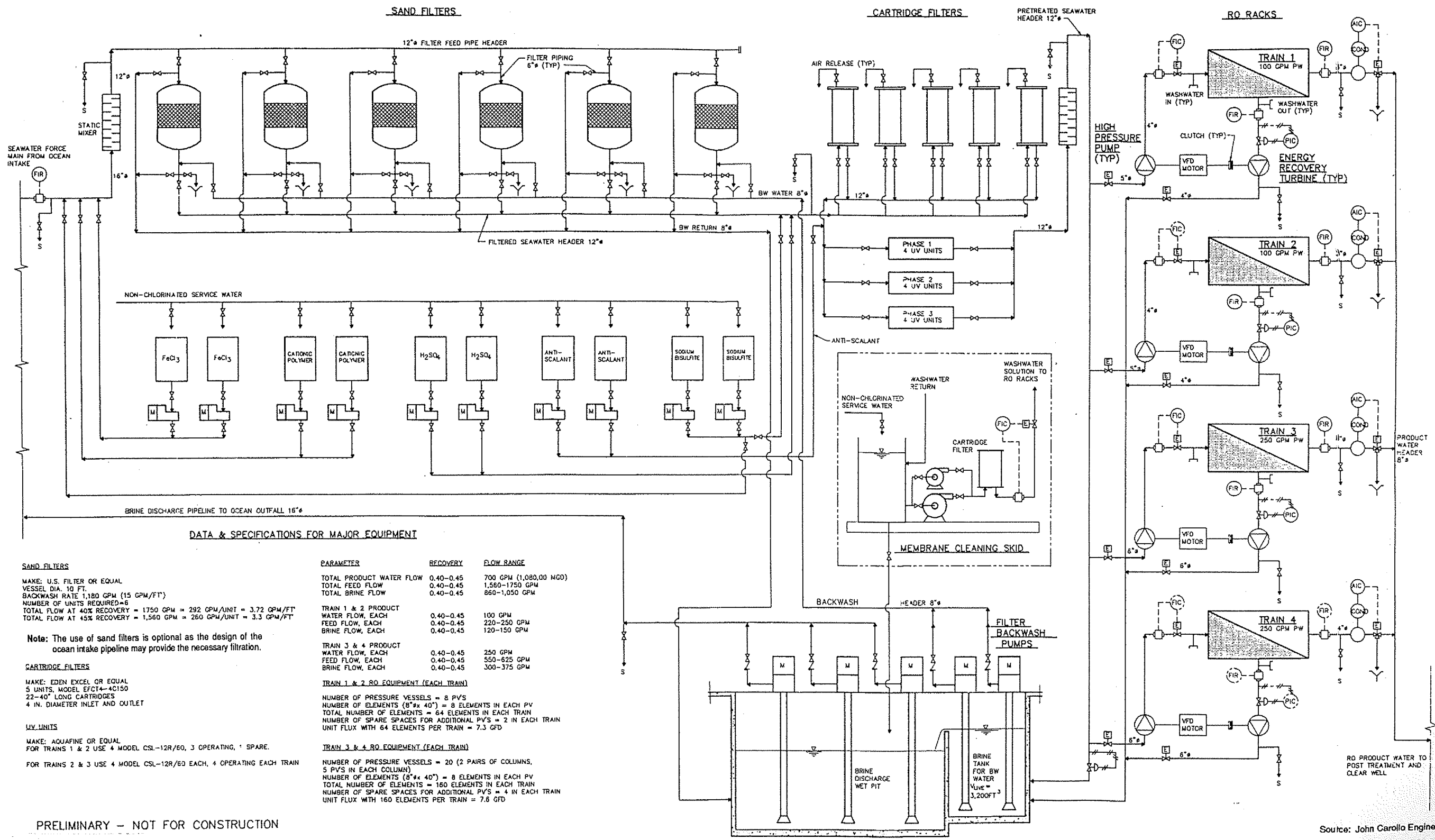
The intake well screen would terminate with a length of blank casing that rises up to the sea floor. The exposed end of the intake will be fitted with a removable cover so that silt accumulated in the intake line can be blown out and the intake line can be used as an open water intake if infiltration rates become too low. Open water intake will have a large surface area screen to lower velocities and prevent fish entrapment.

The final length and design of the well screen pipe will be selected after obtaining information regarding the texture of the sea floor sediments. A minimum of two and a maximum of four submersible pumps would be mounted on the base of the vertical caisson. Continuously supplied with seawater from the collection system, the pumps would drive the water up the shaft and through the intake pipeline to the Desalination Plant. Appropriate valves, controls, and alarms would also be installed to insure reliable operation. If sea floor conditions are unsuitable for an infiltration gallery, the pipeline will extend just beyond the wave zone and terminate in an open water intake elevated several feet above the sea floor. An intake structure would be constructed in accordance with the current design standards to prevent entrainment of marine life.

#### **4.5 Pretreatment**

By using an infiltration gallery to supply seawater for the project, the need for an extensive pretreatment system would be eliminated. Filtration through the sands on the sea floor would remove most of the suspended material in seawater. Pretreatment requirements would be limited to anti-scalant addition and cartridge filtration, which would be done within the Desalination Plant building, ahead of the RO membranes. Technical studies are ongoing to determine whether an infiltration gallery is feasible at this location. If these studies conclude that an infiltration is not feasible, a direct ocean intake would be used.

To prevent the precipitation of chemical complexes such as calcium carbonate ( $\text{CaCO}_3$ ) and calcium sulfate ( $\text{CaSO}_4$ ) during the reverse osmosis process, an anti-scalant would be added to the water as a first step in the treatment process (refer to Exhibit 7, SCHEMATIC PROCESS FLOW DIAGRAM). The anti-scalant would be a threshold inhibitor such as polyacrylate. Flocon 100 or an approved equal would be utilized; this is a non-toxic,



**DATA & SPECIFICATIONS FOR MAJOR EQUIPMENT**

**SAND FILTERS**

MAKE: U.S. FILTER OR EQUAL  
 VESSEL DIA. 10 FT.  
 BACKWASH RATE 1,180 GPM (15 GPM/FT)  
 NUMBER OF UNITS REQUIRED=6  
 TOTAL FLOW AT 40% RECOVERY = 1,750 GPM = 292 GPM/UNIT = 3.72 GPM/FT  
 TOTAL FLOW AT 45% RECOVERY = 1,560 GPM = 260 GPM/UNIT = 3.3 GPM/FT

**Note:** The use of sand filters is optional as the design of the ocean intake pipeline may provide the necessary filtration.

**CARTRIDGE FILTERS**

MAKE: EDEN EXCEL OR EQUAL  
 5 UNITS, MODEL EFC14-4C150  
 22-40" LONG CARTRIDGES  
 4 IN. DIAMETER INLET AND OUTLET

**UV UNITS**

MAKE: AQUAFINE OR EQUAL  
 FOR TRAINS 1 & 2 USE 4 MODEL CSL-12R/60, 3 OPERATING, 1 SPARE.  
 FOR TRAINS 2 & 3 USE 4 MODEL CSL-12R/60 EACH, 4 OPERATING EACH TRAIN

PARAMETER	RECOVERY	FLOW RANGE
TOTAL PRODUCT WATER FLOW	0.40-0.45	700 GPM (1,080,00 MGD)
TOTAL FEED FLOW	0.40-0.45	1,560-1,750 GPM
TOTAL BRINE FLOW	0.40-0.45	850-1,050 GPM
<b>TRAIN 1 &amp; 2 PRODUCT</b>		
WATER FLOW, EACH	0.40-0.45	100 GPM
FEED FLOW, EACH	0.40-0.45	220-250 GPM
BRINE FLOW, EACH	0.40-0.45	120-150 GPM
<b>TRAIN 3 &amp; 4 PRODUCT</b>		
WATER FLOW, EACH	0.40-0.45	250 GPM
FEED FLOW, EACH	0.40-0.45	550-625 GPM
BRINE FLOW, EACH	0.40-0.45	300-375 GPM

**TRAIN 1 & 2 RO EQUIPMENT (EACH TRAIN)**  
 NUMBER OF PRESSURE VESSELS = 8 PVS  
 NUMBER OF ELEMENTS (8"x40") = 8 ELEMENTS IN EACH PV  
 TOTAL NUMBER OF ELEMENTS = 64 ELEMENTS IN EACH TRAIN  
 NUMBER OF SPARE SPACES FOR ADDITIONAL PVS = 2 IN EACH TRAIN  
 UNIT FLUX WITH 64 ELEMENTS PER TRAIN = 7.3 GFD

**TRAIN 3 & 4 RO EQUIPMENT (EACH TRAIN)**  
 NUMBER OF PRESSURE VESSELS = 20 (2 PAIRS OF COLUMNS, 5 PVS IN EACH COLUMN)  
 NUMBER OF ELEMENTS (8"x40") = 8 ELEMENTS IN EACH PV  
 TOTAL NUMBER OF ELEMENTS = 160 ELEMENTS IN EACH TRAIN  
 NUMBER OF SPARE SPACES FOR ADDITIONAL PVS = 4 IN EACH TRAIN  
 UNIT FLUX WITH 160 ELEMENTS PER TRAIN = 7.6 GFD

PRELIMINARY - NOT FOR CONSTRUCTION

Source: John Carollo Engineers

CAMBRIA DESALINATION FACILITY  
**Schematic Process Flow Diagram**

Exhibit 7

— biodegradable substance approved by the EPA for drinking water treatment. It would be delivered and stored in 55-gallon drums and would be fed using a metering pump.

Water drawn directly from the ocean contains organisms that must be removed by sand filters. If they are required, a filter aid chemical (or coagulant) would be added to the intake water to maximize the efficiency of the filter. The chemical normally used to aid filtration is ferric chloride (FeCl<sub>3</sub>), however, other coagulants are available.

In simple terms, when these chemicals are metered into water, these compounds dissolve into free ions, in this case Fe and Cl. The iron ion rapidly attaches itself to microscopic sized particles, such as plankton, and causes the small particles to agglomerate into larger particles forming what is called floc. Floc is large enough to be seen by the naked eye and is easily retained on the sand filter.

Periodically, the filter must be backwashed which produces a wastewater which is initially quite murky and then becomes clear as the filter is cleaned. The filter backwash water contains the organic material which has been brought in from the ocean and is not a toxic or hazardous material. The organic material in the backwash water is more concentrated than what is typically found in the ocean.

To safely dispose of the filtered backwash water, it will first be stored in a 12,000 gallon tank and then slowly metered back into the brine stream. The Regional Water Quality Control Board has established limits on the rate at which organic material can be discharged into the ocean to protect the marine environment. The filtered backwash water discharge concentration will be held below those limits.

Cartridge filters with an effective pore size of 5 microns would be used prior to the reverse osmosis system to remove any remaining particles in the seawater that would clog the membrane. The cartridge filters would be changed when head loss increases to 15 pounds per square inch (psi) and would be disposed of in a sanitary landfill.

Water would then be fed into a high pressure pump driven by an electric motor. The high pressure water would be piped to a series of cylinder-shaped membranes. To allow the modules to operate separately, each module would be fed with a single feed pump. Multi-stage centrifugal pumps (which may also be single stage) would be utilized to produce the high pressures required for the reverse osmosis process.

Approximately 45 percent of the water would pass through the membrane, which strips out the dissolved chemicals in the process. Having passed through the membrane, the water would no longer be sea water, but almost pure water suitable for drinking. The product water would be collected in an exterior shell. The energy required to separate water molecules from other dissolved chemicals would reduce the water pressure from about 900 psi to 10 psi for the product water.

The chemicals or elements that were stripped out would now remain in the pressure vessel. These additional seawater elements would increase the concentration of the water that did not migrate through the membrane. This non-purified stream of brine would flow out of the membrane with almost twice the concentration of seawater. This rejected concentrated seawater will be returned to the ocean.

However, as it leaves the reverse osmosis cylinder, the concentrated seawater would remain at a very high pressure. This high pressure concentrated seawater is a useful source of energy. To utilize and recapture this energy, the concentrated seawater can be forced through a turbine (or other similar device) where the high pressure is used to turn a shaft. This is the same shaft that would drive the high pressure pumps feeding the R.O. unit, thus reducing the amount of energy the electric motors must exert to raise the pressure of the incoming feedwater. Depending on the equipment selected, approximately 35 percent of the energy applied in the feed stream may be recovered. In this manner, the overall project energy demand would be reduced.

With normal operation of the reverse osmosis system, material would accumulate on the membrane surface. These materials may include inorganic materials too small to be removed by the cartridge filters. The accumulation of these materials leads to membrane fouling and a reduction in system performance, thus, higher feed pressures would be needed to maintain the same water production rate. To remove the fouling material and restore system performance, the membranes would be taken off-line and cleaned, using chemical detergents and surfactants. The pH of the water used to flush the membranes before and after cleaning would be adjusted using sodium hydroxide (NaOH) and sulfuric acid (H<sub>2</sub>SO<sub>4</sub>). These are chemicals that, once diluted, may be safely discharged to a sanitary sewer. The pH of the spent cleaning agents may have to be adjusted prior to disposal. The cleaning agents would be delivered to the site as a concentrate in 55-gallon drums. The spent cleaning solution would be returned to the storage tank, where the pH would be adjusted, if necessary, and disposed of through the sanitary sewer. At no time would the cleaning solution be discharged to the ocean.

— Other cleaning agents are available, including proprietary mixtures sold by companies specializing in membrane cleaning compounds. Final selection of cleaning agents, equipment, and procedures would be based on the recommendation of the membrane manufacturer and would be defined during final design. The frequency of membrane cleaning is dependent on the quality of the feed. It should be noted that the CCSD intends to use UV disinfection system to minimize the growth of microbes within the membrane elements. Chlorine and its byproducts from the chemical reaction have often proved to be a major cause of membrane failures. When thin-film composite membranes are used in the membrane process, the reverse osmosis feed stream must be dechlorinated to prevent premature failure of the membrane. UV disinfection is a safe alternative to the use of chlorine and other oxidants.

#### 4.6 Posttreatment

The reverse osmosis permeate (product water) would need to be post-treated to control corrosion and provide a disinfectant residual. Corrosion control treatment is necessary to reduce the corrosion of water transmission and distribution pipelines, service lines, and building plumbing. Disinfectant addition would be required to protect against pathogenic microbial growths in pipelines and to comply with the requirements of the California Surface Water Treatment Rule (SWTR).

An alternative to adding chemicals to reduce the corrosivity of the reverse osmosis permeate would be to blend the permeate with well water from CCSD's San Simeon well field. The well water contains sufficient concentrations of ions, such as calcium, to neutralize the pH and eliminate the corrosivity of the product water. Blending would eliminate the need for lime and carbon dioxide storage and feed equipment. In addition, blending the two waters would decrease the hardness of water served to CCSD's customers.

A possible blending scenario would consist of blending the two waters in the treated water clear well. A pipeline would be constructed to convey San Simeon well water to the clear well. This pipeline may only have to be constructed between the CCSD water main along San Simeon Creek Road and the clear well. The operation of the Desalination Plant and the CCSD wells would have to be coordinated to ensure an adequate blending ratio for corrosion control of water. A blending ratio of at least one part well water with four parts desalination product water would be necessary.

Sodium hypochlorite (NaOCl) is proposed to produce a free chlorine (HOCl/OCl) residual in the product water. Sodium hypochlorite solution (12.5 percent chlorine) would be delivered in either a liquid, granular or tablet form to the Desalination Plant site. This would provide about 30 days of storage for a 1 MGD plant. Containment walls would be constructed around the tank to contain any spills. The sodium hypochlorite would be fed using metering pumps to a point downstream of the permeate booster pumps. The disinfectant would be metered into the clear well which would allow sufficient contact time to kill pathogens; then the water would be pumped via the booster pumps into the potable water system.

The SWTR contains disinfection requirements for desalination facilities that would need to be met if the State Department of Health Services (DOHS) considers the seawater supply to be either a surface water source or ground water under the direct influence of surface water. To comply with the disinfection requirement, a disinfectant residual and contact time before the delivery of the water to the first service connection would be maintained.

#### **4.7 Concentrated Seawater Disposal**

Several design options for seawater disposal have been considered by the CCSD. In April, 1994, Jones & Stokes Associates prepared a study which evaluates several potential outfall design alternatives for the proposed facility. Evaluations of wastewater discharges are typically based on the ability of the outfall to dilute constituents of concern to acceptable concentrations within a specified area or distance from the outfall. In this case, the constituent of concern is salinity, and there are currently no State or Federal water quality standards for salinity discharge to the ocean.

The results of the Jones & Stokes study indicate that a variety of outfall designs and locations would be capable of diluting the brine to a safe salinity level within a reasonably small area. Thus, the choice of an outfall alternative can be based on other criteria such as cost, engineering feasibility or environmental conditions. The preferred option is a deep underwater discharge. Other options such as a surf zone and a shoreline discharge are discussed in Section 7, ALTERNATIVES.

A buried pipeline would extend offshore approximately 300 meters (1,000 feet) to a water depth of 8 to 9 meters (25 to 30 feet). From there, a diffuser pipe resting on the sea floor would extend perpendicular to shore for approximately 30 meters (100 feet), with six to 10 jet ports spaced uniformly along it. Simulation results indicated that this spacing would be sufficient to prevent individual jet plumes from coalescing before settling to the sea floor.

Each port would consist of a jet at the end of a riser pipe that would elevate the jet orifice about 1 meter (3.2 feet) above the sea floor to protect against burial by drifting sands. The jet direction would be perpendicular to the main diffuser pipe at an angle of about 45° above horizontal. Alternate jets would be directed toward the opposite side of the diffuser pipe.

The brine discharge would consist of concentrated seawater with a total dissolved solids concentration of approximately 60 ppt. To bring the salinity down to 103 percent of ambient salinity, a dilution factor of 26:1 (26 parts ambient seawater to 1 part brine) would be necessary.

In addition to a salinity of approximately 60 ppt, the brine would contain small amounts of biodegradable antiscalant compounds and possibly backwash from onshore filters for the raw seawater entering the plant. These additional compounds are nontoxic or would be diluted to nontoxic concentrations before discharge. They would have a negligible effect on the density of the brine.

Presently, no numerical standards exist for salinity of brine discharges from desalination plants. ~~However, bioassays of selected marine organisms completed for other desalination projects on the central California coast found adverse effects on sea urchin embryos when salinity was as low as 36.5 parts per thousand (ppt), 110 percent of ambient salinity (33 ppt) (ABA Consultants, 1992; Aquatic Bioassay and Consulting Laboratories, 1992; Water Engineering and Modeling, 1993).~~ However, bioassays of selected marine organisms completed for other desalination projects on the central California coast provide an indication of the threshold at which adverse effects become noticeable in sensitive organisms. (ABA Consultants 1992; Aquatic Bioassay and Consulting Laboratories 1992; Water Engineering and Modeling 1993). Results of these tests can be summarized as follows:

- no effect on sand dollars exposed for 10 days to salinities less than 128% of ambient salinity, but noticeable effects at higher salinities,
- no effect on olive snails exposed for 10 days to salinities less than 143% of ambient salinity, but noticeable effects at higher salinities,
- no effect on giant kelp spores exposed for 48 hours to salinities between 100-130% of ambient salinity,

- no effect on amphipods exposed for 48 hours to salinities between 100-115% of ambient salinity,
- a large decrease in normal sea urchin embryos at 110% of ambient salinity, but a follow-up test found no adverse effects at salinities less than 115% of ambient,
- no effect on reject brine from an existing desalination plant (Diablo Canyon) on kelp germination or growth, and
- a noticeable decrease in normal sea urchin embryo development in desalination plant brine diluted to 110% of ambient salinity.

These tests indicated that sea urchin embryos were the most sensitive to elevated salinity and that adverse effects were sometimes noticeable at salinities as low as 110% of ambient salinity. Adverse effects were not found at salinities less than 110% of ambient salinity.

Appendix B, Salinity Modeling Report for Brine Outfall, provides detailed information pertaining to the plume modeling for simulation of near-field and far-field dilution simulation. Near-field dilution results from turbulent mixing caused by the velocity of the discharge as it exits the outfall jets. Regulatory requirements of the California Ocean Plan define the area in which near-field mixing occurs as the zone of initial dilution (ZID). Additional (far-field) dilution occurs when the brine plumes from the jets slowly drift away from the outfall and are dispersed by tidal currents and wave motion. The simulation results demonstrate that near-field and far-field mixing processes are capable of diluting the brine discharge to less than 34.0 ppt (103 percent of ambient salinity) before the discharge plume reaches sensitive marine organisms in the kelp beds near the outfall site.

An outfall diffuser consisting of 10 jet ports spaced uniformly along a 30-meter (100-foot) outfall pipe, each pointed upward at a 45° angle and discharging with a jet velocity of 3.3 m/s (11 ft/s), can achieve a dilution factor of 22:1 within the ZID. This corresponds to a salinity of 34.2 ppt (103.5% of ambient salinity), which is much less than the lowest salinity associated with adverse effects in previous bioassays and only slightly larger than the conservative target salinity selected for this study (34 ppt, or 26:1 dilution). This outfall design is also reasonable from an engineering standpoint. Far-field mixing can easily provide the small amount of additional dilution needed to meet the target salinity level. This represents a reasonable outfall design, and it almost provides the total amount of dilution required to completely avoid impacts on marine organisms.

~~Additional dilution occurs when the brine plumes from the jets slowly drift away from the outfall and are dispersed by tidal currents and wave motion.~~ Even if very conservative assumptions are made regarding vertical mixing, diffusivity, and current speed and direction, far-field dispersion is sufficient to decrease the salinity of the discharge to harmless levels within 85 meters (280 feet) of the outfall.

The outfall would need to be buried fairly deeply where it crosses the beach and near shore area to avoid exposure and potential damage by waves during winter. The distance from shore to the point of discharge would be dictated by water depth and the need to provide adequate separation between the brine plume and the seawater intake. Because of the gently sloping bathymetry of the proposed discharge sites, the outfall would need to be located at least 700 feet offshore to avoid damage from winter storms.

The sand swath extending from the San Simeon Beach area appears to be of ample width to allow complete dispersion of the brine plumes before they encounter the kelp beds, which are the biologically most sensitive areas. If the ambient current is always from north to south, the outfall may be located closer to the northern edge of the sand swath to allow more distance between the outfall and the downgradient kelp beds.

Seasonal and long-term shifting of beach sands at the proposed outfall location could expose the buried part of the outfall pipe during winter storms and result in wave damage to the outfall. Submerged outfalls can also be buried by shifting sands. This potential problem can be avoided by the use of vertical jet risers.

#### **4.8 Power Supply**

Extended conversations were had with both the electric and gas suppliers for Cambria, in order to determine the least expensive and most advantageous power source for the desalination unit. If the CCSD needs to operate the plant on a full time basis, the current advantage clearly lies with natural gas. Conversely, if the plant is operated for only a month during an off-peak electric season (i.e., fall/winter), then electricity has the advantage. The matter is made more complex by cogeneration rules. If cogeneration equipment is installed to capture waste heat, then gas prices are further reduced.

The proposed system would be capable of using either natural gas powered engines coupled with electric generators, or take electricity directly from the electrical grid. The advantage of such a system is the ability to utilize the least expensive power source, depending on the

time of year and mode of operation. Two operational scenarios may occur upon operation of the facility:

1. The facility would generate its own power utilizing a gas motor/electric generator system; or
2. The facility would purchase electricity from Pacific Gas & Electric, provided by the local electrical grid.

The dual power supply facility would be constructed with natural gas engines and have a back up option of using purchased electricity, if necessary.

Table 4

**PROJECT ENERGY REQUIREMENTS**

Year	Capacity Flow (Gallons per Minute)	Daily Electrical Requirements		Daily Natural Gas Requirements	
		Without Energy Recovery (kwh/day)	With Energy Recovery (kwh/day)	Gas Demand at 25% Thermal Efficiency (Therms per Day)	Gas Demand at 38% Thermal Efficiency (Therms per Day)
1995	200	7,000	5,800	555	370
2000	450	15,500	12,400	1,080	720
2005	700	24,000	19,200	1,950	1,300

Table 4 presents the anticipated power consumption for an electrical or natural gas powered plant. Note that the power use is subject to several operational constraints, principally that it will be used only on an intermittent basis. In addition, power consumption could be reduced substantially below the values shown in the table if turbine-generators are used to recover the energy released when the waste brine is depressurized.

Lowering the pressure of the waste brine can be accomplished in several ways. A simple, inexpensive pressure reducing valve can be used; however, the energy contained in the high pressure water is lost. Alternatively, a more complex method for reducing the pressure is to pass the water through a turbine. The water turns the turbine, which drives a generator to produce electricity. In this manner, useful energy is recovered from the pressure reducing process.

— The turbine-generator process requires relatively expensive equipment, including electrical control and regulation facilities. Whether the extra cost of the energy recovery facilities is cost effective can only be determined once the exact cost of energy is known. Therefore, both levels of energy use listed in the above table are being considered.

#### 4.9 Construction Methods

Construction activities for the Desalination Plant site include site clearing and 1,300 cubic yards of grading and earthwork onsite. Development of the Plant includes installation of underground utilities and piping, placement of foundations and walls, installation of equipment, electrical work, finish work and landscaping. Total construction time is approximately nine months, including 60 days for grading activities.

Construction activities for onshore pipelines from the Desalination Plant to the caisson on the bluff lot would include right-of-way clearing, two trenches 4 feet in depth, each totaling 4,500 linear feet, relocating existing buried utilities if necessary, pipeline installation, backfilling, compaction, resurfacing, revegetating and testing. The pipeline trenches would be excavated by contemporary construction methods consistent with CALOSHA regulations. Staging areas would include parts of the bluff top property, portions of the County roadways and other CCSD property locations in the vicinity. Although further consultations will be required with the Department of Transportation for the pipeline crossing at Highway 1, a potential construction technique under consideration is to jack the pipeline under the highway, thereby reducing surface and access impacts.

Pipeline construction crew sizes would vary, but typically consist of about 8 workers and their equipment. Typical pipeline construction would proceed at an average rate of about 200 feet per day; progress would be faster or slower depending on the terrain. The construction area would have a minimum width of 25 not more than 20 feet to accommodate the trench itself, excavation machinery and spoils removal or storage. Special provisions and equipment will be utilized along the 11-foot flagpole portion of the flag lot to minimize disturbance. Where sufficient room is available, the construction area would be 35 to 50 feet wide. A residential unit currently under construction adjacent to the south of the 11-foot wide driveway will not be adversely impacted by construction activities.

Construction of the bluff top vertical caisson will be completed through the use of drilling and dredging excavation. The approximately 65 foot shaft will yield approximately 400 cubic yards of excavated material which is to be trucked offsite to a permitted gravel mine operation approximately one half mile away.

The horizontal pipe from the bottom of the caisson to the offshore intake and outfall facilities will be constructed using microtunneling methods. At the terminus of the micro-tunnel, approximately 500 feet offshore, a floating barge will be used to install both the outfall and seawater intake pipelines. The barge will be secured over the areas to be trenched with the use of four (4) anchors. The trench for the intake pipeline will be excavated using either a clamshell dredge or a suction dredge. The excavated material will be stored temporarily in a berm on the sea floor parallel to the trench and will subsequently be used to backfill the trench.

#### **4.10 Project Operations and Water Supply Performance**

The plant will be constructed as needed to meet potable water shortages. The availability of water from the CCSD's primary water source, wells in the San Simeon and Santa Rosa Creek groundwater basins, depends upon streamflow timing and amount.

Since streamflow is unpredictable, a schedule of operation for the Desalination Plant cannot be precisely stated. However, based on water production during the past several years, which includes dry and normal years, a probable operations schedule has been developed.

It is anticipated that the Desalination Plant will operate approximately four months of the year, from September 1 to December 31. Earlier operation in summer may be necessary in some years so that the combined supply from groundwater and desalination will last until the following winter. The first phase of the system will be completed in mid-1995. Subsequent stages will be added at approximately 5-year intervals. The plant will reach full capacity about 2005.

This operations schedule is based on historic data which indicates sufficient quantities of water can be extracted from groundwater until early fall. Significant quantities of rainfall typically do not occur until December or January. In the interim, the groundwater basin is not recharged and water from the Desalination Plant is required to provide a continuous potable water supply.

The heart of a desalination plant is the membrane core formed in the shape of a cylinder. The membrane core allows passage of water molecules, but excludes most other dissolved minerals found in seawater. The membranes can be damaged by certain chemicals (such as chlorine), by bacterial growth, and frequent on-off cycles. Because of these limitations, the preferred mode of operation is to bring the plant into service once a year and keep water production constant until it can be shut down, cleaned, and "moth-balled" for the

— remainder of the year. Once the plant is in operation, it must remain in service producing a constant quantity of water. Occasional, short-term power outages of less than 12 hours can be tolerated, even though such events stress the membranes and can shorten their life.

The product water will meet all primary and secondary drinking water standards, testing requirements and procedures set forth in Title 22, California Code of Regulations, Environmental Health (1989). The CCSD will need to comply with the State Department of Health Protocol for applying the Surface Water Treatment Rule (SWTR) to Desalination Treatment Plants.

Because the nearby San Simeon Creek outlet is located near the intake, the Department of Health Services may require that the Desalination Plant not be operational for up to three days following a 0.5-inch rainfall during a 24-hour period. The Creek's watershed includes farm homes and cattle grazing and the creek runoff which may contain pathogens which would pollute the ocean in the vicinity of the intake. It should be noted that this potential requirement should consider that undiluted creek runoff goes much more directly into the water system via the existing wells than via the ocean infiltration gallery and Desalination Plant. Also, creek water floats on the ocean and 0.5 inches of rainfall in early season (September through December) correlates poorly with streamflow. Any wastewater discharge in the area will need to be adequately disinfected.

The treatment plant operators must be certified to comply with Regulations for Certification of Water Treatment Plant Operators. Adequate cross connection control and water and sewer line separation must be provided.

The treatment plant operation will need to be monitored using a continuous conductivity meter, turbidimeter and chlorine analyzers. Complete chemical analyses will need to be made at least quarterly. Other parameters will need to be made at least quarterly. Other parameters such as bacteria, turbidity, chlorine residuals, pH, etc, will need to be made on a daily or hourly basis. The CCSD will need to submit a monthly report to the State Department of Health Services on the treatment plant operation by the tenth of each month as specified by the SWTR.