FINAL REPORT

Evaluation of Seawater Desalination Projects Proposed for the Monterey Peninsula

Submitted to:
Monterey Peninsula Water Management District

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Abbreviations and Acronyms

ac-ft – Acre-Feet

ASR – Aquifer Storage and Recovery

AWCC – American Water Capital Corporation

AWWC – American Water Works Company

B-E – Bookman Edmonston

CAW – California American Water

CDHS – California Department of Health Services

CDR – Concept Design Report (CWP and MBRSDP)

CEQA – California Environmental Quality Act

CPUC – California Public Utilities Commission

CWP – Coastal Water Project

DBPs – Disinfection By-Products

DWCS – Desalinated Water Conveyance System

EIR – Environmental Impact Report

HDD – Horizontal Directionally Drilled

MBRSDP – Monterey Bay Regional Seawater Desalination Project

MCL – Maximum Contaminant Level

MCWD – Marina Coast Water District

mgd – Million Gallons Per Day

MF – Micro Filtration

MLPP – Moss Landing Power Plant

MPWMD – Monterey Peninsula Water Management District

MRWPCA – Monterey Regional Water Pollution Control Agency

NPDES – National Polluant Discharge Elimination System

National Refractories – National Refractories and Minerals Corporation

O&M – Operation and Maintenance

OTC – Once-Through Cooling

P/SMCSD – Pajaro/Sunny Mesa Community Services District

PEA – Proponent's Environmental Assessment (CWP)

RO – Reverse Osmosis

SCDP – Sand City Desalination Project

SDV – Seawater Desalination Vessel

SOCs – Synthetic Organic Chemicals

SWRCB – State Water Resources Control Board

TBD – To Be Determined

TDS – Total Dissolved Solids

TOC – Total Organic Carbon

WSC – Water Standard Company

Executive Summary

Bookman-Edmonston (B-E), a Division of GEI Consultants, Inc., along with sub-consultants Malcolm Pirnie, Inc. and Separation Processes, Inc., is providing engineering support to the Monterey Peninsula Water Management District (MPWMD) to review and evaluate four seawater desalination projects that have been proposed for the Monterey Peninsula. In 2006, B-E and its sub-consultants prepared a report evaluating three of these projects. A report titled "Seawater Desalination Projects Evaluation" and dated June 26, 2006, was provided to MPWMD. Comments on the report and questions regarding the project were submitted by project proponents, MPWMD Board members, and members of the public. B-E was retained to respond to these comments and questions, and to add an evaluation of a fourth project, the Seawater Desalination Vessel concept proposed by Water Standard Company. The draft report containing responses to comments on the June 26, 2006 report and adding the Seawater Desalination Vessel was provided to MPWMD on July 10, 2007. This final report updates and responds to comments on the July 10, 2007 draft. The four projects evaluated in the current report and their respective sponsors are:

Proponent	Proposed Project
CAW California American Water	**CWP** Coastal Water Project
P/SMCSD Pajaro/Sunny Mesa Community Services District	**MBRSDP** Monterey Regional Seawater Desalination Project
MPWMD Monterey Peninsula Water Management District	**SCDP** Sand City Desalination Project
WSC Water Standard Company	**SDV** Seawater Desalination Vessel

1. California American Water (CAW) – Coastal Water Project (CWP). The proposed project includes a 10 million gallons per day (mgd) desalination plant combined with an aquifer storage and recovery (ASR) component in the Seaside Groundwater Basin providing an additional 1,300 acre-feet per year.
2. Pajaro/Sunny Mesa Community Services District (P/SMCSD) in cooperation with Poseidon Resources Corporation (Poseidon) – 20 mgd Monterey Bay Regional Seawater Desalination Project (MBRSDP).
3. Monterey Peninsula Water Management District (MPWMD) – 7.5 mgd Sand City Desalination Project (SCDP).
4. Water Standard Company (WSC) – 10 to 20 mgd Seawater Desalination Vessel (SDV).

Project Summaries

The four projects are in the conceptual or preliminary stage of development and all four have as their objective to provide California American Water with a replacement water supply to

comply with the State Water Resources Control Board (SWRCB) Order No. 95-10, with some expandable capacity to meet regional needs. Brief summaries of the projects follow.

Project name:	Coastal Water Project (CWP)
Proponent(s):	California American Water (CAW)
Location:	Moss Landing Power Plant (MLPP), Moss Landing
Purpose:	Primarily (Basic Coastal Water Project), to comply with State of California Water Resources Control Board Order No. 95-10 by replacing the Carmel River shortfall, and to offset a portion of the Seaside Groundwater Basin overdraft. Alternatively (Regional Coastal Water Project), as a regional water supply project to meet the Monterey Peninsula build-out water demands; the water needs of the Marina Coast Water District; and the water needs of Moss Landing, Castroville, and Northern Monterey County. The project is currently progressing as the Basic Coastal Water Project.
Production volume:	Basic Coastal Water Project: 11,730 ac-ft per year (includes 1,300 ac-ft per year from Seaside Basin ASR) Regional Coastal Water Project: 20,272 ac-ft per year (includes 1,300 ac-ft per year from Seaside Basin ASR)

Project name:	Monterey Bay Regional Seawater Desalination Project (MBRSDP)
Proponent(s):	Pajaro/Sunny Mesa Community Services District in cooperation with Poseidon Resources Corporation
Location:	The former National Refractories plant site, Moss Landing
Purpose:	To replace and augment existing water supplies serving the Monterey Peninsula, certain areas of northern Monterey County, the service area of the Pajaro/Sunny Mesa Community Services District and portions of the Pajaro Valley Water Management Agency service area.
Production volume:	20 mgd (22,400 ac-ft per year capacity) (20,930 ac-ft per year demand identified)

Project name:	Sand City Desalination Project (SCDP)
Proponent(s):	Monterey Peninsula Water Management District
Location:	The desalination plant would be constructed at one of three potential sites within the City of Sand City. Seawater collection wells would be in the City of Sand City and on the property of the former Fort Ord. Brine disposal would be through the Monterey Regional Water Pollution Control Agency outfall north of Marina.
Purpose:	To assist CAW in developing a legal water supply to meet the provisions of the State Water Resources Control Board Order No. 95-10, and to offset a portion of the Seaside Groundwater Basin overdraft.
Production volume:	7.5 mgd (8,400 ac-ft per year)

Project name:	Seawater Desalination Vessel (SDV)
Proponent(s):	Water Standard Company (WSC)
Location:	The seawater desalination vessel would be anchored in Monterey Bay, likely less than five miles from shore. Seawater would be treated on the vessel and delivered to CAW, and potentially to other customers as well. Brine disposal would be made at the vessel.
Purpose:	To provide water to satisfy a range of potable water demands in the Monterey Peninsula area and Northern Monterey County.
Production volume:	10 to 20 mgd (11,200 to 22,400 ac-ft per year) expandable up to 85,000 ac-ft per year

Project Function

A primary purpose of all four projects is to resolve the issues associated with SWRCB Order No. 95-10 and the overdraft of the Seaside Groundwater Basin. In addition to resolving these two issues, the Regional CWP and the MBRSDP would provide solutions to regional water supply issues.

Each of the projects has primarily identified customers within CAW's service area due to the implications of SWRCB Order No. 95-10. In addition, the Regional CWP, the MBRSDP, and the SDV have identified potential customers to the north. The only commitment by these northern customers would be for the MBRSDP in the P/SMCSD service area.

The proposed technology for the seawater intake and brine discharge for the four projects varies. The primary difference is the proposal to use wells for feed water at the SCDP compared to ocean intakes for the CWP and the MBRSDP. Wells may avoid significant pretreatment and its associated cost. A great deal of information on the appropriate seawater desalination technology will be obtained during the proposed pilot plant testing for the CWP and the MBRSDP. Water intake for the SDV would be below the level that light penetrates (i.e., below the photic zone) to decrease impact to organisms.

Brine discharge for the CWP would be via the MLPP outfall. For the MBRSDP, the primary option for brine discharge is the National Refractories and Minerals Corporation (National Refractories) outfall, with the MLPP outfall as an alternative. Technically, either of these discharge options may be possible; however, additional studies are needed to determine the National Refractories outfall's structural integrity and the fate of the brine if discharged at this location. Brine discharge for the SCDP would be via horizontal directionally drilled (HDD) wells along the coastline north of Sand City in former Fort Ord, or via the Monterey Regional Water Pollution Control Agency (MRWPCA) outfall as an alternative. Additional technical studies would be needed to determine if brine discharge to HDD wells is feasible and if seasonal storage is needed if the outfall is utilized. The SDV would discharge brine through diffusers into the open ocean.

The biggest issues with the waste stream fate are institutional constraints. There are long-term issues associated with one-pass power plant discharges to the ocean (also known as once-through cooling) and the impact of concentrated seawater brine discharge to the ocean. These issues will need to be resolved for any project that moves forward.

CWP proponents have produced the most comprehensive supporting documentation of the four projects. The CWP is the only project for which an environmental document beyond the draft level has been completed. A document known as the Proponents Environmental Assessment (PEA) was completed for the CWP in accordance with California Public Utilities Commission (CPUC) regulations. An administrative Draft Environmental Impact Report has been prepared for the SCDP in accordance with the California Environmental Quality Act (CEQA), and the CPUC is currently preparing a Draft EIR for the CWP. CEQA documents have not been initiated for either the MBRSDP or the SDV. The CWP has a number of site-specific studies that appear to have been useful in the preparation of its supporting construction cost information and provide a solid foundation for any future design work.

The CWP and the MBRSDP have the most comprehensive information for pilot plant work. Permits are in place for the CWP pilot plant, and plant construction has begun at the Moss Landing Power Plant. The MBRSDP project proponents are in the process of obtaining the necessary permits to construct and operate the pilot plant at the former National Refractories site. The MBRSDP is the only one of the three land-based projects for which an agreement or rights to the land have been secured for their proposed full-scale desalination plant.

The SCDP has been developed conceptually but has not yet concluded on the location of the desalination plant facility or determined a treated water pipeline alignment. Additional technical work on the use of the MRWPCA outfall is needed to determine an appropriate seawater intake method and to quantify seasonal storage requirements.

The SDV is a completely self-contained seawater desalination treatment plant installed on a ship. Electrical energy and propulsion will be provided by gas turbine engines fueled with bunker fuel or biodiesel. A seabed intake or outfall is not needed for the alternative. A seabed pipeline is proposed to bring product water to the shore. Alternately, water produced on the ship would be shuttled to shore via barges. Facilities required for distribution of the water to customers on-shore need to be developed but it is assumed that they would be similar to other alternatives.

Projected Performance

Several potential water quality issues were identified for the CWP in its Conceptual Design Report (CDR).[1] One issue is the formation of significant chlorinated disinfection by-products (DBPs). DBPs could result from the reaction of total organic carbon (TOC) in the

[1] RBF Consulting, September 16, 2005

MLPP Units 6 & 7 intake with the proposed amount of free chlorine and a combined 21 minutes of contact time in the coagulation and flocculation processes.

Other concerns of the B-E evaluation team regarding the CWP are the allocation of the physical pathogen removal credits, identification of a target for total dissolved solids (TDS), and the possible presence of synthetic organic chemicals (SOCs) in Moss Landing Harbor. The CWP CDR does not specify how the physical pathogen removal credits for *Giardia*, *Cryptosporidium*, and viruses will be allocated throughout the treatment process by the State of California Department of Health Services (CDHS) nor does it identify a target for TDS. All of these issues warrant more detailed planning as the CWP enters the pilot stage.

Areas of concern to the B-E evaluators for the MBRSDP are the information gaps provided by the MBRSDP CDR[2] regarding the allocation of physical pathogen removal credits, pesticides and agricultural runoff, and the use of chloramines to comply with CDHS disinfection requirements. However, the CDR does note that formation of DBPs would not be a concern due to the low TOC levels compared with CWP TOC levels.

In addition to the information gaps, the most significant water quality concerns identified by the B-E evaluators associated with the MBRSDP involve the diverse systems owned by the Pajaro/Sunny Mesa Community Services District (P/SMCSD). The MBRSDP CDR indicates that the water produced by the plant is compatible with the water in the P/SMCSD's distribution system. With customers not yet identified and a variety of disparate water qualities among the systems owned by the P/SMCSD, however, this claim cannot be substantiated. If the water quality is moderately different, it may be infeasible to treat the desalinated water to match that of the receiving water of each system. Moreover, additional pipe loop and/or coupon testing[3] may need to be conducted for the piping in each receiving system.

A major area of concern to the B-E evaluators for the SCDP is the occasional non-point source pollution, which could potentially cause the beach wells to become infiltrated with enteric viruses, SOCs, pharmaceutical residuals, and/or endocrine disruptors. Because there are no test wells constructed at this stage of project development, the potential for such contamination cannot be accurately assessed. However, the acknowledgement and awareness of this possible contamination is important at this early stage of project development.

[2] P/SMCSD in cooperation with Poseidon Resources Corporation, April 2006.

[3] Pipe loop and coupon testing are used to determine the corrosion potential of the material by exposing a sample of the pipe or pipe material to the water. Highly purified water can be very corrosive to some pipe materials.

No water quality concerns were identified by the SDV project proponents. The proponents assert that the impacts on marine life are minimized because the multiple depth intake system takes water beneath the primary plankton and phytoplankton habitat. Brine is mixed with seawater in chambers on board the vessel to cool the brine and dilute the salinity. The brine is discharged through diffusers near the water surface.

Economics

The four projects are in various stages of development. The CWP and the SCDP are at a conceptual or preliminary level, but the CWP is more developed. More work on resolving site-specific technical issues for the CWP has been performed; therefore, a more complete assessment of the associated construction costs has been made. Construction costs for the SCDP were estimated based on potential alignments due to the fact that the SCDP does not have a preferred treatment plant site or preferred pipeline alignment. The MBRSDP estimate is at a screening level of development. Construction cost estimates are apparently developed from projects of similar nature. The SDV proposal claims use of proven off-the-shelf technologies, and includes construction bids for some of the principal components. No comparable ship-based desalination facilities of this size have been constructed, so full-scale construction and life-cycle costs have not been established. The breakdowns of costs for the four projects are provided in Section 5.

Assumptions for connecting into the CAW distribution system are inconsistent among the alternatives. In particular, the need for storage or additional supplies to meet peak day demands is absent from the proposals except for CWP options that include an ASR component. Without regulatory storage, either peak day demands will not be met or the full annual capacity will not be achieved. Lack of a specific provision for regulatory storage may overstate the annual yield of an alternative and thus understate its unit cost.

The estimated capital cost for the CWP, without the aquifer storage and recovery (ASR) component, is $186M (2007 dollars) and the total operation and maintenance (O&M) cost with membrane replacement is $8.19M per year. Including the ASR component, the estimated capital cost is $210M and the total O&M cost is $8.84M per year. Long-term financing for the capital investment required to implement the CWP has not been secured by CAW, but it is clear that the company has an avenue to secure such financing when required (see section 5.1 of this report). The California Public Utilities Commission has approved interim rates to enable recovery of certain CAW pre-construction costs for the CWP.

Poseidon Resources Corporation estimates indicate that the total capital cost for the MBRSDP is $165M (2007 dollars) and the total O&M cost is $16.9M per year. The desalination component values used for the estimate were derived from quotes received on other projects with substantially similar equipment, albeit different size. Poseidon can potentially become the lead entity responsible for the project financing. It is a United States corporation whose largest shareholder is Warburg Pincus, an international investment firm. With Warburg Pincus, it appears that Poseidon has extensive private equity financing

resources if obligated to obtain private financing for the proposed MBRSDP in-lieu of the P/SMCSD not pursuing municipal bond financing.

The report titled "Monterey Peninsula Water Supply Project, Phase 2 Technical Memorandum, Project Facilities Alternatives for the Sand City Desalination Project, 7.5 million gallons/day (8,400 acre-feet/year)"[4] provides a desalination plant cost component of $29M (2007 dollars). This cost is a reasonable value for the SCDP and 25 percent contingency is appropriate, considering the level of estimate provided. Total capital costs range from $185M to $200M. A financing plan for the SCDP by the MPWMD has not been developed. However, two prior water supply projects proposed by MPWMD provide examples of potential financing avenues to be taken if the SCDP is formalized (see section 5.3 of this report).

The SDV proponent has provided information indicating that capital cost of the SDV, completely fitted for operation, and two water barges would be $189M. A seabed pipeline alternative was estimated at $131M. These estimates have been updated several times over the past year. Implementation and project-scale contingency costs are low or were excluded from proponent's estimates. The seabed pipeline alternative capital cost would total an estimated $166M when appropriate implementation and contingency costs are added. O&M costs were $11.1M per year based on a subsidized biodiesel fuel cost of $0.048/KWh[5]; however, the fuel costs could range up to $0.093/KWh. Proponent's conceptual cost estimate for an 18 mgd[6] seabed pipeline and connection to the CAW system is $45,370,000. Partial financing may be available from the project proponents[7].

For the land-based desalination projects, the capital cost estimates were based on preliminary-level design, which warrants a larger contingency than employed in the CWP and MBRSDP estimates. A 10 to 15 percent greater contingency is recommended on those projects. The O&M cost estimates of these projects were generally considered reasonable, with the exception of SCDP, which indicated substantially higher energy consumption for the reverse osmosis (RO) process than currently anticipated for high-efficiency designs.

The following table summarizes the projects' current cost status. The costs have been refined by the B-E team to make them more comparable (2007 cost levels, overheads, contingencies, etc.). Of particular note is the cost per acre-ft for the CWP Regional Project, the MBRSDP, and SDV being within 10 percent of each other. Given some of the unknown

[4] Camp Dresser & McKee Inc., June 23, 2004

[5] Other documents provided by proponents show a minimum cost of $0.052/KWh.

[6] Though earlier proponent documents describe a proposed 20 mgd ship-based desalination project, the more recent estimates to bring the product water to shore describe an 18 mgd system.

[7] Proponent's comments on draft GEI/B-E report state "WSC is prepared to fully fund the construction of a vessel without support and sell a unit cost of water. WSC has the financing capability to do this."

cost elements as described in Section 5, the 10 percent represents a very small difference.[8] The CWP Basic Project's per-acre-ft costs would be expected to be higher than those of the CWP Regional Project alternative due to the diseconomy of small scale.

Table ES-1 – Summary of Desalination Project Capacities and Estimated Costs

2007 Costs for Desalination Projects
with standard overhead and contingency allowance, excluding land and pilot testing
(millions of 2007 dollars)

	Coastal Water Project				Monterey Bay Regional Seawater Desalination Project[\1]	Sand City Desalination Project		Seawater Desalination Vessel[\2]	
	Desal Only		Desal + ASR						
	Proposed Project	Regional Project	Proposed Project	Regional Project		Low range	High Range	Subsidized Fuel	Un-Subsidized Fuel
RO Capacity (mgd)	10	18	10	18	20	7.5	7.5	18	18
(total af/yr)	*10,430*	*18,970*	*11,730*	*20,270*	*22,420*	*8,410*	*8,410*	*20,180*	*20,180*
Desalination Facilities	**$90.29**	**$120.29**	**$90.29**	**$120.29**	**$108.47**	**$71.05**	**$79.95**	**$88.38**	**$88.38**
($/mgd)	*$9.03*	*$6.68*	*$9.03*	*$6.68*	*$5.42*	*$9.47*	*$10.66*	*$4.91*	*$4.91*
Seawater feed and brine disposal (incl. SCV ship cost)	$6.67	$6.21	$6.67	$6.21		$41.71	$50.61	$47.10	$47.10
Residuals handling and treatment	$1.30	$1.39	$1.30	$1.39		$0.00	$0.00		
Desalination process	$82.31	$112.68	$82.31	$112.68		$29.34	$29.34	$41.29	$41.29
Finished water storage & pumping facilities						$0.00	$0.00		
Desalinated Water Pipelines	**$24.20**	**$35.66**	**$24.20**	**$35.66**	**$28.28**	**$13.18**	**$13.18**	**$31.37**	**$31.37**
Electrical Transmission Upgrades						**$1.04**	**$1.04**		
Terminal Reservoir and ASR Pump Station	**$5.76**	**$8.92**	**$5.76**	**$8.92**					
Segunda/ ASR System			**$15.06**	**$9.54**					
Field Office Overhead *(8%)*						**$6.82**	**$7.53**		
Contractor Mark-Ups *(16.25%)*						**$14.96**	**$16.53**		
Total Construction Costs	**$120.25**	**$164.86**	**$135.30**	**$174.39**	**$136.75**	**$107.05**	**$118.23**	**$119.76**	**$119.76**
Engineering, Overhead, Legal	**$28.86**	**$39.57**	**$32.47**	**$41.85**	**$32.82**	**$40.14**	**$44.34**	**$28.74**	**$28.74**
	24.0%	*24.0%*	*24.0%*	*24.0%*	*24.0%*	*30.0%*	*30.0%*	*24.0%*	*24.0%*
Contingency	**$37.28**	**$51.11**	**$41.94**	**$54.06**	**$42.39**	**$26.76**	**$29.56**	**$37.12**	**$37.12**
	25.0%	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*
Total Capital Costs	**$186.38**	**$255.53**	**$209.72**	**$270.31**	**$211.97**	**$173.96**	**$192.12**	**$185.62**	**$185.62**
Operations and Maintenance *($M/yr)*									
Desalination Facilities/Power	$6.25	$10.12	$6.25	$10.12		$5.90	$5.90		
Desalination Water Conveyance	$0.42	$0.95	$0.42	$0.95		$1.54	$1.89		
Terminal Reservoir/ASR Pump Station	$0.07	$0.33	$0.07	$0.33					
Segunda/ ASR System	$0.00	$0.00	$0.65	$0.13					
Subtotal O&M Costs	**$6.74**	**$11.40**	**$7.39**	**$11.53**		**$7.44**	**$7.79**		
Repairs and Replacements	**$1.45**	$0.00	**$1.45**	$0.00		$1.30	$1.30		
Total O&M *($M/yr)*	**$8.19**	**$11.40**	**$8.84**	**$11.53**	**$16.90**	**$8.74**	**$9.09**	**$16.26**	**$20.85**
($/af)	*$730*	*$560*	*$790*	*$570*	*$750*	*$1,040*	*$1,080*	*$810*	*$1,030*
Total Annualized Cost (7%, 30 yrs) *($M/yr)*	$23.21	$31.99	$25.74	$33.31	$33.98	$22.76	$24.57	$31.22	$35.81
Unit Cost *($/af)*	*$2,230*	*$1,690*	*$2,190*	*$1,640*	*$1,520*	*$2,710*	*$2,920*	*$1,550*	*$1,770*

Notes:
\1 MBRSDP is currently described as a 20 mgd (22,420 af/yr) facility; 20,930 af/yr of demand has been identified, which increases unit cost to $1,620/af. Cost detail is subject to a confidentiality agreement.
\2 20 mgd is proposed for SCV, but proponents provided conveyance for 18 mgd. 24% overhead used -- proponents estimate 16.1%. 25% contingency used -- proponents estimate 24%. Cost detail is subject to a confidentiality agreement.

[8] Costs for elements of both the MBRSDP and the SDV appear to be underestimated by approximately 10 percent

Regional Water Supply Considerations

The CWP is proposed to serve the CAW territories on the Monterey Peninsula (formally known as CAW's "Monterey District") and adjacent areas. It would provide enough desalinated water to comply with SWRCB Order No. 95-10 and to offset 1,000 ac-ft per year of the overdraft of the Seaside Groundwater Basin. An option is under consideration to upsize to the Regional CWP to allow for future increased deliveries to the Monterey Peninsula and to supply water to the Marina Coast Water District, Moss Landing, Castroville, and Northern Monterey County.

The MBRSDP is proposed to serve the Monterey Peninsula, Northern Monterey County, P/SMCSD service areas, and portions of the Pajaro Valley Water Management Agency. Contemplated major distribution system serving areas north, east, and west of the National Refractories treatment plant site could be added incrementally in the future.

The SCDP is intended to serve only the CAW Monterey District territories and may only partially offset SWRCB Order No. 95-10 reductions and the overdraft of the Seaside Groundwater Basin. The project should be capable of expansion, provided additional planning is performed.

The SDV is intended to serve the Monterey Peninsula plus areas to the north. The SDV can be outfitted to produce up to 85,000 ac-ft per year and provide water throughout the region.

Implementability

Mitigating impingement and entrainment impacts from seawater intake is a major issue for the CWP and the MBRSDP. The proposed CWP desalination plant would not have a separate direct ocean water intake. It would instead receive raw seawater from the MLPP once-through cooling (OTC) water return system. Water withdrawn from MLPP would not alter the operations of the MLPP nor would it change the volume and velocity of water entering the MLPP intakes. Also, the implementation of the desalination facility would not alter the potential impacts associated with operation of the MLPP. Therefore, as long as the MLPP is permitted to continue operating with OTC technology, the CWP would not have any adverse impacts on the aquatic resources of the associated marine environment.

The proposed water intake for the MBRSDP would be from one of two sources: (1) direct pumping from the Monterey Bay via the existing National Refractories intake, and/or (2) the cooling water from Units 6 and 7 at the MLPP. For the full-scale MBRSDP facility, the heated water from the MLPP is the preferred source. No evidence was found to indicate that the cooling water system operations would result in an adverse impact on the populations of fish and invertebrates inhabiting Moss Landing Harbor, Elkhorn Slough, and Monterey Bay. Assessment of potential impacts of operating the National Refractories outfall could not be conducted due to damage to the outfall.

The SCDP would include either an array of horizontal directionally drilled or radial collector wells for seawater collection located along the coastal beachfront of Sand City. Because the intake for the seawater is below the sea floor, it is assumed that no potential impacts from impingement or entrainment would result from seawater withdrawal. However, additional studies are needed to determine the technical feasibility of such a system.

Marine vessels operate under unique regulations and legislation that require direct knowledge of international maritime organizations. Conducting business in the maritime environment would require the SDV project operator to have expertise so that exposure to unforeseen risks, such as vessel operation, safety failures, and fuel spills, can be minimized. Purchasing of vessels, classification, and maintenance of ocean structures require specialized experience.

Schedules for the MBRSDP and SDV are similar, with the target of delivering water by 2010. Recent information from CAW indicates a project completion date of 2012. The SCDP currently does not have an updated schedule.

All three terrestrially based projects would have similar permitting requirements. Little activity has been done in this area. Primarily, permitting activities for the CWP and MBRSDP have focused on their respective pilot plants. CAW has secured permits from Monterey County and the California Coastal Commission for the CWP pilot plant, and construction of the pilot plant is currently underway on the Moss Landing Power Plant site. P/SMCSD has filed applications but to date has not obtained the necessary permits for the MBRSDP pilot plant at the former National Refractories site.

1 Introduction

GEI Consultants, Inc., Bookman-Edmonston Division, along with sub-consultants Malcolm Pirnie, Inc. and Separation Processes, Inc., (collectively, the B-E team) is providing engineering support to the Monterey Peninsula Water Management District (MPWMD) to review and evaluate four seawater desalination projects that have been proposed for the Monterey Peninsula. The four projects, their respective sponsors, and proposed locations are as follows:

1. California American Water (CAW) – Coastal Water Project (CWP) – the proposed project includes a 10 million gallon per day (mgd) desalination plant located at the Moss Landing Power Plant (MLPP) in Moss Landing. This project includes an aquifer storage and recovery (ASR) component in the Seaside Groundwater Basin.

2. Pajaro/Sunny Mesa Community Services District (P/SMCSD) in cooperation with Poseidon Resources Corporation (Poseidon) – Monterey Bay Regional Seawater Desalination Project (MBRSDP) – proposed 20 mgd plant located at the former National Refractories and Minerals Corporation (National Refractories) plant site in Moss Landing.

3. MPWMD – 7.5 mgd Sand City Desalination Project (SCDP) – proposed plant location is one of three sites in Sand City.

4. Water Standard Company (WSC) – Seawater Desalination Vessel (SDV) is proposed to be anchored five miles from shore. The desalination plant capacity is proposed to range from 10 to 20 mgd.

The B-E team has been retained by MPWMD to provide an independent, unbiased, third-party assessment of four proposed desalination projects and to make recommendations on each project's technical merit, completeness, and readiness to proceed. This assessment can be used in support of the MPWMD Board's possible determination of the best project or projects to support.

The MPWMD is responsible for integrated management of the water resources on the Monterey Peninsula, Seaside Basin, and Carmel River drainage. CAW is an investor-owned public utility responsible for providing water service to a majority of the residents within the MPWMD. A substantial portion of CAW's water supply is pumped from wells along the Carmel River. In 1995, the SWRCB, in its Order No. 95-10, determined that water in the Carmel Valley alluvial aquifer is considered to be a subterranean stream flowing in a known and definite channel rather than percolating groundwater, and that CAW had been diverting an average of 10,730 ac-ft per year from the Carmel River system in excess of its valid right of 3,376 ac-ft per year. The SWRCB directed that CAW obtain a supplemental or alternative

supply to meet system water demands that are in excess of CAW's valid Carmel River right plus what CAW can produce from the Seaside Groundwater Basin. In a 2006 court order directing adjudication of the Seaside Groundwater Basin, it was determined that CAW has an interim right to 3,505 ac-ft per year from that source. This right will be further reduced to 1,494 ac-ft per year over the 13-year period starting in 2009. Thus CAW will ultimately have valid rights to 4,870 ac-ft per year from these two sources. Water needs in excess of this amount must be supplied from supplemental or alternative sources.

2 Project Summaries

The following project summaries provide key information for each of the projects. Each summary includes:

- Project name
- Proponent(s)
- Location
- Purpose
- Production volume
- Key features
- Facility map
- Key information provided to review team
- Persons interviewed

The four projects are distinctly dissimilar and are at various stages of development. Each of the projects has identified a unique location, although the CWP and MBRSDP have adjacent proposed locations in Moss Landing at the MLPP and NMRC site, respectively. Similarly, the proposed treated water pipeline alignment from the proposed desalination plants to the southern users differ, although the CWP and MBRSDP alignments have similar elements.

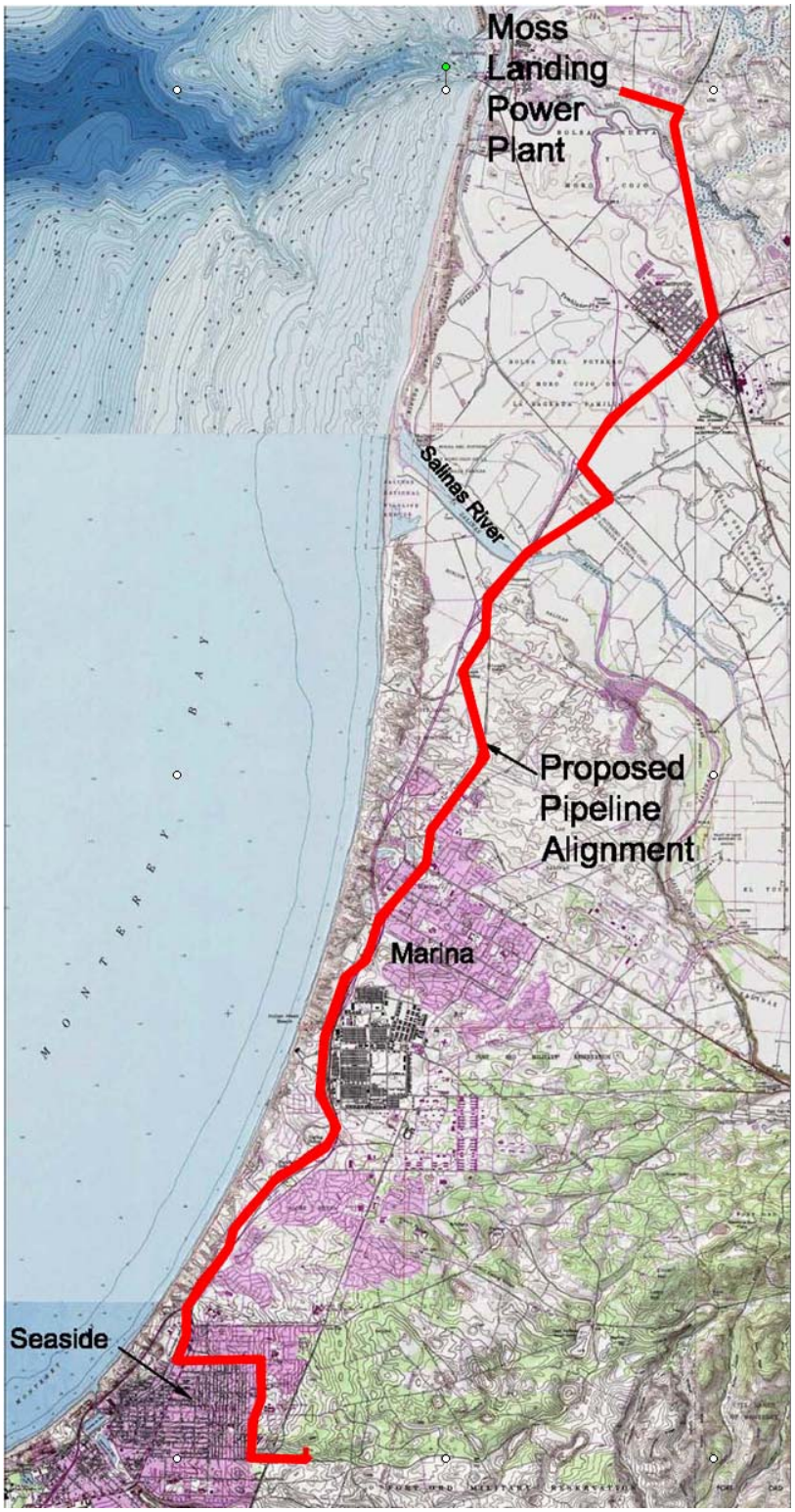
Each of the three terrestrially based proposed desalination plant treatment capacities is different. These differences are due primarily to differing project purposes. The CWP is proposed by CAW as the Basic CWP, with the intent to address SWRCB Order No. 95-10 and a portion of the Seaside Groundwater Basin overdraft. However, the Regional CWP alternative has capacities and intended users similar to the MBRSDP.

2.1 Coastal Water Project (CAW)

Project name:	Coastal Water Project (CWP)
Proponent(s):	California American Water (CAW)
Location:	Moss Landing Power Plant, Moss Landing
Purpose:	Primarily (Basic Coastal Water Project), to comply with State of California Water Resources Control Board Order No. 95-10 by replacing the Carmel River shortfall, and to offset a portion of the Seaside Groundwater Basin overdraft. Alternatively (Regional Coastal Water Project), as a regional water supply project to meet the Monterey Peninsula build-out water demands; the water needs of the Marina Coast Water District; and the water needs of Moss Landing, Castroville, and Northern Monterey County. The project is currently progressing as the Basic Coastal Water Project
Production volume:	Basic Coastal Water Project: 11,730 ac-ft per year Seawater desalination plant: 10,430 ac-ft per year (10mgd) Aquifer storage and recovery: 1,300 ac-ft per year Regional Coastal Water Project: 20,272 ac-ft per year Seawater desalination plant: 18,972 ac-ft per year (18 mgd) Aquifer storage and recovery: 1,300 ac-ft per year
Key features:	1. Raw water pipeline will be used to transfer seawater from the Moss Landing Power Plant cooling water discharge stream to the desalination plant site proper. 2. Return water discharge will return concentrated seawater brine back to the Moss Landing Power Plant cooling water discharge stream. 3. Equalization basin will receive and store the incoming raw water. 4. Raw water pumping station will convey seawater from the equalization basin to a pre-filtration process. 5. Raw water pretreatment process 6. Reverse osmosis (RO) process 7. Post-treatment process 8. Treated water storage 9. Treated water pumping station 10. Treated water pipeline 11. ASR operation expected to be operational by winter 2008 / 2009 and the full desalination plant operational by late 2010.
Key Information provided to review team:	1. Coastal Water Project Conceptual Design Report California American Water – September 2005 2. Proponents Environmental Assessment for the Coastal Water Project – July 2005
Persons interviewed:	1. Sarah Hardgrave, RBF Consulting 2. John C. Klein, CAW

Figure 1 shows the MLPP site and the proposed pipeline alignment.

Figure 1 – Coastal Water Project Location Map

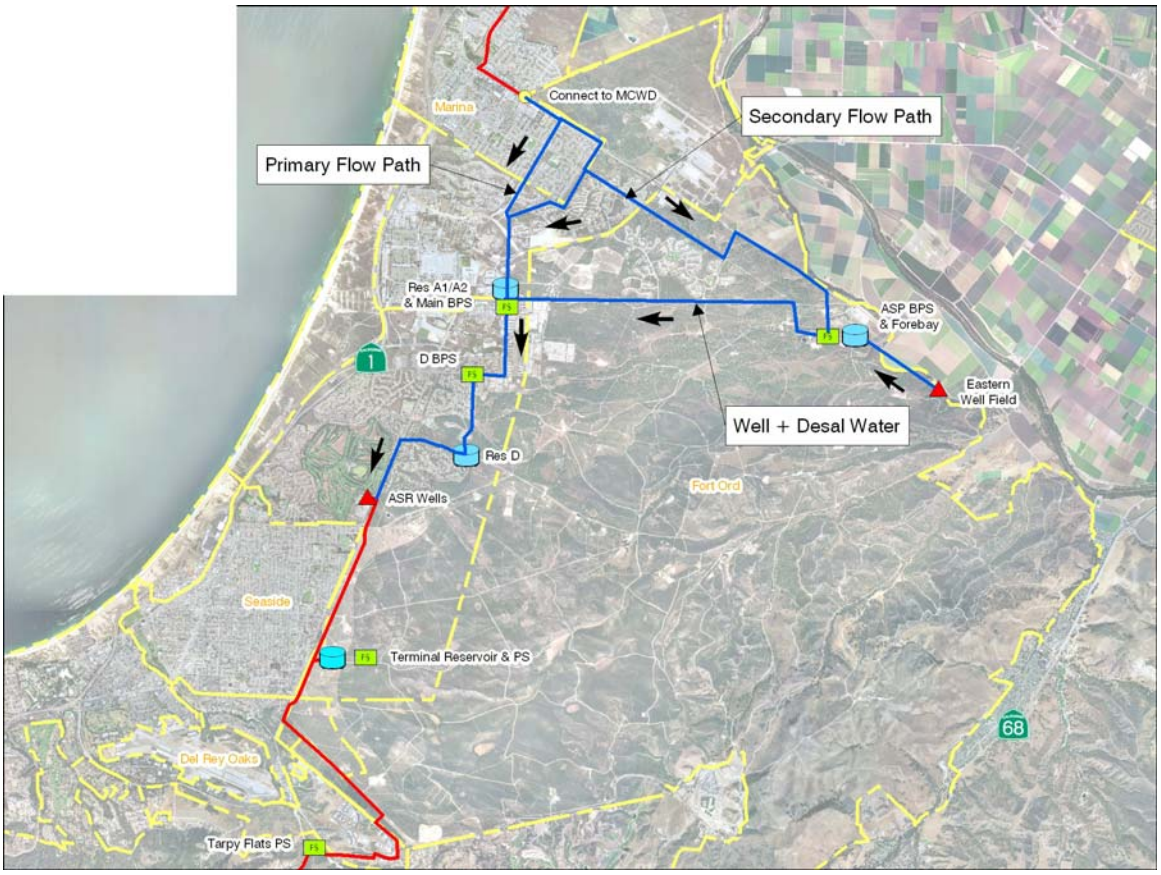


Coastal Water Project, Conceptual Design Report (Draft), September 16, 2005

Potential Shared Distribution Facilities with Marina Coast Water District

Representatives of CAW and the Marina Coast Water District (MCWD) have discussed the potential for sharing major distribution system facilities (pipelines, booster pumps, valves, etc.) for the portion of the CWP delivery system between the desalination plant to the CAW service area that runs through the MCWD service area (City of Marina and adjacent areas, and the former Fort Ord Military Reservation) (see Figure 2). The purposes of the shared facilities are to reduce costs to both service areas and to allow an interconnection that would allow water from one system to be provided to the other in case of an emergency. No firm estimate of potential cost savings is available, and potential institutional arrangements among CAW, MCWD, and regulatory agencies have not been addressed.

Figure 2 - Potential CAW/MCWD Shared Facilities

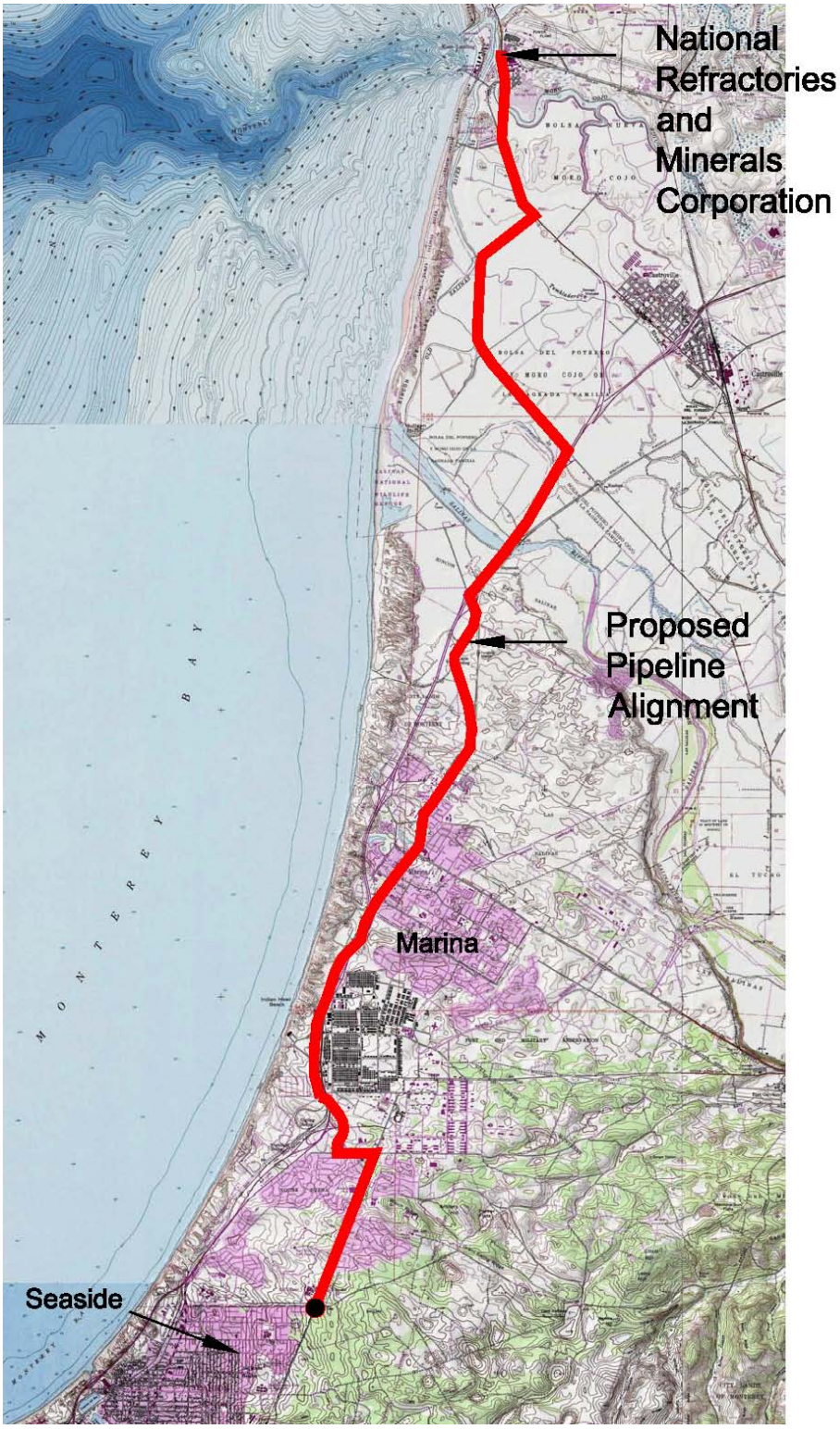


2.2 Monterey Bay Regional Seawater Desalination Project (P/SMCSD)

Project name:	Monterey Bay Regional Desalination Project (MBRSDP)
Proponent(s):	Pajaro/Sunny Mesa Community Services District in cooperation with Poseidon Resources Corporation
Location:	The former National Refractories and Minerals Corporation plant site, Moss Landing
Purpose:	To replace and augment existing water supplies serving the Monterey Peninsula, certain areas of northern Monterey County, the service area of the Pajaro/Sunny Mesa Community Services District and portions of the Pajaro Valley Water Management Agency service area.
Production volume:	20 mgd (22,400 ac-ft per year capacity) (20,930 ac-ft/ year demand identified)
Key features:	1. Pump station and raw water pipeline that will be used to transfer seawater from the Moss Landing Power Plant cooling water discharge stream and/or from the existing seawater intake at the National Refractories site to the desalination plant site proper. 2. Return water discharge that will return concentrated seawater brine to the National Refractories Ocean Outfall. 3. Source water fine screens, which will be 3/8-inch or smaller opening mechanical screens, to prevent debris from entering the desalination plant treatment facilities. 4. Sedimentation basins that will provide initial clarification. 5. Pre-treatment filters consisting of either granular media filtration or micro-screening and membrane filtration. 6. Reverse osmosis (RO) process 7. Post-treatment process 8. Treated water storage 9. Treated water pumping station 10. Treated water pipeline
Information provided to review team:	1. Monterey Bay Regional Desalination Project, Conceptual Design Report – April 2006 2. Monterey Bay Regional Desalination Project, Report of Waste Discharge – March 2006 3. Monterey Bay Regional Desalination Project, Report of Waste Discharge Application for Renewal NPDES Permit CA 0007005, National Refractories Ocean Outfall – November 1, 2005 4. Monterey Bay Regional Seawater Desalination Pilot Project – Proposition 50 Grant Application – March 22, 2006 5. Monterey Peninsula Water Management District Comparative Matrix of Water Supply Projects – September 8, 2005
Persons interviewed:	1. Peter MacLaggan, Poseidon Resources Corporation

Figure 3 shows the National Refractories site and the proposed pipeline alignment.

Figure 3 – Monterey Bay Regional Seawater Desalination Project Location Map



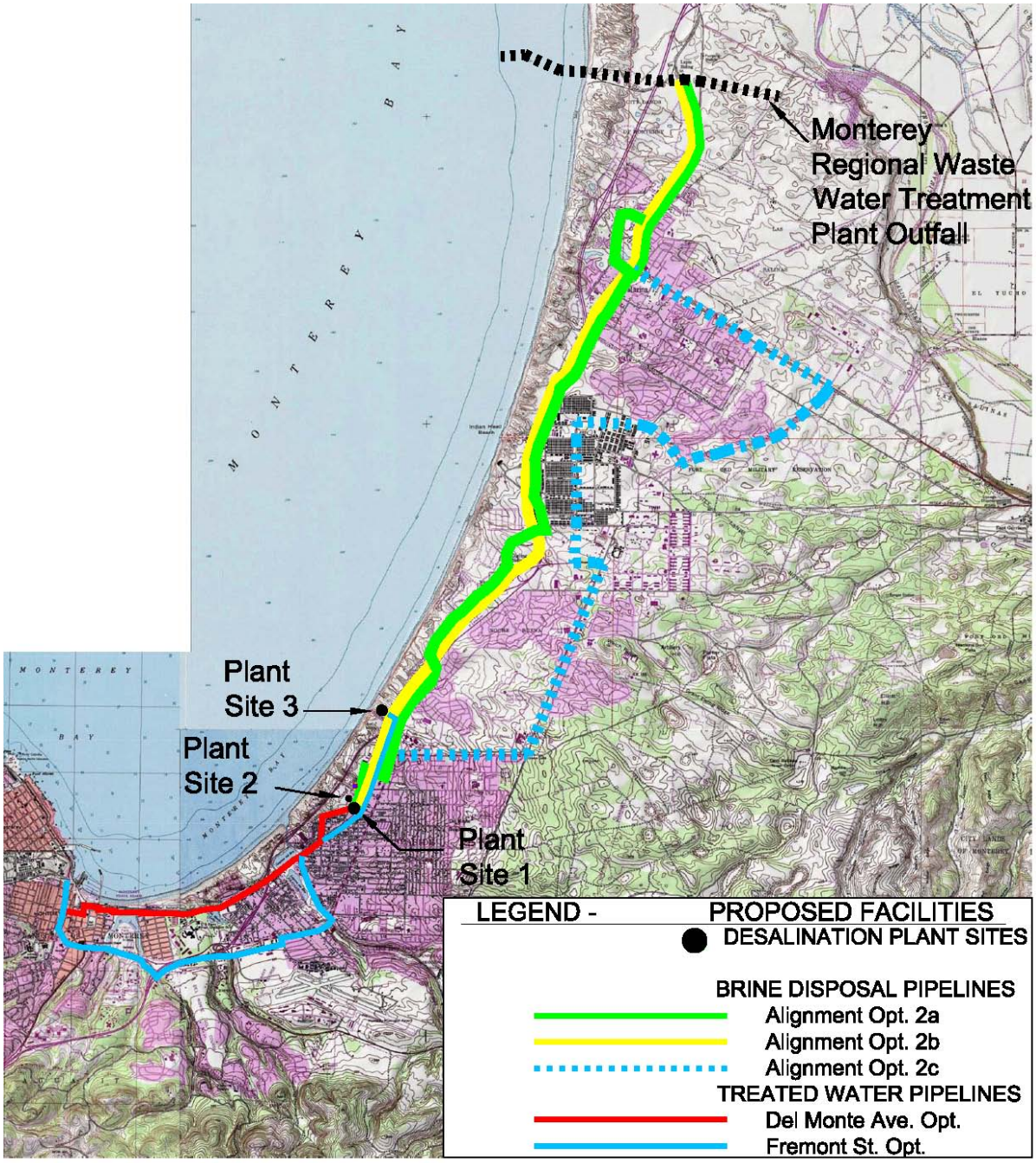
Pajaro Sunny Mesa Community District, Monterey County, California: Proposed Transmission Pipeline Alignment, July 2004

2.3 Sand City Desalination Project (MPWMD)

Project name:	Sand City Desalination Project
Proponent(s):	Monterey Peninsula Water Management District
Location:	The desalination plant would be constructed at one of three potential sites within the City of Sand City. Seawater collection wells would be located within the City of Sand City and on former Fort Ord lands. Brine disposal would be through beach wells (radial wells and/or horizontal directionally drilled wells) in former Fort Ord or via the Monterey Regional Water Pollution Control Agency outfall north of Marina.
Purpose:	To assist CAW with development of a legal water supply to meet the provisions of the State Water Resources Control Board Order No. 95-10, and to offset a portion of the Seaside Groundwater Basin overdraft.
Production volume:	8,400 ac-ft per year (7.5 mgd)
Key features:	1. Seawater collection through horizontal directionally drilled (HDD) wells and/or radial wells located along the beach in Sand City and the former Fort Ord. 2. Seawater collection manifold pipeline through city streets. 3. Return water discharge will return concentrated seawater brine to the ocean via beach wells or the Monterey Regional Water Pollution Control Agency outfall north of Marina. 4. Reverse osmosis (RO) process 5. Post-treatment process 6. Treated water storage 7. Treated water pumping station 8. Treated water pipeline
Information provided to review team:	1. Monterey Peninsula Water Supply Project Alternatives (Phase 1 Technical Memorandum) – March 2003 2. Monterey Peninsula Water Supply Project Phase 2 Technical Memorandum – October 2003 3. MPWMD Water Supply Project, Board Review Draft Environmental Impact Report – December 2003 4. Sand City Desalination Project Feasibility Study – April 16, 2004
Persons interviewed:	1. Andrew Bell, MPWMD 2. Joseph Oliver, MPWMD 3. Craig Von Bargen, Camp Dresser & McKee, Inc.

Figure 4 shows the potential treatment plant sites and potential treated and brine discharge pipeline alignments.

Figure 4 – Sand City Desalination Project Location Map



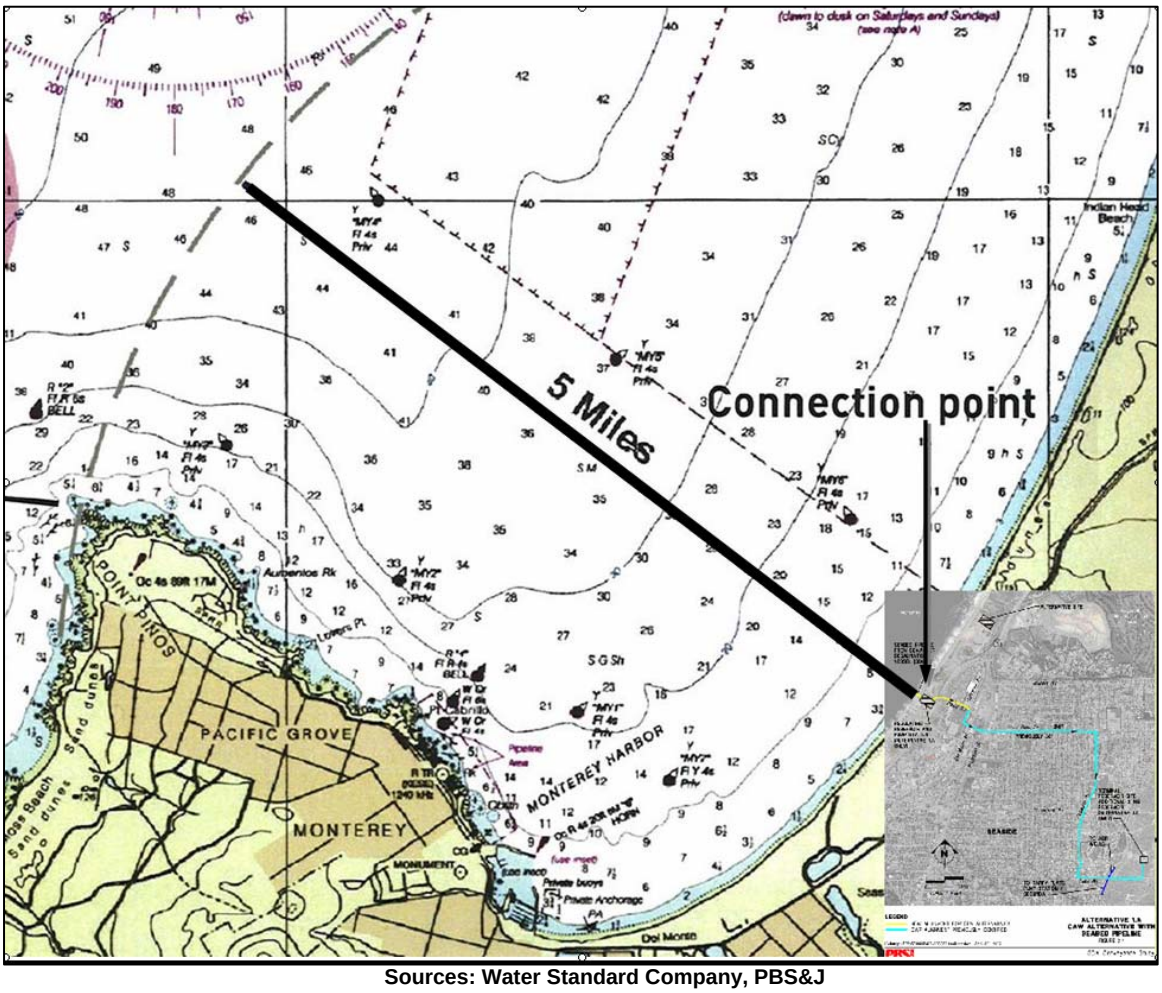
Monterey Peninsula Water Management District Water Supply Project, Board Review Draft Environmental Impact Report, December 2003

2.4 Seawater Desalination Vessel (Water Standard Company)

Project name:	Seawater Desalination Vessel
Proponent(s):	Water Standard Company
Location:	The seawater desalination vessel would be anchored in Monterey Bay, likely less than five miles from shore. Seawater would be treated on the vessel and delivered to CAW, and potentially to other customers as well. Brine disposal would be made at the vessel.
Purpose:	To provide water to satisfy a range of potable water demands in the Monterey Peninsula area and Northern Monterey County.
Production volume:	10 to 20 mgd (11,200 to 22,400 ac-ft per year) up to 85,000 ac-ft per year
Key features:	1. Microfiltration pretreatment system that is planned to extend RO membrane life 2. Potential use of biodiesel 3. Ship-based 4. Multiple depth intake system 5. Desalination facility 6. Post treatment facility 7. Gas turbines with steam cogeneration capability and catalytic emissions treatment 8. Brine discharge is diluted and made at water surface 9. Treated water transmitted by barges or seabed pipeline
Key Information provided to review team:	1. Proponent's statement and supporting material 2. Proponent's presentation to Metropolitan Water District of Southern California 3. Proponent's comments on GEI/B-E draft report and supporting materials
Persons interviewed:	1. Skip Griffin, PBS&J 2. Andrew Gordon, Water Standard Company 3. Amanda Brock, Water Standard Company 4. Paul Michel, Monterey Bay National Marine Sanctuary 5. Charles Lester, California Coastal Commission 6. Marsha McNutt, Monterey Bay Aquarium Research Institute 7. Mike Robinson, V-Ships

Figure 5 shows the potential location of the SDV and shore-based facilities. The final location for anchoring the vessel and the route for the treated-water seabed pipeline have not been determined.

Figure 5 – Seawater Desalination Vessel Project Location Map



Sources: Water Standard Company, PBS&J

3 Project Function

This section provides the following information for each project:

- Project purpose
- Customers identified
- Technology appropriate/demonstrated on this or similar supply
- Waste stream fate identified
- Availability of historic feedwater quality data and sanitary survey
- Quality of supporting documentation
- Supports regional MPWMD objectives
- Omissions or fatal flaws

A primary purpose of all four projects is to resolve the issues associated with SWRCB Order No. 95-10 and the overdraft of the Seaside Groundwater Basin. The Regional CWP and the MBRSDP would provide additional water supplies to meet regional water demand as well as resolve SWRCB Order No. 95-10 and Seaside Groundwater Basin overdraft issues.

Each of the projects has primarily identified customers within CAW's service area due to the requirements of SWRCB Order No. 95-10. In addition, the Regional CWP and the MBRSDP have identified water demands of potential customers on the Monterey Peninsula and in areas to the north. The only existing commitments by the MBRSDP are customers in the P/SMCSD service area.

The proposed technology for each of the projects varies as described in detail below. A major difference is the proposal to use wells for feed water at the SCDP compared to ocean intakes for the CWP and the MBRSDP. The ship-based intake and outfall of the SDV project is unique. A great deal of information on the appropriate seawater desalination technology will be obtained during the pilot plant testing scheduled for the CWP and the MBRSDP.

Brine discharge for the CWP would be via the MLPP outfall. For the MBRSDP, the primary option for brine discharge is the National Refractories outfall with the MLPP outfall as an alternative. Brine discharge for the SCDP would be via radial wells or horizontal directionally drilled wells along the coastline north of Sand City in former Fort Ord, or via the Monterey Regional Water Pollution Control Agency (MRWPCA) outfall as an alternative. Technically, all of these discharge options may be possible. However, additional studies are needed to determine the adequacy of the condition of the National Refractories outfall and the fate of the brine plume as it enters the receiving waters. Additional analyses

are needed to determine the adequacy of using horizontal directionally drilled wells for brine disposal.

An underwater video obtained on the National Refractories outfall shows that some of the joints have failed and many of the diffusers are clogged. Repairs can be made, however, and the outfall could be put back into service. Use of the MRWPCA outfall could be accomplished but additional studies will need to be done to determine how to manage seasonal flow variations.

The biggest issues with the waste stream fate are institutional constraints that are discussed in more detail in Section 7. There are long-term issues associated with one-pass or OTC power plants, ocean water cooling systems, and the impact of concentrated seawater brine discharges to the ocean environment.

CWP proponents have produced the most comprehensive supporting documentation of the four projects. The CWP is the only project for which an environmental document beyond the draft level has been completed. A document known as the Proponents Environmental Assessment (PEA) was completed for the CWP in accordance with California Public Utilities Commission (CPUC) regulations. An administrative Draft Environmental Impact Report (EIR) has been prepared for the SCDP in accordance with the California Environmental Quality Act (CEQA), and the CPUC is currently preparing a Draft EIR for the CWP. CEQA documents have not been initiated for either the MBRSDP or the SDV. The CWP has a number of site-specific studies that appear to have been useful in the preparation of its supporting construction cost information and provide a solid foundation for any future design work.

The MBRSDP has the most comprehensive information for its pilot plant. A permit for the pilot plant has been obtained from Monterey County, but an additional permit is required from the Coastal Commission. Once the Coastal Commission permit is obtained Pajaro/Sunny Mesa will be able to proceed with construction and testing. The MBRSDP is also the only one of the four projects that has an agreement for siting its proposed treatment plant.

The SCDP has been developed conceptually but has not yet determined the location of the desalination facility or treated water pipeline alignment. Additional technical work on the use of the MRWPCA outfall is also necessary to determine what seasonal storage requirements would be needed.

Information regarding the SDV was provided through a variety of documents mostly provided to the project team as confidential under a non-disclosure agreement. Price bids for ship purchase, retrofitting, and power generation were included. The information as a whole is considered preliminary, and has been updated several times by project proponents over the course of this study..

Table 1 presents a summary of project sizes, intake locations, and waste streams.

Table 1 – Intake and Waste Stream Comparison

Project Name	Coastal Water Project	Monterey Bay Regional Seawater Desalination Project	Sand City Desalination Project	Seawater Desalination Vessel
Production volume	10,430 ac-ft per year[1]	22,400 ac-ft per year	8,400 ac-ft per year[2]	22,400 ac-ft per year[3]
Production rate	10 mgd	20 mgd	7.5 mgd	20 mgd
Provides 10,730 ac-ft per year Order No. 95-10 replacement supply	Yes	Yes	No	Yes
Intake location	Moss Landing Power Plant discharge stream	Moss Landing Power Plant discharge stream and/or National Refractories outfall	Radial or HHD wells in Sand City and former Fort Ord	Up to five miles from shore on a vessel
Residual streams				
Brine	Moss Landing Power Plant disengagement basin thence to MLPP outfall	National Refractories outfall (alternative: MLPP outfall)	Radial or HHD wells in former Fort Ord (alternative: MRWPCA[4] outfall north of Marina)	Diluted with seawater and discharge to ocean surface
Pretreatment solids	Sanitary landfill	Sanitary landfill	None expected	None
Pretreatment sludge	Return Flow Pipeline	National Refractories outfall	None expected	None
Handling of membrane cleaning solutions	Treatment or collection and storage	National Refractories outfall	Not specified	Sodium Hypochlorite, Caustic Soda and Citric Acid[5] – The disposal of these solutions are not specified.

[1] Expandable to 18,972 ac-ft per year.
[2] 8,400 ac-ft per year represents replacement supply needed to meet current water production from the Carmel River as limited by SWRCB Order No. 95-10, and to offset 500 ac-ft per year of the Seaside Groundwater Basin overdraft.
[3] Expandable to 85,000 ac-ft per year
[4] Monterey Regional Water Pollution Control Agency.
[5] Added in proponent's 8/13/07 comment letter on GEI/B-E draft report. In subsequent submittal, proponents provide "general guidelines and some typical cleaning solution specifications from one vendor" and a letter dated November 26, 2007 from Pall Corporation which states, "the following chemicals are routinely used and intended for use here: 12.5% Sodium Hypochlorite, 25% Caustic Soda , 50% Citric Acid, 30% Sodium Bisulfite, and 100% Antiscalant." A request for proponents to describe the disposal of the membrane cleaning solutions did not receive a response.

3.1 Coastal Water Project (CWP)

Project Purpose

CAW proposes the CWP as a viable alternative to the Carmel River Dam and Reservoir Project to enable CAW to comply with SWRCB Order No. 95-10, to offset 1,000 ac-ft per

year of the Seaside Groundwater Basin overdraft, and to provide California American Water customers with a reliable and legal water supply.[9]

Customers Identified

The Basic CWP would provide water to existing CAW service area customers to comply with SWRCB Order No. 95-10 and to reduce overdraft of the Seaside Groundwater Basin by 1,000 ac-ft per year.

The Regional CWP alternative would provide water to existing CAW service area customers and supply 3,572 ac-ft per year for future additional demands within the CAW service area. It would also provide water to Marina Coast Water District service area customers and to water customers in Moss Landing, the city of Castroville, and Northern Monterey County.

Technology Appropriate/Demonstrated on this or Similar Supply

The treatment technology for the CWP is described in several documents. The most recent of these documents, obtained in the course of this study, is the CWP Conceptual Design Report (CDR)[10] prepared by RBF Consultants for CAW. Descriptions of the treatment approach in the CDR are generally consistent with the earlier Proponent's Environmental Assessment[11] (PEA). The PEA includes additional supporting data that were included in this evaluation.

The proposed overall treatment process is based on the use of reverse osmosis (RO) to accomplish the desalination treatment objectives of the project. Substantial pretreatment systems have been included to provide suitable feed water to the RO process and post-treatment chemical addition is provided to condition the product water to meet aesthetic, compatibility, and regulatory objectives.

Pretreatment System

The CDR provides a general description and process flow diagram of the proposed pretreatment process, which indicates the use of membrane filtration (microfiltration or ultrafiltration) possibly augmented by the use of coagulant addition. No representations are made regarding the water quality expected from this open intake seawater source. The magnitude of variations in suspended solids, algal activity, and oil concentrations are not stated or predicted in the documents. The possibility exists that some form of clarification,

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[9] Amended Application to California Public Utilities Commission for CWP (A.04-09-019) – July 14, 2005.

[10] RBF Consulting, *California American Water, Coastal Water Project Conceptual Design Report (Draft)* - September 16, 2005.

[11] RBF Consulting, *California American Water, Proponent's Environmental Assessment for the Coastal Water Project, CPUC Proceeding A.04-09-019* - July 14, 2005.

possibly dissolved–air flotation, prior to the filtration process would be optimum. While the CDR does include possible coagulant addition, the feedwater quality may justify the inclusion of a clarification process to optimize the membrane filtration system cost and performance. The use of membrane filtration is considered an appropriate selection for this open intake seawater supply. While existing full-scale implementation of this technology on seawater is not extensive, the track record as RO pretreatment on other challenging source waters (e.g., municipal wastewater) is substantial. Additionally, several long-term seawater pilot studies have provided strong indication of successful application of membrane filtration on seawater. The CDR states that pilot testing of the pretreatment will be required to make a final determination of actual chemical requirements and dosages. There are also other critical membrane filtration design criteria, some of which are not defined in the CDR, which must be verified through pilot testing. These include the design flux, which defines the filtrate hydraulic loading on the membrane, typically in units of gallons per square foot of membrane area per day (gfd). The flux defines the membrane area needed for production of design capacity. The omission of design flux prevents assessment of the level of conservatism in the membrane filtration design. The CDR indicates the use of chlorination of the feed water for biological control and subsequent dechlorination, an approach that has been identified at other projects as problematic.[12] Long-term pilot testing is needed to validate a chlorination/dechlorination biological control strategy.

Reverse Osmosis

The CDR describes a traditional approach to seawater RO design that has been successfully implemented at other sites. However, the operating flux of the RO system, which is a customary design value to be defined in a CDR, has not been identified. While the stated characteristics of the CWP RO process are considered to be reasonably conservative and conducive to an efficient, reliable process, the indicated RO operating pressure (900 psi) is possibly low. The documents do not provide clear indication of the operating temperature and flux assumed to arrive at this pressure value. Underestimating the operating pressure would impact the operation and maintenance (O&M) expense estimates. The level of redundancy in the treatment system design has not been stated. The RO design includes the use of an energy recovery device, which recovers energy from the high pressure (800-950 psi) concentrate stream being discharged. The use of the energy recovery device reduces the power requirements for the RO feed pump, a substantial component of the cost of desalination. Energy recovery technology has seen significant advancement in the past few years and it is important that proposed projects reflect the latest developments. The energy recovery device performance stated in the CDR is reasonable and appropriate.

[12] Hamida, A. & Moch, I., Controlling Biological Fouling in Open Sea Intake RO Plants without Continuous Chlorination, International Desalination and Water Reuse Quarterly Nov/Dec 1996.

Conclusion

The component treatment technologies (membrane filtration and reverse osmosis) selected for the CWP are appropriate for the application. Important design parameters of the membrane filtration and RO must be defined through long-term pilot testing. Some aspects of the described chemical addition approach (coagulation and biological control) must also be developed and/or verified though pilot testing. Definition of the feedwater temperature range and level of redundancy are important fundamental design parameters that have not been adequately addressed in the CDR.

Waste Stream Fate Identified

Brine disposal would be via the Return Flow Pipeline to the Moss Landing Power Plant (MLPP) disengagement basin where the brine would be mixed with MLPP cooling water and then discharged to the ocean via the MLPP cooling water outfall. The MLPP cooling water outfall is currently used as part of the MLPP operation.

The effect of discharges from the CWP desalination plant on the receiving water quality in Monterey Bay has been evaluated using computational fluid dynamics modeling. The study is included as an appendix to the PEA.

The desalination process will produce residual streams from the source water fine screening process, continuous waste flow from the pretreatment process, and waste cleaning solutions from the cleaning of the pretreatment membranes and RO membranes. Fine-screened materials would be pumped into the Return Flow Pipeline. Cleaning chemicals would require either separate treatment or collection and storage prior to disposal. The pilot study will better define the pretreatment process and the cleaning requirements.

Solids produced from the Micro Filtration (MF) waste treatment would be processed and dried on-site for ultimate disposal at a landfill. The site plan includes a new rail spur to facilitate material handling.

Availability of Historical Feedwater Quality Data and Sanitary Survey

The PEA includes a section on potable water quality. Water samples that were used for the water quality data contained in this section were obtained from the MLPP Surge Chamber Unit 6. This sample location differs from the proposed seawater diversion location at the MLPP Disengaging Basin but is expected to have similar water quality. Water quality data were also obtained from intakes in the Moss Landing Harbor for testing required for a National Pollution Discharge Elimination System (NPDES) permit. The obtained water quality data were used extensively in a number of studies prepared in support of the project.

A sanitary survey has not been prepared but would be required for submittal to the California Department of Health Services for approval prior to operation of the facility.

Quality of Supporting Documentation

The CWP has the most comprehensive documentation of the three terrestrially based projects. The most specific project documentation includes the Conceptual Design Report and the Proponent's Environmental Assessment.

The Conceptual Design Report (CDR) includes the following sections:

- Source Water Intake and Brine Disposal
- Desalination Plant
- Desalination Water Conveyance System
- Aquifer Storage and Recovery Facilities
- Proposed Project Costs

The CDR provides studies and layouts of many of the proposed facilities. The quality of the work is good and it provides a good understanding of the design concepts, thus facilitating the accuracy of the construction cost estimates.

The CDR includes as appendices the pipeline alignment drawings and project costs. The pipeline alignment drawings, at a scale of 1" = 80', show the alignment on aerial photographs. Profile information has been limited to critical crossings such as water courses and highways. The information shown is of good quality and this conceptual information would assist the CWP team's construction cost estimating efforts.

The PEA is another well-prepared document showing project-specific detail appropriate to the project status. The body of the PEA includes site-specific information including relevant conceptual designs and environmental impacts. Also included in the PEA are detailed studies shown in the Appendices and Technical Memoranda.

Appendices to the PEA for the CWP are as follows:

- Air Quality Data
- Computational Fluid Dynamics Modeling for Moss Landing Power Plant
- Addendum to Computational Fluid Dynamics Modeling for Moss Landing Power Plant
- Flow Science: Draft Working Documents
- Visual Simulation Methodology for the Coastal Water Project
- Public Scoping Summary
- Flow Science: Draft Technical Memorandum
- List of Property Owners for the Coastal Water Project

- California American Water Monterey County Coastal Water Project Marine Biological Resources Phase II Report
- Noise Data for the Coastal Water Project
- California American Water Monterey County Coastal Water Project Terrestrial Biological Resources Phase II Report
- Cultural Resources Assessment Technical Report
- Preliminary Geotechnical Evaluation Monterey County Coastal Water Project
- Preliminary Hazardous Materials Assessment

Technical Memoranda included in the PEA are as follows:

- ASR Wellfield Conceptual Design, Modeling Analysis, and Preliminary Environmental Assessment
- Aquifer Storage and Recovery (ASR) / Segunda Conveyance System
- Brine Disposal
- MLPP Cooling Water Supply
- Desalination Plant at the Duke Energy East Site
- Desalinated Water Conveyance System (DWCS)
- Feasibility of Using HDD Wells for Water Supply
- HDD Well Supply
- North Marina Site Alternative Desalination Plant
- Site Comparison
- System Flow Management and Hydraulics
- Terminal Reservoir

Supports Local Area and Regional Objectives

The CWP supports local area objectives by resolving the water supply deficit associated with SWRCB Order No. 95-10 and by providing 1,000 ac-ft per year to reduce overdraft of the Seaside Groundwater Basin. The regional project alternative also supports regional objectives by providing potential expansion to the regional water supply system.

Omissions or Fatal Flaws

See Table 11, Regulatory Requirements, in Section 7 of this report in regard to the potential need for additional information.

3.2 Monterey Bay Regional Seawater Desalination Project (MBRSDP)

Project Purpose

The MBRSDP is proposed by Pajaro/Sunny Mesa Community Services District (P/SMCSD) to enable the Monterey Peninsula area to comply with SWRCB Order No. 95-10, to offset overdraft of the Seaside Groundwater Basin, and to provide supplemental water supplies to serve portions of Northern Monterey County.

Customers Identified

The MBRSDP will serve the Monterey Peninsula, the service area of the P/SMCSD, and other areas of Northern Monterey County and portions of the Pajaro Valley Water Management Agency[13] service area. A regional desalination plant capable of meeting the regional requirements is envisioned. The plant would be constructed in phases as additional users are brought into the system.

However, although at present the identified project water demands include 10,730 ac-ft per year to comply with SWRCB order No. 95-10 and 3,000 ac-ft per year to reduce overdraft of the Seaside Groundwater Basin, no additional supply is proposed to meet future demands in the Monterey Peninsula area.

Technology Appropriate/Demonstrated on this or Similar Supply

The technical description for the MBRSDP is included in the Conceptual Design Report (CDR)[13] and the project's Proposition 50 Pilot Project Grant Application to California Department of Water Resources.[14] Both documents were prepared by Poseidon Resources for P/SMCSD.

The proposed treatment process is based on the use of RO to accomplish the water quality objectives of the project. The proposed feed water source has been documented to experience high turbidity, and extensive pretreatment systems have been included to provide suitable feed water to the RO process.

Pretreatment

Currently, clarification followed by filtration is anticipated to be the major pretreatment steps. The project will rely on pilot testing to identify the optimum pretreatment approach.

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[13] Pajaro/Sunny Mesa Community Services District in Cooperation with Poseidon Resources Corporation, *Monterey Bay Regional Desalination Project, Conceptual Design Report*, April 2006.

[14] Pajaro/Sunny Mesa Community Services District, *Monterey Bay Regional Desalination Project, Proposition 50 P/SMCSD Pilot Demonstration Project Grant Application*, March 22, 2006.

Both sedimentation and dissolved-air flotation (DAF) are considered options for the initial clarification. Conventional granular media filtration and membrane filtration are options for the filtration step. The project's Proposition 50 Grant Application for pilot testing provides a thorough description of the pilot approach. It is anticipated that this pilot testing could develop the information necessary to design an effective and reliable pretreatment process. The consideration of DAF is appropriate, considering the possible presence of oil and algae in the feed water.

One area of concern is the selection of DynaSand technology by Poseidon Resources as a "conventional" filtration on other projects. This filtration technology does not have successful full-scale experience on seawater. While successful pilot performance at another site has been reported, this process may introduce a higher level of risk than traditional granular media filtration, such as with dual-media filtration. Selection of the granular media filtration style for piloting has not been identified by the project proponent. Poseidon Resources, according to a June 28, 2006 email, stated that they have not selected the filtration media that would be used in a pilot study or in a full-scale plant for the MBRSDP. The DynaSand specification, included in the elevation drawings as submitted to the Monterey County Planning Department, was to show the physical dimensions of the largest available filtration technology. Poseidon Resources stated that DynaSand was used to preserve (1) maximum planning flexibility, and (2) the opportunity to study all available technologies in the pilot study.

Reverse Osmosis

The CDR describes a traditional approach to seawater RO design that has been successfully implemented at other sites.

Conclusion

In general, the component treatment technologies (clarification, filtration, and reverse osmosis) selected for piloting are appropriate for the application. Important design parameters must be established through long-term pilot testing. Pilot testing plans have been well documented. The disciplined execution of this pilot testing will be critical to the development of an effective and optimized design.

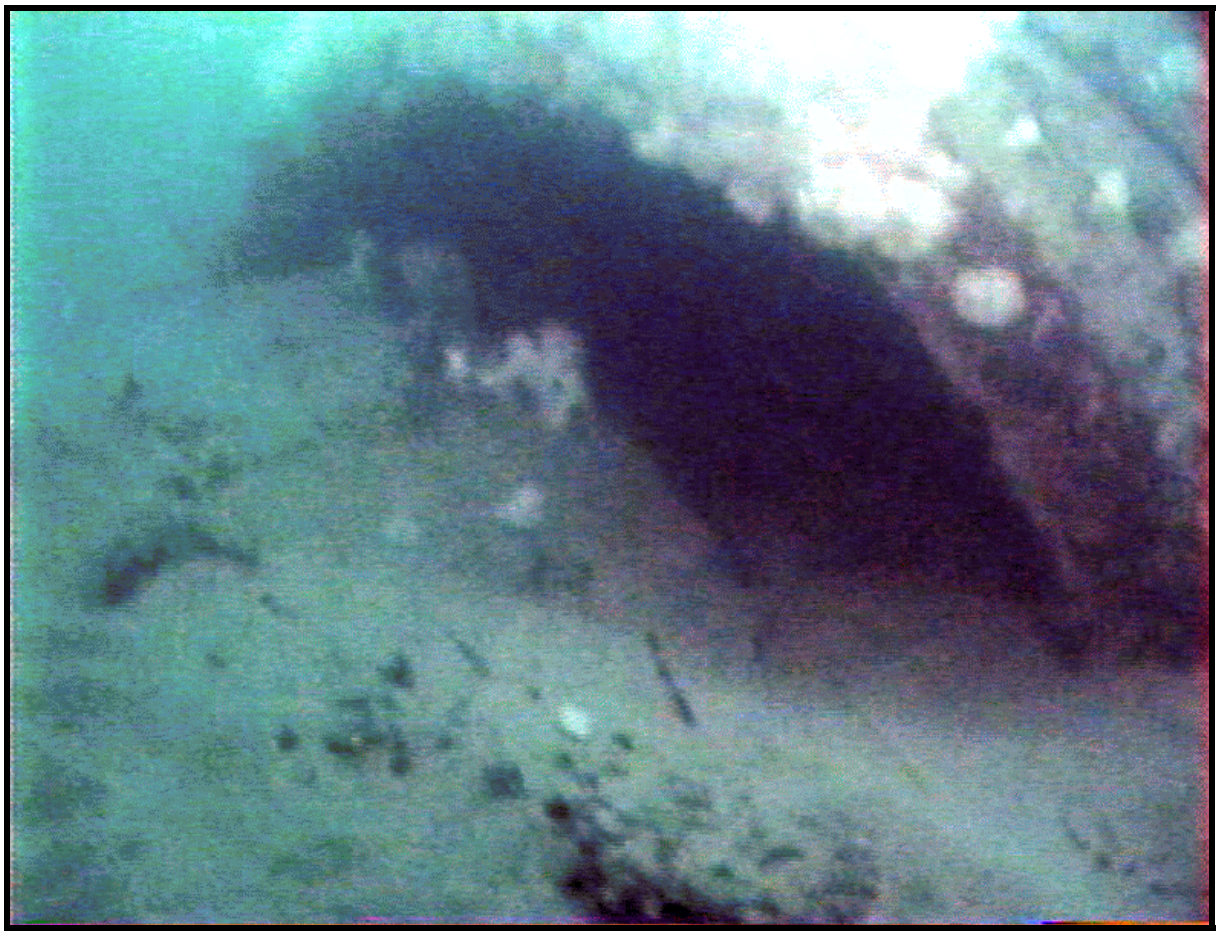
Waste Stream Fate Identified

Waste brine from the RO process will be discharged to the National Refractories ocean outfall[13] or the MLPP discharge stream. The National Refractories ocean outfall is currently not in use and is in need of repair, as is indicated in the following photographs (Figures 6 and 7). Project cost estimates have addressed the need to repair the outfall but a description of the extent of repair has not been presented. Therefore, an assessment as to the reasonableness of the repair costs could not be made.

Residual streams from clarified sludge and granular pretreatment filter waste backwash are proposed to be discharged to the National Refractories ocean outfall. Chemicals used for membrane cleaning will be stored and neutralized prior to discharge to the National Refractories ocean outfall.

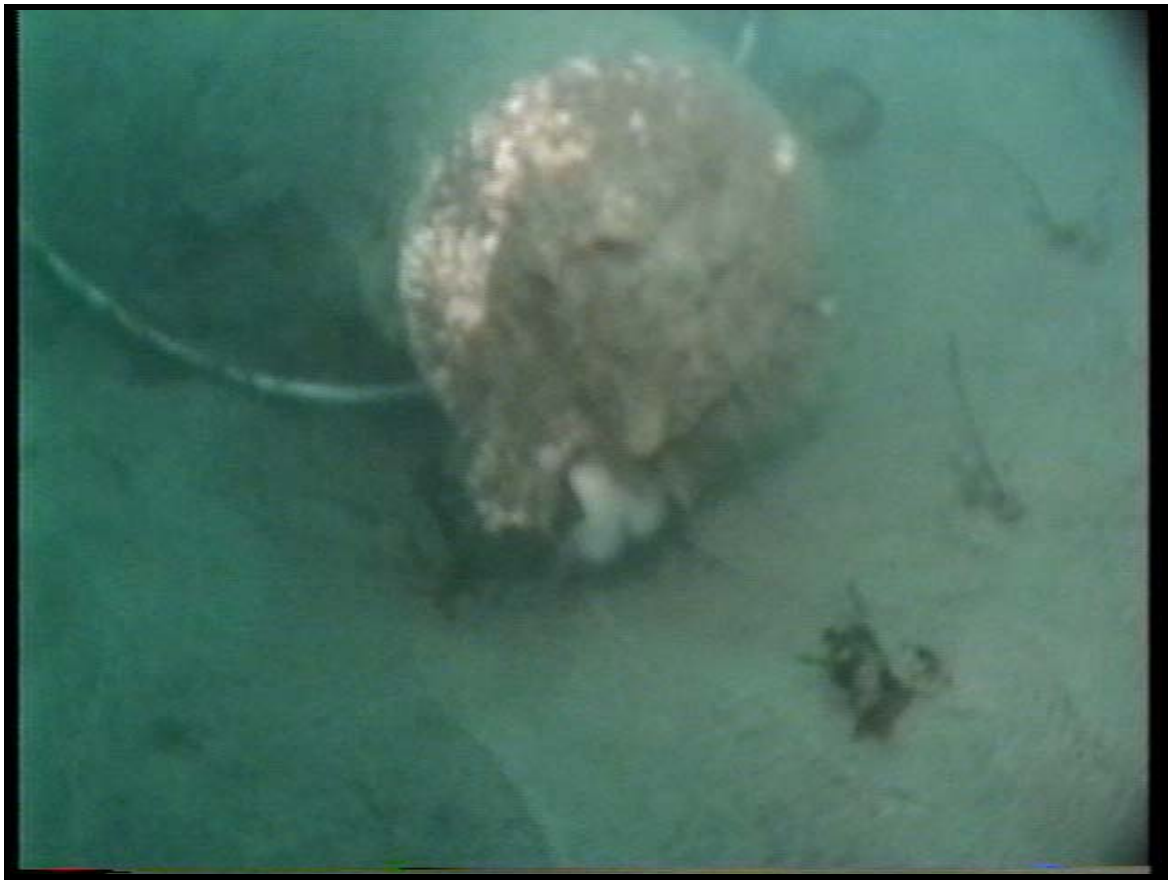
Solids from the source water screening will be retained in storage bins and hauled to a sanitary landfill.

Figure 6 – Joint Separation on National Refractories Outfall



Joint Separation on Outfall

Figure 7 – Clogged Diffusers on National Refractories Outfall



Clogged Diffuser

Availability of Historical Feedwater Quality Data and Sanitary Survey

The Monterey Bay Regional Desalination Project Report of Waste Discharge (Application for Renewal NPDES Permit CA0007005 National Refractories Ocean Outfall, dated November 1, 2005) contains data on seawater influent quality. These data were used to project effluent quality contained in the document. The document states: "Comprehensive data characterizing the quality of the seawater influent to the MBRSDP will be developed as part of the proposed pilot plant test program."

A sanitary survey has not been prepared but would be required for submittal to the California Department of Health Services for approval prior to operation of the facility.

Quality of Supporting Documentation

The most comprehensive document provided or obtained in support of the full-scale MBRSDP is the Monterey Bay Regional Desalination Project Conceptual Design Report, dated April 2006. The report describes the following:

- The proposed plant location
- General project implementation schedule
- Project progress to date
- Project description
- Facility operation and maintenance
- Project costs

The project description includes the following:

- Photos of pilot plant filter equipment
- An enhanced aerial photo showing key desalination plant facilities
- A general configuration of a seawater RO system train
- A table showing key intake seawater design characteristics
- A table summarizing the seawater RO basic design criteria

The Conceptual Design Report provides little information on the treated water pipeline(s). However, a figure has been provided that shows an alignment, which is shown herein as Figure 3.

Supports Local Area and Regional Objectives

The MBRSDP supports local area objectives by resolving the water supply deficit associated with SWRCB Order No. 95-10 and by providing 3,000 ac-ft per year to reduce overdraft of the Seaside Groundwater Basin. No additional supply is proposed to meet future demands in the Monterey Peninsula area. The project would supply water to the P/SMCSD service area, portions of the Pajaro Valley Water Management Agency service area, and certain other areas in Northern Monterey County, in support of regional water supply objectives.

Omissions or Fatal Flaws

Additional studies are needed to determine the adequacy of using the National Refractories ocean outfall for brine disposal and the fate of the brine plume in the receiving waters. See also Table 11, Regulatory Requirements, in Section 7 of this report in regard to the potential need for additional information.

3.3 Sand City Desalination Project (SCDP)

Project Purpose

The proposed 7.5 mgd/8,400 ac-ft per year desalination plant would allow CAW to meet the provisions of SWRCB Order No. 95-10 and the court decision in the Seaside Groundwater Basin adjudication, provide a supplemental supply to meet needs in excess of CAW's current total valid rights (6,880 ac-ft per year[15]), and to continue to provide a reliable supply of water to existing Monterey Peninsula customers.

Customers Identified

The project would provide water to existing CAW service area customers.

Technology Appropriate/Demonstrated on this or Similar Supply

The technical description for this project is included in both the Final Phase 1 Technical Memorandum[16] and the Board Review Draft Environmental Impact Report (EIR).[17] A notable aspect of this project is that the source seawater is obtained from a shoreline well field.

While the proposed treatment process is based on the use of reverse osmosis to accomplish the desalination treatment objectives of the project, the extensive pretreatment required for open-intake feed sources is avoided with this well source. Post-treatment chemical addition is still provided to condition the product water to meet aesthetic, compatibility, and regulatory objectives.

Factors to be considered for the project to be expanded are listed below:

- Intake (many of these considerations are interrelated)
  - Additional beachfront property
  - Local aesthetic impact (on former Ford Ord property, if applicable)
  - Influence of expanded well field on local hydrogeology
- Desalination plant
  - Sufficient space for footprint of expanded plant, including larger clearwell

[15] 3,376 ac-ft per year from Carmel River sources and 3,504 acre-feet per year from the Seaside Groundwater Basin.

[16] Camp Dresser & McKee, Inc., *Monterey Peninsula Water Supply Project Alternatives – Final Phase 1 Technical Memorandum*, March 2003.

  - Availability of additional land (if necessary based on analysis of expanded desalination plant footprint)

- Concentrate discharge
  - Blended water quality vs. NPDES discharge limits for TDS and other WQ parameters (as applicable)
  - Capacity of outfall to accommodate increased brine flow
  - Potential sacrifice of outfall capacity allocated for future development in the area in favor of allocating unused capacity for brine
  - Minimization of stormwater capacity in the outfall and how this might be mitigated (e.g., storage tanks, ASR well, if possible, etc.); storage tanks for this purpose could be more costly than those for other purposes given the need for corrosion resistant materials
- Cost
  - Both capital and O&M; the plant will cost more; however, the unit total life cycle cost (i.e., amortized) may be reduced as a result of economies of scale
- Permitting
  - A revised EIR may be necessary
  - Other permits would also have to accommodate the expanded capacity, as applicable

Pretreatment System

The ability of seawater wells to reliably provide RO feed water that is low in suspended solids has been demonstrated in numerous full-scale installations. The benefits of this source vs. open intakes include the avoidance of the capital and O&M expense of the pretreatment, avoidance of entrainment impacts, increased reliability, and, often, reduced RO membrane fouling. The pretreatment equipment defined for this project consists of cartridge filtration and antiscalant addition, which is sufficient for this application. While the wells do not yet exist, preventing verification of the feed water quality, it is reasonable to anticipate suspended solids levels that are acceptable for RO.

Reverse Osmosis

The Final Phase 1 Technical Memorandum and the Board Review Draft EIR describe a traditional approach to seawater RO design that has been successfully implemented at other sites. The design consists of four 33 percent-capacity RO trains, which provide substantial

[17] Jones & Stokes Associates, *Monterey Peninsula Water Management District Water Supply Project, Board Review Draft Environmental Impact Report*, December 2003.

redundancy and reliability to the treatment facility. The stated operating pressures are reasonable for this application. Considering that the conceptual design effort for this project's RO plant occurred in 2003, it is expected that the anticipated energy recovery performance is relatively conservative compared to current approaches that benefit from recent advances in energy recovery devices.

Conclusion

The treatment design for the Sand City project, consisting of RO operated directly on well water is an appropriate approach that has been successfully implemented at many locations. The design has been developed only to the conceptual level. However, no serious omissions or fatal flaws in the treatment process are anticipated.

Waste Stream Fate Identified

Brine from the desalination process would be disposed either in HDD wells or via connection to the MRWPCA's treated wastewater outfall to the Pacific Ocean.[17] Descriptions of the fate of cleaning chemicals and other waste streams were not identified.

Studies considering an HDD system for brine disposal have determined that such a system is technically feasible in the Fort Ord area. Such a disposal concept could be an issue, however, because the regional aquiclude (Seaside Clay) is absent in the area, creating a window with direct hydrologic communication with the underlying aquifer (the Paso Robles Aquifer system). Additional modeling is needed to determine the potential effects of mixing desalination brine and seawater with freshwater in the Paso Robles aquifer.

Brine discharge to the MRWPCA's treated water wastewater outfall is technically feasible although initial studies indicate that capacity may not be available for all outfall flow conditions. Additional studies are needed to determine if storage or operational modifications can be made to accommodate all outfall operating parameters. This could include the evaluation of seasonal storage to manage the occurrence of when brine discharge exceeds outfall capacity during high-flow periods.

Availability of Historical Feedwater Quality Data and Sanitary Survey

No source water quality information was provided in any of the reviewed documents. Additional work will be needed to develop these data. Future test wells would need to be drilled and water quality samples obtained. Long-term water quality impacts will also need to be evaluated.

Quality of Supporting Documentation

The quality of the work prepared in support of this project is good; however, much of the work has been to determine the project's feasibility. A good portion of this feasibility-related

work is focused on seawater intake and brine disposal. Since there are limited data available on similar types of installations, the amount of feasibility-level assessments is appropriate.

Specific desalination treatment plant sites and specific pipeline alignments have not been determined. The reviewed material showed various alternatives for the proposed facilities.

Supports Local Area and Regional Objectives

The SCDP supports local area objectives by addressing the water supply deficit associated with SWRCB Order No. 95-10 and by providing 500 ac-ft per year to reduce overdraft of the Seaside Groundwater Basin. As proposed, the project would not supply water to areas outside the CAW service area.

Omissions or Fatal Flaws

Additional study of the use of radial wells or horizontal directionally drilled wells and other aspects of the SCDP is needed to determine their appropriateness for use in this application. A previous study of the SCDP[18] identified the following information needs to further assess project feasibility and water supply yields:

Geologic/Hydrogeologic

- Assess the near shore subsurface conditions along the beach (e.g., State Parks and Seaside area) to evaluate feasibility of the reconfigured shoreline parallel HDD collector well concept.
- Conduct aquifer pump tests at suitable collector and disposal sites once locations of facilities are better defined to refine predicted system yields.

Seawater Intake

- Further evaluate suitable locations for radial collector wells to identify suitable locations for stand-alone system or to augment onshore HDD configuration.
- Finalize detailed evaluation of the revised HDD configuration in order to determine project feasibility.
- Further evaluate onshore HDD well collector configuration to improve operations and feasibility.
- Evaluate water quality and potential pre-treatment processes resulting from infiltration of surface water from Roberts Lake.
- Drill test well(s) and conduct extended pumping test(s) to measure response to pumping in coastal aquifer within the underlying Paso Robles aquifer.

[18] Camp Dresser & McKee, Monterey Peninsula Water Management District, Sand City Desalination Project, Feasibility Study, April 16, 2004, pages 7-5 and 7-6

Brine Disposal

- Evaluate potential impacts and institutional impediments associated with discharge of brine into the interconnected shallow unconfined coastal aquifer and lower semiconfined Paso Robles aquifer.
- Evaluate brine disposal implications related to relocating the seawater well collector well field to proposed brine discharge locations at former Fort Ord combined with brine disposal at the regional wastewater treatment plant outfall.

Numeric Modeling

- Further evaluate and define regional groundwater flow conditions within the dune sand aquifer to establish an accurate baseline condition for the coastal region.

See also Table 11, Regulatory Requirements, in Section 7 of this report in regard to the potential need for additional information.

3.4 Seawater Desalination Vessel (SDV)

Project Purpose

The proposed project would provide 10 to 20 mgd (11,200 to 22,400 ac-ft per year) of desalinated water from a seawater desalination vessel would allow CAW to meet the provisions of SWRCB Order No. 95-10, provide a legal and reliable supply of water to existing and future Monterey Peninsula customers, as well as other areas of Northern Monterey County. Proponents state the capacity is expandable to 85,000 acre-feet per year, which, if expanded, would serve areas throughout the Monterey Bay region.

Customers Identified

The project would provide water to existing CAW service area customers.

Technology Appropriate/Demonstrated on this or Similar Supply

The seawater desalination vessel (SDV) has a number of potential attributes that impact the permitting issues, and potential environmental impacts associated with both the intake and brine discharge systems. Each of these systems is discussed below based on the information presented by Water Standard Company and an understanding of the marine environment. The extent of information provided for the SDV intake and brine discharge systems is conceptual at best and many of the benefits identified by the proponent represent goals rather than benefits until sufficient engineering analyses have been completed to define how the systems will achieve their goals. Although the proponent's promotional materials[19] suggest

[19] Water Standard Company, *The Benefits of a Seawater Conversion Vessel* (presentation), September 27, 2006

that intake and discharge permits are not required for the SDV, other material submitted by the Water Standard Company suggest, and our belief is, that they will be required and are key permits needed to operate.

Seawater Intake System

The SDV proponent calls its seawater intake system a "Multi-Depth Intake Anti-Entrapment System." The intake system consists of three elements. The first element is its ability to move the intake and target non-sensitive areas. The proponents state that the SDV would be stationed about five miles offshore where the intake pipe could be lowered into deep water below the penetration of sunlight. The upper surface waters within the light penetration zone are generally expected to support the most abundant and diverse aquatic communities. A second key element of the intake system is that the lower portion would be equipped with one or more EPA Regulation "Johnson-type" well screens with slot sizes small enough to minimize entrainment of marine organisms. The implication is that sufficiently small screen could be used to prevent significant entrainment of aquatic organisms. The third key element was stated to be design of the system so that it would have a low hydraulic head and low intake velocities (i.e., less than 0.5 fps). Intake velocities less than 0.5 fps are generally expected to prevent significant amounts of impingement of aquatic organisms against the intake screens. The above three elements are intuitively attractive, but insufficient information is provided to evaluate whether the proposed Multi-Depth Intake Anti-Entrapment System will achieve acceptable performance criteria or if these are merely the goals for the system[20].

Similar to on-shore plants, the intake system is expected to require a SWRCB permit to withdraw water provided it operates within State and U.S. waters. Because the ship could be readily moved, it is anticipated that one of two approaches would need to be met in order to receive approval to withdraw extensive amounts of seawater: (1) demonstrate that the design of the intake system is sufficiently forgiving that it could be deployed in almost any location without concerns of environmental impacts, or (2) delineate ocean conditions and marine communities in sufficient detail, including on-going monitoring programs, in order to define a range of environmental conditions where the intake system would be allowed to operate. The ability to move the SDV and change the depth of the Multi-Depth Intake Anti-Entrapment System away from sensitive areas is stated as a benefit, but the proponent will also likely be required to demonstrate how engineering and operational controls will prevent the operators from accidentally moving the SDV and its intake system into sensitive areas that may not follow assumed generalizations regarding ocean conditions. This may require extensive marine studies and engineering design studies. While not necessarily

[20] Proponent's comments on the draft GEI/B-E report state: "The intake would be designed for a half foot per second intake velocity using a 1 mm EPA 316B compliant well screen with blowback. … there are literally hundreds of intakes operating the USA using these same criteria and therefore they are not goals at all. They are legitimate design criteria."

insurmountable, these issues will likely take more effort and time for permitting than is implied in the materials provided by the proponent[21]. Since release of the draft of this report, the WSC's preferred alternative would anchor the ship in a single position and transport the product water to shore via a permanent seabed pipeline. As proposed, the seabed pipeline would run roughly parallel to the Monterey Peninsula and could be located as close as two miles off Pacific Grove, which may raise concerns with visual aesthetics. Extending the pipeline further would move the pipeline terminus into significantly deeper water in the Monterey Canyon with a resultant increase in cost and requirements for materials tolerant of higher pressures. Two other issues not discussed that will be required to be addressed in the permitting process and for operation include:

1. How will design systems and operational controls prevent the intake system from being impacted by (or causing impacts to) flexible risers, mooring lines, product off-loading hoses, and other temporary or permanent parts of the SDV and its associated systems during operation under a variety of sea conditions[22]; and

2. How will the potential re-circulation between the intake and discharge systems be addressed given the variety of sea, current, and operational conditions that could be encountered (see discussion of discharge system below regarding concerns in the design system).

Brine Discharge System

The proponent states that:

> "All brine is pumped into our salinity plume deterrent chamber and diluted with raw seawater for two purposes, first, to dilute the salinity levels of the brine to have benign exit water and second, to balance the temperature of the diluted brine to be the same as the surface water skin as it exits through our multiport dispersion system as benign exit

[21] Proponent's comments on the draft GEI/B-E report state: "Once in place in the area and location permitted, the SDV is not anticipated to move. [Water Standard Company will] not be determining the intake depth points without close consultation with local marine research institutes and governmental regulatory bodies such as NOAA and the California Coastal Commission. An on-going monitoring program will be defined by the site specific NPDES permit. In recognition of the operational controls and criteria, WSC has contracted with Vships and Bureau VERITAS, who deal with these issues on a daily basis, to specifically address these issues for the Monterey projects."

[22] Proponent's comments on the draft GEI/B-E report state: "The mooring system will allow the ship to 'weather vane' around a pivot point at the front of the ship. Mooring lines, flexible risers and product off-loading hoses are all below the pivot point and do not move with the ship. Intake pipes and brine discharge pipes are attached to the ship and will be located away and above mooring lines and risers enabling them to rotate around the mooring without interference. As the sea conditions change, so can the vessel be engineered to react and move accordingly in place."

water. A critical environmental advantage of this process is the discharging of the exit water at the surface, rather than through diffusers at the bottom."

Offshore discharge of brine from a movable vessel offers different opportunities and challenges than a traditional fixed bottom discharge. As with the proponent's information regarding the intake system, limited engineering specifics are presented to support claims by the proponent of the benefits of the brine discharge system. Nonetheless, sufficient information is provided to make it apparent that, as presented, the Salinity Plume Deterrent Systems and the Multi-Port Dispersion Systems may have critical flaws that could prevent issuance of a discharge permit under the National Discharge Pollutant Elimination System (NDPES) established by EPA and implemented by the Regional Water Quality Control Board. The areas of concern discussed below need not be fatal flaws but are issues that need to be addressed. The corresponding studies required to site such a system are much more complex than implied in the documentation provided by the proponent.

From a regulatory perspective, the Salinity Plume Deterrent System as proposed would minimize the exposure of marine organisms to high brine concentrations; however, the proposal appears to be entirely dependent on dilution, and EPA and the Regional Water Quality Control Board policies and regulations do not consider dilution to be an acceptable form of treatment. The policy implications of issuing a new NPDES permit on this basis are very significant. State and federal regulations would apply for operation within State and U.S. waters. Applicable U.S. Coast Guard requirements would also apply. Proponents do not describe disposal of pretreatment sludges, which are treated by land-based desalination plants. Regulatory agencies would likely have a difficult time changing their policies to allow for a treatment system that is, in reality, a dilution system. In the unlikely event dilution was allowed in an NPDES permit, the volume required would be significantly greater than the amount of product water produced due to the natural levels of salinity in the intake dilution water[23].

The proponent claims that there are significant benefits of a surface water discharge compared to a fixed bottom water discharge. Although this could conceptually be correct, the proposed system does not demonstrate an understanding of NPDES permitting regulations and agency policies. Most existing outfalls are located on the bottom to avoid conflicts with navigation and because most NPDES discharges into the marine environment are either freshwater or heated cooling water. In the majority of both cases, the effluent discharge could be expected to be less dense than seawater, and a rising plume adds to far-field dilution. In contrast, discharge of brine from desalination is generally denser than seawater, and, all else being equal, more far-field dilution of brine could be expected from a

[23] Proponent's comments on the draft GEI/B-E report suggest a dilution ratio of a half part of raw seawater to every one part of brine. Technical support for this opinion was requested from proponent, but was not provided.

surface discharge from a sinking plume than from a bottom plume. However, all else is rarely equal and much more information about discharge and receiving water characteristics is required to ensure protection of aquatic organisms. Near- and far-field dilution of discharged effluents are impacted by many additional factors, such as initial discharge velocity, discharge and receiving water density, near- and far-field water currents and flushing, angle of discharge relative to currents and other physical features. The proponent states that the discharge would be a low-velocity discharge of diluted brine to near-ambient density and would remove many of the features that enhance far-field dilution. Instead, the proponent's approach would leave a "plume of effluent" in surface waters (typically considered some of the most sensitive areas of a water body) that would have reduced tendencies to disperse by forces other than far-field advection. This goes against most accepted regulatory policies and criteria for designing an outfall.

The proposed brine discharge system could be modified for a high-velocity discharge without dilution in the Salinity Plume Deterrent Systems. Initial velocity would create dilution and the density could cause a sinking plume (assuming temperatures were controlled so as to not neutralize the effect of density on far-field dilution). However, the potential for re-circulation between the discharge and the intake system under a variety of sea conditions is a concern. A considerable amount of design, impact evaluations, and operational controls are likely to be required to create an acceptable discharge system.

The desalination treatment process proposed to be implemented in the Water Standard Company Seawater Desalination Vessel consists of the use of commercially available treatment components. The overall treatment process is based on the use of reverse osmosis to accomplish the desalination treatment objectives of the project. A low-pressure membrane pretreatment system (microfiltration) has been included to provide suitable feed water to the RO process and post-treatment is provided to condition the product water to meet aesthetic, compatibility and regulatory objectives. Documentation of the Water Standard Company project has been provided to the reviewer under the terms of a Non-Disclosure Agreement. Certain observations presented here cannot be explained in complete detail without violating this Agreement.

Pretreatment System

Water Standard Company has provided a general description and process flow diagram of the proposed pretreatment process, which indicates the use of Pall microfiltration. As discussed regarding the Coastal Water Project, the use of membrane filtration is considered an appropriate selection for an open intake seawater supply. While existing full-scale implementation of this technology on seawater is not extensive, the track record as RO pretreatment on other challenging source waters (e.g., municipal wastewater) is substantial. Additionally, several long-term seawater pilot studies have provided strong indication of successful application of membrane filtration on seawater. However, it is still standard practice that membrane pretreatment (microfiltration or ultrafiltration) be pilot tested on local

conditions to establish design parameters and prescreening requirements. The project proponent indicates no pilot testing is planned or necessary, based on their extensive shipboard experience. The applicability of this experience is questioned relative to the use of the Pall microfiltration pretreatment process.

Materials of construction indicated in the proponent's documentation of the Pall microfiltration system include materials which the reviewer considers inadequate for long-term life in a seawater application. This raises concern regarding the proponent's costs estimating, as use of these components will provide an attractive capital cost, but would result in the need for large maintenance operating budgets and adversely affect reliability and down-time[24].

Reverse Osmosis

The Water Standard Company describes a traditional approach to seawater RO design which has been successfully implemented at other sites. The level of redundancy in the RO treatment system design is substantial (25 percent).

Costs

In general, the capital costs for the treatment equipment components appear to be realistic (an exception being the post treatment equipment). However, the level of contingency in the estimate is quite low, a level generally reserved for the highest level estimate. Considering the unusual location of this installation (shipboard) a more substantial contingency would appear warranted.

Regarding treatment equipment operating expenses, the major cost components have been identified. While the estimated values for known expenses are realistic (see energy comment to follow), the allowance for maintenance materials/spares/repairs is extremely low and considered inadequate. The values are considered low for a land-based installation and especially so for this shipboard location. Inclusion of additional maintenance and miscellaneous budget is needed.

The energy consumption indicated in the estimate is realistic, but assumed to be produced on-board at a very low unit cost. Should this assumption of low cost electricity not be realized, the economics of this project would be dramatically altered, as electricity is a large component of operating expense and in turn overall cost of water.

[24] Proponent's comments on draft GEI/B-E report state "As indicated [by] Pall, materials in contact with Seawater will be Duplex Stainless Steel, PVC or HDPE. All seawater compatible. Any materials that may have been shown otherwise on the earlier submission were shown in error."

Costs for chemicals in the estimate appear to be purchase costs, not including expense of transporting and handling them to the ship.

Additionally, no contingency or on-line factor appears to have been included in the operating cost estimate.

Conclusion

The component treatment technologies (membrane filtration and reverse osmosis) selected for the Water Standard Company project are in concept appropriate for the application. However, important design parameters of the membrane filtration and RO must be defined through long-term pilot testing. Of specific concern is the development of chemical washing design parameters (Pall's EFM process) and Clean-in-Place requirements. Considering that these processes generally use chemicals (e.g., sodium hypochlorite, caustic, and acids) that require special handling and introduce safety requirements, their impact on operating on shipboard could be critical.

The proponent's cost estimates for the treatment components of the project are considered optimistic, with the selection of maintenance budget and contingency level (both capital and operating). Assumptions on electricity expense deserve additional scrutiny should the project receive further consideration

Waste Stream Fate Identified

Brine from the desalination process would be disposed of by diluting it with native seawater in containers on the vessel. This process is also designed to cool the diluted brine to levels near ambient seawater temperature. The diluted brine is discharged at sea surface.

Availability of Historical Feedwater Quality Data and Sanitary Survey

No data have been collected.

Quality of Supporting Documentation

The most comprehensive document provided or obtained in support of the SDV is the proponent's statement, dated April 2007. The six-page statement provided summary information regarding the following:

- Project proposal
- Project description and summary
- Contract option
- Drinking water production and operations
- Timeline and schedule
- Public outreach and lobbying efforts

Costing information was provided in another document. The proponent has submitted additional information over the past year in public presentations and in response to requests by this reviewer. The project has evolved substantially over this time, much of the new information contradicts or supersedes information provided in the proponent's statement, and cost estimates have been sharply increased for some major components. An updated proponent's statement has not been provided.

Supports Local Area and Regional Objectives

The SDV supports local area objectives by resolving the water supply issues associated with SWRCB Order No. 95-10 and by providing water to reduce overdraft of the Seaside Groundwater Basin. Although not specified by the project proponents, the project has the potential to meet additional water needs in the region.

Omissions or Fatal Flaws

Because a project of this type and size has not been constructed before, life cycle costs for construction, operation, maintenance, and replacement cannot be determined with great confidence. See also Table 11, Regulatory Requirements, in Section 7 of this report in regard to the potential need for additional information.

4 Projected Performance

This section discusses the following topics for each proposed project:

- TDS objective(s)
- Title 22 drinking water standards (i.e., primary standards, pathogen control, DBP minimization, etc.)
- Corrosion control in the distribution system
- Blending with existing distribution system water
- Disinfection practices sufficient

4.1 Coastal Water Project (CWP)

In general, the Coastal Water Project (CWP) Conceptual Design Report (CDR)[25] specifies appropriate, conceptual-state treatment process information for assessing desalination plant performance relative to drinking water quality with no significant gaps or deficiencies. However, there are some potential issues that warrant more detailed planning as the project enters the pilot stage. (See Table 1 for project intake and outfall locations.)

For example, the CDR indicates that 3.0 mg/L of free chlorine will be added just prior to the coagulation and flocculation pretreatment processes. Although not explicitly specified in the CDR, this disinfection step is likely intended to satisfy the various state and federal requirements for primary disinfection for surface water treatment plants. No information is provided in the CDR to justify the sufficiency of this dose for achieving the 0.5-log *Giardia* inactivation credit that will almost certainly be required by the California Department of Health Services (CDHS). In addition, data provided by Duke Energy Power Services[26] from its National Pollution Discharge Elimination System (NPDES) permit renewal sampling in 1999 indicate that total organic carbon (TOC) levels in the power plant Units 6 and 7 intake and discharge are approximately 10 mg/L, an amount that is unusually high for a surface water source as well as for seawater. This level of TOC, coupled with a 3.0 mg/L chlorine dose and a combined 21 minutes of contact time in the coagulation and flocculation processes as well as additional contact time in the submerged membrane filtration basins, could result in the formation of significant chlorinated disinfection by-products (DBPs), which are strictly regulated in drinking water systems. The reaction of this TOC with the

[25] RBF Consulting, *California American Water, Coastal Water Project, Conceptual Design Report (Draft)*, September 16, 2005.

[26] California American Water, *CWP Source Water Monitoring Documents*, transmitted from Lela Adams at California American Water to Larry Gallery, RBF Consulting, December 14, 2004.

applied chlorine would diminish the disinfection potential for inactivating pathogens. Both the efficacy of primary disinfection and the potential for DBP formation, as well as the possible removal of these DBPs via the reverse osmosis (RO) processes need to be explicitly evaluated during the pilot phase, as noted in the CDR. Note that while the feed for the seawater desalination plant is planned to be withdrawn from the discharge for Units 1 and 2 prior to the point at which the cooling water flow is combined with that from Units 6 and 7 prior to discharge, Units 1 and 2 and Units 6 and 7 utilize intakes in Moss Landing Harbor and may have similar water quality.

The CDR also does not specify how the physical pathogen removal credits for *Giardia*, *Cryptosporidium*, and viruses would be allocated to the various treatment processes by the CDHS; however, it is likely that the combination of membrane filtration, cartridge filtration, and RO would achieve the required pathogen removal objectives.

Another potential water quality issue is the possible presence of synthetic organic chemicals (SOCs) in the watershed. A report developed by The Watershed Institute at California State University Monterey Bay[27] indicated the detection of the pesticides chloropyrifos (up to 0.145 μg/L) and diazinon (up to 0.682 μg/L) in Moss Landing Harbor. While there are no maximum contaminant levels (MCLs) for these two compounds, the levels detected are in the same range as the MCLs for some other regulated SOCs, which also could be present in the watershed that drains into Moss Landing Harbor. Because the ability of the RO process to remove various SOCs can vary depending on the compound and may not be well documented in the literature, the pilot phase should include a full screen for SOCs (as well as for all regulated drinking water parameters) in both the feed and RO permeate water. Note that the 1999 NPDES permit renewal sampling did not detect the presence of any regulated SOCs in the intake water for power plant Units 6 and 7.

The CDR specifies that the hardness, alkalinity, and pH of the RO permeate would be adjusted via chemical applications both for aesthetic considerations and to protect the distribution system piping. The CDR also indicates that a corrosion inhibitor may be needed. In addition, the PEA[28] indicates that RO post-treatment would be applied with consideration for blending with other water supplies. No total dissolved solids (TDS) target is specified, however, nor is the potential impact of these chemical additions on the ability of the treatment process to meet that target.

The CDR states an assumption of five percent downtime for maintenance, but indicates an annual average daily capacity that is 97 percent of the design daily capacity. Nonetheless,

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[27] California State University, Monterey Bay, Watershed Institute, *Monitoring Chloropyrifos and Diazinon in Impaired Surface Waters of the Lower Salinas Region,* March 31, 2004.

[28] RBF Consulting, *California American Water, Coastal Water Project – Proponent's Environmental Assessment for the Coastal Water Project, CPUC Proceeding A.04-09-019*, July 14, 2005.

this on-line time would require redundancy in all treatment processes and pumping facilities. No references are made to the redundancy levels in the treatment plant design or to the basis of the cost estimates.

4.2 Monterey Bay Regional Seawater Desalination Project (MBRSDP)

The CDR provides significant general information about the Monterey Bay Regional Desalination Project (MBRSDP),[29] although in many cases there is less supporting detail than would typically be provided at the conceptual level. For example, the CDR indicates that the desalination plant will be in compliance with the applicable requirements of both the federal Safe Drinking Water Act (SDWA) and Title 22 of the California Code of Regulations, although it does not specify how the required pathogen removal and inactivation credits will be achieved.[30] While the proposed treatment process, including clarification, media or membrane filtration, cartridge filtration, and reverse osmosis (RO), should be sufficient for meeting the physical pathogen removal requirements, there is no indication of how the CDHS would allocate the removal credit among these processes.

Supplemental information provided by Poseidon Resources in a letter dated July 14, 2006, provided additional detail with respect to the manner in which pathogen removal and inactivation would be achieved.

Treatment Process	*Giardia* Credit	Virus Credit
Sedimentation / Filtration	2-log	1-log
Reverse Osmosis	2-log	2-log
Disinfection (Free Chlorine)	2-log	1-log
TOTAL	6-log	4-log

Poseidon indicated that it anticipates the desalination plant will need to be designed to achieve 4-log *Giardia* and 3-log virus reduction. This is inconsistent with the state and federal regulations governing surface water treatment, however, which specify 3-log *Giardia* and 4-log virus reduction, as well as 3-log *Cryptosporidium* reduction, which is not mentioned in Poseidon's analysis. Because seawater collected via an open intake would be

[29] Pajaro/Sunny Mesa Community Services District in Cooperation with Poseidon Resources Corporation, *Monterey Bay Regional Desalination Project Conceptual Design Report*, April 2006.

[30] In a June 28, 2006 email, a representative of Poseidon Resources stated that it has been working closely with CDHS on permitting large-scale desalination projects in California and has received conditional approval for a project in Huntington Beach. Poseidon Resources believes that it understands what is required to obtain CDHS approval for the MBRSDP. These statements were not verified.

considered surface water, the desalination plant must comply with these regulations. In addition, it is unlikely that 2-log disinfection of *Giardia* would be achievable in a contact tank, as the combination of high chlorine dosage and/or the large tank size necessary to achieve this inactivation would be extremely unusual in a water treatment plant. Nevertheless, the other log removal / inactivation credits suggested for the various processes relative to both *Giardia* and viruses are within the range of those typically permitted by the CDHS, and a 0.5-log *Giardia* inactivation using free chlorine, as required by the CDHS under its policy of providing multiple barrier protection, is reasonable to expect in the desalination plant's contact tank. Moreover, the removal of *Cryptosporidium* permitted by the CDHS is typically similar to that for *Giardia*. Thus, despite the inaccuracies in Poseidon's analysis of pathogen reduction, it is likely that the proposed combination of treatment processes would be sufficient to achieve the requisite pathogen removal.

The CDR indicates that chloramines will be added downstream of the product water storage tank, and that the product water transfer line would provide adequate contact time to comply with CDHS disinfection requirements. Chloramines constitute a relatively weak primary disinfectant, however, and no supporting detail is provided to justify its use, particularly in a water transfer line.[30] Supplemental information provided by Poseidon Resources in a letter dated July 14, 2006, tacitly refutes the CDR, specifying that free chlorine (vs. chloramines) will be applied in the product water storage tank (vs. the water transfer line) to achieve primary disinfection. In addition, the letter notes that if all purchasers of the water from the desalination plant utilize either chlorine or chloramines as a residual disinfectant, then the MBRSDP will likewise apply this disinfectant at the effluent of the plant. If the various purchasers do not each use the same residual (i.e., secondary) disinfectant, however, then only free chlorine will be used. In the latter case, each purchaser using chloramines would be obligated to provide facilities for applying ammonia to the delivered water at its own cost.

Likewise, the CDR notes that pesticides and agricultural runoff will not be a factor for source water quality, but there is no rationale to substantiate this assertion.[31] A full water quality analysis for all regulated drinking water contaminants should be conducted during the piloting phase prior to full-scale project implementation. The CDR does cite low total organic carbon (TOC) levels (more consistent with typical ambient seawater concentrations than those reported by Duke Energy for its Moss Landing Harbor Units 6 and 7 intake and discharge), and coupled with the use of coagulation and polymer in the pretreatment process prior to any chlorine addition, the formation of chlorinated disinfection by-products should not be an issue.

[31] In a June 28, 2006 email, a representative of Poseidon Resources stated that monthly water quality monitoring has been conducted since October 2005. The program has included collecting seawater samples from the Moss Landing Harbor. The samples were tested for 300 constituents including pesticides and other agricultural runoff constituents, as regulated under the California Ocean Plan and the state and federal Safe Drinking Water Acts. Poseidon Resources concluded from the testing program that pesticides and agricultural runoff will not be a factor. The data provided by Poseidon Resources do not support this conclusion.

In addition to these information gaps, the most significant water quality concerns associated with the MBRSDP involve the diverse systems owned by the Pajaro/Sunny Mesa Community Services District (P/SMCSD) that could potentially receive water from the proposed seawater desalination plant, as well as other systems that could purchase the water, which have yet to be identified.[32,33] The CDR indicates that the water produced by the seawater desalination plant will be compatible with the water in the distribution systems to which it is delivered; however, with customers not yet identified and a variety of disparate water qualities among the systems owned by the P/SMCSD, this claim cannot be substantiated. If the water quality is even moderately different among the various systems to which the desalinated seawater would be delivered, it may be infeasible to treat the desalinated water to match that of the receiving waters of each system for aesthetics, residual disinfection, total dissolved solids (TDS), and corrosion control. Moreover, additional pipe loop and/or coupon testing[34] may need to be conducted for the piping in each receiving system. If the custom post-treatment conditioning and corrosion testing are not conducted as a component of the MBRSDP, then any system purchasing desalinated seawater from the P/SMCSD would have to assume responsibility for these project elements, effectively increasing the cost of water to the respective ratepayers. This cost, as applicable, should be factored into the overall cost of desalinated seawater in addition to the purchase price from the P/SMCSD.[35]

The CDR provides discussion of redundancy and peak flow provisions in the design. At average flow the RO has five duty and one standby train. Similarly, redundancy of the product pumping facilities is provided. It would appear that a sound redundancy approach is being applied system wide.

4.3 Sand City Desalination Project (SCDP)

Both the Final Phase 1 Technical Memorandum[36] and the Board Review Draft Environmental Impact Report (EIR)[37] explicitly indicate that the combination of sand

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[32] Monterey County Local Agency Formation Commission, *North County Municipal Services Review* (Revised Final Draft), February 2006.

[33] "PUC OKs Water Systems Sale – Alisal Water Corporation Ordered to Sell Them," The Salinas Californian, May 16, 2006.

[34] Pipe loop and coupon testing are used to determine the corrosion potential of the material by exposing a sample of the pipe or pipe material to the water. Highly purified water can be very corrosive to some pipe materials.

[35] In a June 28, 2006 email, Poseidon Resources stated that product water quality control is critical to the success of the MBRSDP. It intends to follow protocols developed as part of comprehensive studies developed for other California Poseidon Resources desalination plants for the MBRSDP. No information regarding the previous studies conducted by Poseidon Resources was provided for the analysis conducted in the report.

[36] Camp Dresser & McKee, *Monterey Peninsula Water Management District, Monterey Peninsula Water Supply Project Alternatives – Final Phase 1 Technical Memorandum*, March 2003.

filtration provided by beach wells, RO, and disinfection using free chlorine (via sodium hypochlorite) should be sufficient to achieve the 4-log virus and 3-log *Giardia* reduction required by the CDHS using a combination of physical removal and chemical inactivation. Although *Cryptosporidium* reduction would also need to be achieved, it is expected that the CDHS would award the process the 3-log reduction in conjunction with the virus and *Giardia* reduction (notwithstanding any additional *Cryptosporidium* reduction required under the newly promulgated federal Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), if applicable). The Board Review Draft EIR also acknowledges that this process includes the capacity to comply with the likely CDHS requirement for a minimum of 2-log virus inactivation using 10 minutes of free chlorine contact time after the RO membranes. However, the CDHS typically requires the more conservative disinfection requirement of either 2-log virus or 0.5-log *Giardia* inactivation, and with the use of free chlorine the *Giardia* benchmark is the more stringent requirement. In any case, with a treated water storage tank of approximately 2.5 million gallons and a treatment plant flow of 7.5 mgd, the contact time in this tank should be sufficient to achieve either of these inactivation requirements for typical chlorine doses applied for primary disinfection.

Although no source water quality information is provided, the TOC levels are generally low in seawater and may be somewhat lower using a beach well intake; thus, the precursor material for disinfection by-product (DBP) formation is expected to be minimal. The Final Phase 1 Technical Memorandum notes that occasional non-point source pollution could potentially cause the beach wells to become infiltrated with enteric viruses, synthetic organic chemicals (SOCs), pharmaceutical residuals, and/or endocrine disruptors. Because there are no test wells constructed at this stage of project development, the potential for such contamination cannot be accurately assessed. While no available documentation regarding the Sand City Desalination Project specifically called for increased monitoring these contaminants and the ability of the proposed treatment process to remove them during either a piloting stage or at full scale, acknowledgement and awareness of this possible contamination is important at this early stage of project development.

Both the Board Review Draft EIR and Final Phase 1 Technical Memorandum indicate that lime and carbon dioxide would be used for post-treatment conditioning to produce "non-corrosive water." The Final Phase 1 Technical Memorandum also notes that the TDS of the RO permeate (product water) are expected to be in the range of 200 to 300 mg/L. However, neither document accounts for matching the finished water to the receiving distribution system in terms of pH, alkalinity, and TDS (including the addition of post-treatment chemicals for conditioning).

[37] Jones & Stokes Associates, *Monterey Peninsula Water Management District Water Supply Project, Board Review Draft Environmental Impact Report*, December 2003.

Appropriate redundancy is indicated for the collector wells, treatment process, and pumping station.

4.4 Seawater Desalination Vessel (SDV)

Although a treatment process schematic is provided in the Water Standard Company (WSC) promotional presentation titled *The Benefits of a Seawater Conversion Vessel*,[38] there is very little information available describing the treatment processes in any detail in the literature provided by the WSC. Thus, there is no indication of how the shipboard treatment process will comply with the requirements of either the federal SDWA or Title 22 of the California Code of Regulations, particularly with respect to the manner in which the required pathogen removal and inactivation credits will be achieved. Given the proposed combination of micro filtration (MF) and RO treatment processes, it is reasonable to assume (although not certain) that the CDHS will award the requisite 2.5-log *Giardia*, 3-log *Cryptosporidium*, and 2-log virus removal credit; however, the presentation indicates that clearwell storage will be minimal, suggesting that it may be insufficient to achieve the 0.5-log *Giardia* and 2-log virus inactivation credit that is mandated for primary disinfection. Although WSC literature does indicate that chemicals such as chlorine used by the purchasing water system can be added on the SDV, there is no mention of any shipboard tankage with sufficient contact time to achieve primary disinfection.[39] In fact, a letter written to the California Public Utilities Commission (CPUC) asserts that a clearwell is not required, suggesting that primary disinfection will not be conducted on the SDV.[40] Note that no justification is provided for this claim in the letter[41]. Therefore, even if the CDHS allows the purchaser of the desalinated water to provide the primary disinfection at the point of receipt (i.e., rather than aboard the SDV), the purchaser would need a contact tank sized to allow all of the delivered water to be disinfected. If new facilities needed to be built for this purpose, the net cost of the water would increase. Similarly, chemical feed facilities may be necessary (at further additional cost to the purchaser) to provide residual disinfection in the distribution system.

The promotional presentation, *The Benefits of a Seawater Conversion Vessel,* indicates that the SDV will always be positioned in areas of the best source water quality, although there is no indication of how this will be determined on an ongoing basis, either in terms of what water quality parameters will be monitored or how frequently.[38] Revised plans to use a seabed pipeline in place of shuttle vessels for product water transport makes lateral movements less likely. Proponent's comments on the draft of this GEI/B-E report state that once the vessel is in place it will not move except as it may move against a mooring system

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[38] Water Standard Company, *The Benefits of a Seawater Conversion Vessel* (presentation), September 27, 2006.
[39] Water Standard Company *Facts at a Glance*, 2006.
[40] Water Standard Company**,** letter to the California Public Utilities Commission, October 25, 2006.
[41] Proponent's comments on the draft GBE/B-E report state: "…post disinfection will be accomplished using the seabed pipeline and shore line reservoir for the requisite detention time and [chlorine contact time] credits. The primary disinfectant will be added on the ship, but the contact times are met in the seabed pipeline and proposed reservoir near the shore."

holding it in place It is also important to note that Title 22 requires source water quality monitoring as well as periodic watershed sanitary surveys and source water assessments, and none of the literature provided by the WSC address how compliance with these requirements would be achieved for a vessel that will change location and intake depth, thereby changing the source water as well as the water quality influences (both natural and anthropogenic, as applicable). There is also no indication of whether the CDHS would approve the receipt of treated water into a municipal distribution system from a drinking water source that is not fixed, or what regulatory conditions it might mandate if it did.

Because the SDV allows for various chemical additions aboard the ship, the treated water could be conditioned to match that of the local water with which it would be blended in the purchaser's distribution system, thereby addressing both corrosion and blending concerns. If the water from a single SDV were to be delivered to two different purchasers with waters of dissimilar quality, however, it may be less feasible to condition the finished water aboard the SDV to match multiple local water supplies. In such cases, one or both of the purchasers would need to add chemical feed facilities to condition the water at added expense. Conditioning for multiple distribution systems may also be an issue in the case in which water is wheeled through the Marina Coast Water District (MCWD) system, as posited in the CPUC letter.[40]

5 Economics

This section provides a review of the economics of each of the four projects. Reviewed items include the following:

- Capital cost
- Operating cost
- Unit cost
- Total energy consumption/efficiency
- Quality of cost estimate (conceptual, preliminary, bid, etc.)
- Age of cost estimate
- Energy cost assumptions
- Financing – identification & adequacy

The four projects have supporting documentation in various stages of development. The CWP is at a conceptual or preliminary level. This assessment is based on the supporting documentation that has been provided. The CWP has done the most work on resolving site-specific technical issues. With this knowledge the estimators are able to make a more complete assessment of the associated construction costs, thus allowing a lower contingency for the estimate.

The SCDP is also at a conceptual or preliminary level but is less developed than the CWP. The SCDP does not have a preferred treatment plant site or preferred pipeline alignment, although it has construction cost estimates for potential alignments. Some site-specific information has been developed but at this time is very general.

The MBRSDP is the least developed and is at a screening level of development. Construction cost estimates are apparently developed from projects of a similar nature.

As each of the projects progresses and more detailed construction cost estimates are made we would expect the estimates to more accurately reflect the specific site conditions. Since many of those site conditions are unknown at this time, the construction cost estimates may not accurately reflect the ultimate construction costs. More accurate estimates would be expected to develop as the projects develop.

The basic technology used for any of the three terrestrially based desalination plants would be similar. Although there are differing philosophies on the pretreatment requirements, the bulk of the desalination system requirements will be comparable; therefore, we would expect any of the three terrestrially based desalination facilities to have similar unit costs with small

deviations due to varying site conditions. This is also assuming that the same quality and grade of materials are used for each project. There may, however, be some savings for a larger capacity plant due to the economies of scale. Any present differences in the unit cost of the desalination facilities appear to be due to the methodology used to prepare the cost estimate or to differing assumptions on material selection.

The four projects have differing treated water capacities and are proposed for different locations. These factors affect the length and diameter of the proposed treated water pipelines.

The CWP and MBRSDP would be located within or adjacent to the MLPP. Both projects could benefit from purchasing power directly from the power plant and not be subject to power costs from the power grid. The reduced power rates are estimated to be on the order of 40 percent and represent a considerable savings in power cost over the project life. The SCDP would have to pay the going rate for power from the power grid for its facilities. The SDV proposal assumes use of subsidized biodiesel for power.

Table 2 summarizes the four projects' current cost status. To aid in comparison, land[42] and pilot project costs have been omitted, and costs have been updated to 2007 cost levels and refined by the B-E team as described in the table's footnotes. Detailed MBRSDP and SDV data subject to non-disclosure agreements are not shown.

Of particular note is the cost per acre-ft for the CWP Regional Project and the large MBRSDP and SDV projects being within 10 percent of each other. Given some of the unknown cost elements as described in this section, 10 percent represents a very small difference. The CWP basic project's per-acre-ft costs would be expected to be higher than those of the CWP Regional Project alternative due to the diseconomy of small scale.

[42] Land costs are omitted due to their very different handling by project proponents. Land and right-of-way costs provided by proponents are included where available in Table 3, Table 6, and Table 7 for the CWP, MBRSDP and SCDP, respectively. See discussion of MBRSDP land and right-of-way costs on p.5-9 through 5-11. No land or right of way costs for on-land SDV pumping and distribution facilities was provided.

Table 2 – Summary of Desalination Project Capacities and Estimated Costs

2007 Costs for Desalination Projects

with standard overhead and contingency allowance, excluding land and pilot testing
(millions of 2007 dollars)

	Coastal Water Project				Monterey Bay Regional Seawater Desalination Project[1]	Sand City Desalination Project		Seawater Desalination Vessel[2]	
	Desal Only		Desal + ASR						
	Proposed Project	Regional Project	Proposed Project	Regional Project		Low range	High Range	Subsidized Fuel	Un-Subsidized Fuel
RO Capacity (mgd)	10	18	10	18	20	7.5	7.5	18	18
(total af/yr)	*10,430*	*18,970*	*11,730*	*20,270*	*22,420*	*8,410*	*8,410*	*20,180*	*20,180*
Desalination Facilities	**$90.29**	**$120.29**	**$90.29**	**$120.29**	**$108.47**	**$71.05**	**$79.95**	**$88.38**	**$88.38**
($/mgd)	*$9.03*	*$6.68*	*$9.03*	*$6.68*	*$5.42*	*$9.47*	*$10.66*	*$4.91*	*$4.91*
Seawater feed and brine disposal (incl. SCV ship cost)	$6.67	$6.21	$6.67	$6.21		$41.71	$50.61	$47.10	$47.10
Residuals handling and treatment	$1.30	$1.39	$1.30	$1.39		$0.00	$0.00		
Desalination process	$82.31	$112.68	$82.31	$112.68		$29.34	$29.34	$41.29	$41.29
Finished water storage & pumping facilities						$0.00	$0.00		
Desalinated Water Pipelines	**$24.20**	**$35.66**	**$24.20**	**$35.66**	**$28.28**	**$13.18**	**$13.18**	**$31.37**	**$31.37**
Electrical Transmission Upgrades						**$1.04**	**$1.04**		
Terminal Reservoir and ASR Pump Station	**$5.76**	**$8.92**	**$5.76**	**$8.92**					
Segunda/ ASR System			**$15.06**	**$9.54**					
Field Office Overhead *(8%)*						**$6.82**	**$7.53**		
Contractor Mark-Ups *(16.25%)*						**$14.96**	**$16.53**		
Total Construction Costs	**$120.25**	**$164.86**	**$135.30**	**$174.39**	**$136.75**	**$107.05**	**$118.23**	**$119.76**	**$119.76**
Engineering, Overhead, Legal	**$28.86**	**$39.57**	**$32.47**	**$41.85**	**$32.82**	**$40.14**	**$44.34**	**$28.74**	**$28.74**
	24.0%	*24.0%*	*24.0%*	*24.0%*	*24.0%*	*30.0%*	*30.0%*	*24.0%*	*24.0%*
Contingency	**$37.28**	**$51.11**	**$41.94**	**$54.06**	**$42.39**	**$26.76**	**$29.56**	**$37.12**	**$37.12**
	25.0%	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*	*25.0%*
Total Capital Costs	**$186.38**	**$255.53**	**$209.72**	**$270.31**	**$211.97**	**$173.96**	**$192.12**	**$185.62**	**$185.62**
Operations and Maintenance *($M/yr)*									
Desalination Facilities/Power	$6.25	$10.12	$6.25	$10.12		$5.90	$5.90		
Desalination Water Conveyance	$0.42	$0.95	$0.42	$0.95		$1.54	$1.89		
Terminal Reservoir/ASR Pump Station	$0.07	$0.33	$0.07	$0.33					
Segunda/ ASR System	$0.00	$0.00	$0.65	$0.13					
Subtotal O&M Costs	**$6.74**	**$11.40**	**$7.39**	**$11.53**		**$7.44**	**$7.79**		
Repairs and Replacements	**$1.45**	$0.00	**$1.45**	$0.00		$1.30	$1.30		
Total O&M *($M/yr)*	**$8.19**	**$11.40**	**$8.84**	**$11.53**	**$16.90**	**$8.74**	**$9.09**	**$16.26**	**$20.85**
($/af)	*$730*	*$560*	*$790*	*$570*	*$750*	*$1,040*	*$1,080*	*$810*	*$1,030*
Total Annualized Cost (7%, 30 yrs) *($M/yr)*	$23.21	$31.99	$25.74	$33.31	$33.98	$22.76	$24.57	$31.22	$35.81
Unit Cost *($/af)*	*$2,230*	*$1,690*	*$2,190*	*$1,640*	*$1,520*	*$2,710*	*$2,920*	*$1,550*	*$1,770*

Notes:

[1] MBRSDP is currently described as a 20 mgd (22,420 af/yr) facility; 20,930 af/yr of demand has been identified, which increases unit cost to $1,620/af. Cost detail is subject to a confidentiality agreement.

[2] 20 mgd is proposed for SCV, but proponents provided conveyance for 18 mgd. 24% overhead used -- proponents estimate 16.1%. 25% contingency used -- proponents estimate 24%. Cost detail is subject to a confidentiality agreement.

5.1 Coastal Water Project (CWP)

Capital Cost

Capital costs were derived for a 10 mgd RO seawater desalination plant, Desalinated Water Conveyance System (DWCS), source water and brine disposal facilities, and a 6.3 mgd injection/ 12.9 mgd extraction (up to 1,300 ac-ft per year) aquifer storage and recovery (ASR) system.[43] Capital costs were estimated using budgetary quotes from vendors and suppliers of equipment and material, and estimates of labor requirements were based on crew requirements and prevailing wages. As shown in Table 3, the estimated capital cost to implement the proposed project is $178,000,000 (2005 dollars).

The original basis of the estimated capital costs was derived from a report by JR Conkey & Associates, entitled "Estimate of Probable Construction Costs – California American Water – Coastal Water Project – Regional Project –2004" (Conkey Report). The Conkey Report was prepared based upon the Regional Coastal Water Project and provides a detailed accounting of anticipated labor, equipment, material and subcontractor costs. In turn, the Conkey Report obtained costs for the MF and RO equipment from a Pridesa define/describe "budget" for the mechanical equipment. Pridesa is a Spanish water treatment contractor with experience supplying large-scale desalination facilities in Europe. When the estimate was prepared, Pridesa was a "sister" company of CAW in that they were owned by the same firm. Pridesa provided CAW a "preliminary budget" for the mechanical equipment.

As part of the Coastal Water Project Conceptual Design Report (September 16, 2005), the Conkey Report estimated numbers were refined to reflect the costs associated with the Basic Coastal Water Project. The Conkey report numbers were also increased to obtain current (at the time of the report) 2005 dollars. The Pridesa MF and RO mechanical equipment quotes were reduced by 33 percent to account for the difference in plant capacity, costs were inflated 4 percent to obtain current 2005 values, and $1.5M was added to each process as allowance for "containment structures." Implementation costs (engineering, environmental documentation, permitting, admin., etc.) of 24 percent were added to the Total Construction Costs. A contingency of 10 percent was applied to the total capital cost.

[43] RBF Consulting, *California American Water, Coastal Water Project Conceptual Design Report* (Draft) - September 16, 2005.

Table 3 – CWP 2005 Capital Cost

Facility	Cost
Desalination Facilities	
Seawater Feed and Brine Disposal	$6,260,000
Residuals Handling and Treatment	$1,220,000
Desalination Processes	$77,200,000
Subtotal, Desalination Facilities	*$84,680,000*
Desalination Water Conveyance Pipelines	
Moss Landing DWSC Pipeline	$6,900,000
TAMC RR DWSC Pipeline	$11,700,000
Seaside DWSC Pipeline	$4,100,000
Subtotal, DWCS Pipelines	*$22,700,000*
Terminal Reservoir and ASR Pump Station	*$5,400,000*
Subtotal this page	*$112,780,000*
Segunda/ ASR System	
Tarpy Flats Pump Station	$3,900,000
Segunda Pump Station Upgrade	$360,000
Segunda Pipeline	$4,800,000
ASR Pipeline	$1,500,000
ASR Wells	$3,560,000
Subtotal, Segunda/ ASR System	*$14,120,000*
Total Construction Costs	$126,900,000
Implementation Costs @ 24%	$30,456,000
ROW/ Easement/ Land Costs	$2,000,000
Capital Costs without Contingency	$159,356,000
Contingency @ 10%	$15,935,600
Pilot Plant	$2,585,000
Capital Cost with Contingency	**$178,000,000**

Comments on the reasonableness of the quantities and unit costs of the capital cost estimate are as follows:

- The original Pridesa Preliminary Budget value for the MF system is considered relatively high for this capacity. Competitive procurement of this equipment is expected to be 25 percent lower than the indicated value.
- The RO costs include $1.5M for "RO containment structures." It is not apparent what this item is or whether it is appropriate.
- The basis for the 33 percent reduction factor to adjust the Conkey Regional scale project to the Proposed Project has not been provided.

- Following the stated method employed to revise the Pridesa/Conkey pretreatment and RO process values to 2005 Proposed Project costs results in substantially lower values than indicated in Table 6-3 of the Conceptual Design Report.
- A 10 percent contingency may be appropriate for a Preliminary Design estimate that uses component costs for the Proposed Project. This estimate, however, is based on factoring costs from an estimate for a project double the size of the Proposed Project and applying an inflation factor to bring it to current dollars. A contingency of at least 25 percent is recommended for this estimate.

Operation and Maintenance Costs

The September 16, 2005, CWP Conceptual Design Report includes the Operations, Repairs, and Replacement Annual Costs Summary table reproduced as Table 4 below.

Table 4 – CWP 2005 Operations, Repairs, and Replacement Annual Costs Summary

Facility	Cost
Desalination Facilities Operations Cost	$6,252,000
DWCS Operations	$417,000
Terminal Reservoir / ASR Pump Station Operations	$72,000
Segunda/ ASR System	$651,000
Subtotal, O&M Costs	*$7,392,000*
Subtotal, Repairs and Replacements	*$1,448,000*
Total O&M with Membrane Replacement	**$8,840,000**

The CWP treatment facility O&M costs are thorough and consistent with expected values for a full-scale MF/RO facility. Electrical costs are assumed to be $0.07/kWh for “within the fence” power to the treatment facility and $0.12/kWh for off-site pumping stations. These costs are consistent with our understanding of the current power rate structure.

Financing –Identification & Adequacy

CAW has served the Monterey area since it acquired utility properties from California Water and Telephone Company in 1966. CAW is one of the state’s largest regulated water utilities with rates subject to authorization from the California Public Utilities Commission (CPUC). CAW is also part of the American Water Works Company’s (AWWC) family of subsidiaries operating in many states across the country. AWWC is one of the largest regulated water utilities in the country, and is part of investor-owned RWE of Germany, Europe’s third largest utility. RWE is considering divesting itself of AWWC properties through a public stock offering.

CAW initially finances capital expenditures through short-term debt borrowed against a line of credit, as authorized by its Board of Directors, followed by subsequent securing of long-term financing. Moneys borrowed short term are repaid either annually or biannually with proceeds from the sale of long-term debt securities of CAW to an affiliate, American Water Capital Corporation (AWCC). AWCC is a wholly owned subsidiary of AWWC and acts on behalf of financing needs for related AWWC-affiliated utility companies across the country. Interest rates associated with borrowed money on a short-term basis are determined by current market conditions. CPUC-filed documents indicate that interest rates for short-term debt are a blended rate resulting from various borrowing with different maturities. Borrowings from the primary lending source of AWCC are priced at the London Inter Bank Offered Rates (LIBOR) and borrowing from back-up credit lines of AWCC is priced at LIBOR interest rates plus 25 basis points. The company indicates that interest rates for long-term debt are comparable to interest rates for public debt securities issued by companies with ratings similar to AWCC. The CPUC has approved the financing relationship between CAW and AWCC (Decision 00-10-067).

The rate application to the CPUC to recover all present and future costs relating to the CWP indicates that pre-construction and construction costs will be financed on an annual basis by short-term borrowings. Further, the company states that depending on market variables and the possibility of a joint and/or public project, there are a number of options for financing. CAW, in conjunction with any public partners, will strive to find the best mix of debt and equity or public financing that will result in the lowest cost financing available.

In a cost of capital exhibit filed as part of an application to increase rates for water service in its Monterey District, CAW indicated it will issue more than $308 million in new long-term debt securities from the end of 2004 through 2008 to replace maturing debt securities and fund additional capital improvements. The company anticipates that new debt will have an annual interest rate of between 6.90 to 7.03 percent for years 2006 through 2008.

Currently, CAW is requesting authority from the CPUC to apply rate surcharges in order to recover pre-2007 costs (estimated at $18.6 million to include environmental studies, engineering, the pilot project, and similar costs) and surcharges for construction cost offsets. The purpose of these surcharges is to reduce rate shock that would be generated by the cost of the CWP if recovery is deferred until the project is completed. The company is also requesting that the average and recovered balance on incurred and approved charges be allowed to accrue interest at CAW's current authorized rate of return for the Monterey District (8.1 percent).

Although CAW has not secured long-term financing for the capital investment required to implement the CWP, it is clear that the company has an avenue to secure such financing when required. It should, of course, be noted that the long-term anticipated financing rate of about 7 percent is not the entire financial burden the ratepayers will ultimately bear. Capital costs for the CWP will have both a financing and equity allocation, which will result in an

overall project cost in excess of 8 percent as reflected in the required rate of return to rate base within which the CWP investment will be recognized. This project at 8 percent by CAW can be compared with potential financing by a municipal agency that currently is able to obtain revenue bonds at about 4.5 percent.

Quality of Cost Estimate

The CWP construction cost estimate is currently at a conceptual or preliminary level. Detailed assessments of certain specific site requirements have been compiled and the costs of those specific requirements are accounted for in the estimates. For example, the detail shown on the pipeline alignment has allowed the estimator to address specific critical crossing requirements (i.e., water courses or highways) and their associated costs.

Additionally, detailed studies have been made of the proposed desalination site requirements and spatial constraints. Analyses of on-site pipeline alignments, facility configurations, connections to existing facilities, and other site-specific information are available to the estimator. This detail allows the estimator to better refine his costs and make a more accurate prediction of the anticipated costs.

Methodology of developing this capital cost estimate justifies use of a greater contingency factor. The root cost values used for the major microfiltration equipment are "budgetary" and appear to be relatively high. Net impact is that a higher capital cost estimate may be appropriate.

5.2 Monterey Bay Regional Seawater Desalination Project (MBRSDP)

Capital Cost

Capital costs for the desalination facilities are provided in the Monterey Bay Regional Desalination Project Conceptual Design Report dated April 2006. The information was provided as shown in Table 5 without line item summaries of the anticipated costs.

The capital costs shown are solely for the desalination facilities and do not include costs for the transmission pipelines and pumping and storage components.

By an application dated March 24, 2006, P/SMCSD submitted the Monterey Bay Regional Seawater Desalination Pilot Project to California Department of Water Resources for a Proposition 50 P/SMCSD Pilot Demonstration Project Grant. Total capital project costs of $2,970,000 were presented. This total is comparable to the CWP Pilot Plant capital cost estimate of $2,585,000 (see Section 5.1). It should be noted that the CWP cost shown in Table 3 includes the cost of the pilot plant. The MBRSDP costs shown in this section do not include the pilot plant costs.

Table 5 – MBRSDP 2006 Capital Cost

Construction Costs – Desalination Plant 2006	
Site improvements	
Seawater Intake Facilities	
Pretreatment System	
Permeate Conditioning and Disinfection Facilities	
Waste Stream Management Facilities	
Instrumentation, Monitoring, and Control System	
Electrical Supply System	
Service and Support Facilities	
Yard Piping	
Other Construction Costs	
Engineering, Construction Management, and Oversight	
Permitting	
Financing	
Startup and Commissioning	
Contractor Fees, Insurance, and Bonding	
Other Direct Costs	
Contingencies	
Total Capital Costs	**$130,000,000**

P/SMCSD retained Kennedy/Jenks Consultants to prepare the project information for the MBRSDP.[44] This information contains a preliminary, planning level capital cost breakdown, reproduced in Table 6.

The line item cost for the Pumping & Storage Components and Transmission Pipeline are $14,000,000 and $16,830,000, respectively. If we apply the percentage for the various items included for the line item Admin, Legal, Engineering and Environmental and the 25 percent contingency to the above amounts we obtain a total cost for the Pumping & Storage Components and Transmission Pipelines of $39,027,000.

Although there are no costs shown for right-of-way, the project includes a pipeline between Moss Landing and the Monterey Peninsula. There would likely be costs for pipeline right-of-way, even though much of the alignment would be in publicly owned roadways and other public rights-of-way.

[44] North Monterey County Desalination Project, Monterey Peninsula Water Management District Decision Matrix," 2006.

Table 6 – MBRSDP Preliminary Capital Cost

ITEM	QUANTITY	UNITS	COST	
DESALINATION COMPONENTS				**$74,000,000**
Intake Pipeline Rehabilitation	1	Lump Sum	$500,000	
Desalination Facility (18mgd)	1	Lump Sum	$72,000,000	
Outfall Pipeline Rehabilitation	1	Lump Sum	$1,500,000	
PUMPING & STORAGE COMPONENTS				**$14,000,000**
Finished Water Storage & Pumping Facilities	1	Lump Sum	$14,000,000	
TRANSMISSION PIPELINE				**$16,830,000**
Transmission Pipeline – Paved/Hwy 1 R-O-W	20000	L.F.	$5,000,000	
Transmission Pipeline – Unpaved R-O-W	47900	L.F.	$9,580,000	
Mojo Cojo Slough Crossing	500	L.F.	$750,000	
Tembladero Slough Crossing	100	L.F.	$250,000	
Salinas River Crossing	1000	L.F.	$1,250,000	
Energy Facilities	Undetermined			
ASR Costs	None Proposed		-----	
Distribution System Requirements	None Proposed		-----	
Construction Subtotal			$104,830,000	
Admin, Legal, Engineering, & Environmental			**$24,635,050**	
Right-of-Way			-----	
Environmental Review, Permits	3%	Of Subtotal	$3,144,900	
Mitigation Measures	Undetermined		-----	
Design Engineering	10%	Of Subtotal	$10,483,000	
Construction Management	7.50%	Of Subtotal	$7,862,250	
Administration/Legal	3%	Of Subtotal	$3,144,900	
Profit	None		0	
Project Subtotal			$129,465,050	
Contingencies	25%		$32,366,263	**$32,366,263**
Project Total			**$162,000,000**	**$162,000,000**

There would also be costs for use of the plant site and intake and outfall facilities. In the agreement between P/SMCSD and the current owner of the plant site (Property and Pipeline Capacity Lease Agreement between the Pajaro/Sunny Mesa Community Services District and HMBY, L.P., A California Limited Partnership, dated March 3, 2004), the following provisions relate to project right-of-way costs:

> "3. RENT. Rent for the subject Premises and Tenant's use of all ancillary facilities, easements, intake and outfall pipelines, tanks, pumps, and all appurtenances thereto shall be paid as follows:
>
> (a) The base rent for the subject Premises shall be $.05 (five cents) per square foot

per year for vacant land and $.10 (ten cents) per square foot for the open water holding tanks on the twenty (20) acre "premises" site. On the first day of the beginning of the fourth year of the lease, and on the first day of every year of the lease, or the Lease extension, thereafter, the base rent shall be increased at a rate of 5% per year. . .

(b) In addition to the base rent, Tenant agrees to pay Landlord, as partial rent for subject Premises, including the intake and outfall pipeline and flow capacities, an amount for each acre foot of potable water produced for municipal or human use or consumption as follows:

i. A base payment of $100 per acre-foot for each acre-foot of potable water produced by Tenant for municipal, agricultural, or human consumption during the term of this lease.

ii. Beginning on the first day of Year Three (3) after the first day that potable water is produced and sold for commercial consumption for municipal, agricultural, or human uses, the base payment shall increase at a rate of 10% per year for every year of the lease from the beginning of Year Three until the end of Year Ten. The adjusted rate per acre-foot shall increase thereafter (beginning in Year Eleven) at a fixed rate of 5% per year for each remaining year of the lease or its extension.

iii. Payment for the first 50,000 acre feet of water to be produced by Tenant shall be prepaid to Landlord on or before the first day that potable water is sold by Tenant for commercial consumption by municipal, agricultural, and human use. ..."

Based on the above agreement, a cost of $2.24 million per year (22,400 acre-feet x $100 per acre-foot, plus per-square-foot charge for the "base rent") would ensue once the plant is in operation.

In response to MPWMD's requests for further detail, Poseidon Resources offered to provide certain portions of that information only on a confidential basis to MPWMD's consultants. Poseidon Resources executed a Confidentiality Agreement with Bookman-Edmonston (B-E) and Separation Process Inc. (SPI). Subsequently, Poseidon Resources provided SPI and B-E with a breakdown of total capital and O&M costs and other project information requested by MPWMD.

The capital cost breakdown for the desalination facilities generally follows the list for the desalination plant. While the estimate is subject to the confidentiality agreement, Poseidon has indicated the Total Capital Cost figure can be disclosed. That figure is $132,000,000 (interestingly, in 2005 dollars vs. 2006 in the CDR). No bases for the values are provided that would indicate the level of estimate that this reflects (screening, conceptual, preliminary, etc.). Discussions with Poseidon on this point indicate the component values were derived from quotes received on other projects with substantially similar equipment, albeit different size. It is the reviewer's assessment that the component values are reasonable and generally in their expected ranges. However, it is not possible to assess if the contingency amount is appropriate without specific knowledge of the source of the component cost estimates.

Based on the limited backup information that is available, it is the reviewer's opinion that the contingency included in the capital estimate is low and an additional 10 to 15 percent is appropriate.

Operation and Maintenance Costs

The total O&M cost provided by Poseidon is $16,900,000 per year. The breakdown of this value includes all items normally considered in O&M estimates of this type. Electrical consumption is consistent with current designs using high energy efficiency components and energy recovery devices. The unit cost of electricity is a reasonable value if negotiation of inside-the-fence power directly from the power producer is anticipated. The O&M costs contain a substantial value identified as Management and Operator Fees. These are in addition to labor costs (labor costs include Plant Manager and Administrative Assistant). Poseidon explained that the Management and Operator Fees include capital reserve, unforeseen risk, insurance, legal expenses, permit compliance, contingency for changes in law, and profit for Poseidon and a contract operating company. This item would require further breakdown in order for the reviewer to assess the reasonableness of the value. All other line items in the O&M estimate are considered reasonable for the described treatment facilities.

Financing – Identification & Adequacy

According to Peter MacLaggan, Senior Vice President of Poseidon Resources Corporation, the development contractor for the P/SMCSD Monterey Bay Regional Seawater Desalination project, P/SMCSD has the right of first refusal to arrange for long-term financing of the capital costs for the MBRSDP. However, the District does not have the obligation to provide financing of capital costs or any obligation for short-term funding of pre-construction costs necessary to implement the project. The Development and Long-Term Management Agreement executed between P/SMCSD and Poseidon to implement the project further specifies that the District has the right to provide financing provided that such financing does not increase the price of water as set forth in the agreement (indicated to range from $1,100 to $1,200 per acre-foot in 2005 dollars). Mr. MacLaggan indicated that no decision has been made by P/SMCSD to undertake financing of the proposed project. He also indicated that if such financing is undertaken by the District, in all probability it would be municipal tax-exempt revenue bonds. B-E was told that to the extent P/SMCSD elects to not provide financing for the project, Poseidon has the right to arrange private equity financing. This scenario is outlined in the Development and Management Agreement between the parties. It was Mr. MacLaggan's opinion that private equity financing could be arranged for a comparable net cost on the order of one half of one percent higher than municipal tax-exempt financing and, of course, would not be tax exempt. The current market for non-taxable municipal revenue bond rates is about 4.5 percent, which would also be the estimated rate if the District undertakes financing for the project. If Poseidon implements financing, the comparable rate is expected to be on the order of 5 percent.

Project development costs such as engineering, permitting, legal, environmental documents, obtaining regulatory permits and approvals, and other related development costs will be initially incurred by Poseidon. Mr. MacLaggan indicated that internal corporate funds would be employed to meet these ongoing costs in order to implement the project. Such costs will be capitalized as part of the project capital cost for eventual reimbursement to Poseidon. Poseidon is also responsible for financing and implementing a pilot project to demonstrate the feasibility of desalination at the site. P/SMCSD submitted an application for a grant from the Department of Water Resources utilizing Proposition 50 funding to finance 50 percent of an estimated $3 million pilot plant project cost. The project was not recommended by DWR staff for grant funding according to the June 12, 2006 Staff Funding Recommendation for the 2006 Proposition 50 funding cycle.

In view of Poseidon Corporation potentially becoming the lead entity responsible for project financing, a brief review was made of the background of Poseidon Resources, Inc. Poseidon was founded in 1995 for the goal of developing and financing water industry projects. According to the company, it is the largest private owner of water facilities in Mexico as well as a leading developer of water and wastewater public-private partnerships in North America. The company is in the process of developing several high-profile desalination projects, including two in southern California at Carlsbad and Huntington Beach. A recent desalination project experience at Tampa Bay, Florida resulted in the project being taken over by the local water authority after plant operational failure and two contractor bankruptcies. Financing was problematic with the Tampa Bay project because of a legal challenge to the project from local homeowners, which resulted in about only half of the financing secured for the project up front. The second contractor-related bankruptcy created an obstacle to obtaining required financing for the rest of the project.[45]

Poseidon is a United States corporation whose largest shareholder is Warburg Pincus, an international investment firm. This partner-owned investment company has holdings in more than 120 companies located in North and South America, Asia, and Europe. Projects in the water industry are only a small portion of the investment activities of Warburg Pincus. However, the company's only business focus is private equity investing. With Warburg Pincus, it appears that Poseidon Resources has extensive private equity financing resources if obligated to obtain financing for the proposed MBRSDP in-lieu of the district not pursuing municipal bond financing.

[45] In a June 28, 2006 email, Poseidon Resources stated that the representation of the Tampa Bay Desalination project was not accurate. Poseidon Resources states that Tampa Bay Water exercised its option to purchase the project from Poseidon Resources when construction was 30% complete. At the time, according to Poseidon, the project was on schedule, within budget, would have been completed according to design, and would have met performance specifications. Furthermore, it states that testimony of water agency staff and outside experts confirms these conclusions and that these conclusions are part of the public record. The additional information does not nullify the initial conclusions of the text.

Quality of Cost Estimate

The current status of the cost estimate appears to be at a screening level. Very little information provided in support of the project was site-specific. Supporting information provided showed general arrangements and very conceptual site-specific layouts. The lack of supporting documentation and discussions with project proponents has led us to believe that the construction cost data submitted relies on cost data from similar facilities recently bid.

The annual volume reported for this proposal assumes the plant is run at full capacity year-round. This is unlikely unless regulating storage or a supplemental supply is provided to allow the project to meet peak demands. This storage or supply is not identified, so the yield may be reduced, additional costs may be required, or both.

Use of a larger contingency would be appropriate for the capital costs provided. The O&M cost estimate for treatment process is considered reasonable.

The exception to the above is information provided for the pilot plant. Comprehensive material has been prepared and submitted for this facility.

5.3 Sand City Desalination Project (SCDP)

Capital Cost

Capital costs for the proposed facilities are provided in the Monterey Peninsula Water Supply Project Phase 2 Technical Memorandum, dated June 23, 2004. The anticipated project costs are summarized in Table 7.

Table 7 – SCDP 2004 Capital and O&M Costs

	Project Option			
	HDD Wells for Collection and Disposal	HDD Wells for Collection and Pipeline to Regional Outfall for Brine Disposal		
Description		Beach Range Road Alignment	Union Pacific ROW Alignment	General Jim Moore Blvd Alignment
Collection System [1]	$21,600,320	$21,600,320	$21,600,320	$21,600,320
Brine Disposal System [1]	$18,555,000	$18,656,500	$19,185,000	$27,127,000
Desalination Plant	$28,250,000	$28,250,000	$28,250,000	$28,250,000
Treated Water Pipelines [2]	$12,692,500	$12,692,500	$12,692,500	$12,692,500
Electrical Transmission Upgrades Allowance [3]	$1,000,000	$1,000,000	$1,000,000	$1,000,000
Subtotal Construction Cost	$82,097,820	$82,199,320	$82,727,820	$90,669,820
Field Office Overhead (8%)	6,567,826	6,575,946	6,618,226	7,253,586
Subtotal	$88,665,646	$88,775,266	$89,346,046	$97,923,406
Contractor Markups (Home Office OH, Insurance, Bond: 16.25%)	$14,408,167	$14,425,981	$14,518,732	$15,912,553

	Project Option			
	HDD Wells for Collection and Disposal	HDD Wells for Collection and Pipeline to Regional Outfall for Brine Disposal		
Description		**Beach Range Road Alignment**	**Union Pacific ROW Alignment**	**General Jim Moore Blvd Alignment**
Subtotal	$103,073,813	$103,201,246	$103,864,772	$113,835,959
Contingency (25%)	$25,768,453	$25,800,312	$25,966,195	$28,458,990
Subtotal	$128,842,266	$129,001,558	$129,830,973	$142,294,949
Capital Cost Markups (Engineering, CM, Admin, Env, Legal: 30%)	38,652,680	38,700,467	38,949,292	42,688,485
Subtotal Capital Cost	$167,494,946	$167,702,025	$168,780,264	$184,983,433
Subtotal Capital Cost – Rounded	$164,500,000	$167,700,000	$168,800,000	$185,000,000
Land Acquisition				
Collection System Easements	$2,400,000	$2,400,000	$2,400,000	$2,400,000
Desalination Site (acquisition) [4]	$3,400,000	$3,400,000	$3,400,000	$3,400,000
Brine Disposal System Easements	$3,300,000	$700,000	$100,000	$200,000
Subtotal	$9,100,000	$6,500,000	$5,900,000	$6,000,000
Hydrogeologic Feasibility Investigations/Test Well	$2,000,000	$2,000,000	$2,000,000	$2,000,000
Total Capital Cost	$178,600,000	$176,200,000	$176,700,000	$193,000,000
Annualized Capital Cost (7%, 30 years)	$14,100,000	$14,200,000	$2,000,000	$2,000,000
Operating and Maintenance Costs				
RO O&M Costs	$1,300,000	$1,300,000	$1,300,000	$1,300,000
RO Power Costs	$5,900,000	$5,900,000	$5,900,000	$5,900,000
Intake/Discharge Facilities Non-Power O&M [5]	$240,000	$240,000	$240,000	$240,000
Intake/Discharge Facilities Power Costs [6]	$1,300,000	$1,350,000	$1,350,000	$1,650,000
Total O&M Costs	$8,740,000	$8,790,000	$8,790,000	$9,090,000
Total Annual Costs	$23,140,000	$22,990,000	$22,990,000	$24,690,000
Project Unit Costs ($/AF)				
Annual Capital Recovery	$1,714	$1,690	$1,690	$1,857
Annual O&M Cost	$1,040	$1,046	$1,046	$1,082
Total Unit Cost	$2,755	$2,737	$2,737	$2,939

[1] Costs to Plant Site 1 or 2
[2] Costs for Alignment Option 2
[3] Allowance for PG&E Grid Improvement
[4] Costs for Site 1. Re-location of existing business not included.
[5] UPRR Alignment would also include annual lease fee, which is not included.
[6] Includes collection wells, brine disposal power, and treated water pump station power.
Cost basis: ENR CCI = 7,644 (San Francisco, December 2002).

The Desalination Plant cost component of $28,500,000 is a reasonable value for this capacity (no breakdown of this value was provided) and the 25 percent contingency is appropriate, considering the level of estimate provided.

Operation and Maintenance Costs

The O&M cost estimate includes power consumption, which is 50 percent higher than currently considered state-of-the-art. Electrical cost is indicated to be $0.125/kWh. While

this value is valid for the gross energy cost, there is no adjustment to reflect high-efficiency design. This adjustment would reduce the annual RO power cost by $2M. While little itemization of O&M costs is provided, the balance of values appears reasonable for the project as described.

Financing – Identification & Adequacy

In view of the absence of a specific project currently being proposed, a financing plan for the SCDP by the MPWMD has not been developed. However, two prior water supply projects proposed by MPWMD provide examples of likely financing avenues to be taken if the Sand City Project is formalized.

In 1993, the District sponsored a 3 mgd Near-Term Desalination Project to provide a water supply to Zone No. 5. Estimated costs totaled $32 million (1994 dollars). The District proposed to implement the project by a private company contract to design, build, and operate the facility. The District envisioned financing through issuance of certificates of participation to finance the capital costs, or relying on the contractor to provide financing with repayment based on a unit water cost (contract standby amount or actual water produced). Final selection of a financing alternative was to be made following a successful voter election. Connection fees and user fees were part of either financing alternative at the time; project-related costs were based on financing at 8 percent for a 20-year term. Ultimately, voter approval was not successful.

The second major project proposed in 1995 involved a Los Padres Dam and Reservoir Project on the Carmel River for an estimated cost of $101.5 million. The District envisioned retaining a consultant to perform design and construction management, public building for construction, and project implementation through a prioritization contract with CAW. Project financing was proposed to be implemented through issuance of revenue bonds under the Revenue Bond Law of 1941. The sources of repayment were from user fees, connection charges, and other non-identified revenue sources. Funding was dependent on voter approval. The District also indicated that it intended to continue considering other funding alternatives including certificates of participation and a public-private partnership with debt and equity participation (CAW or other entity). The financial consultant evaluated rate impacts for a 20-year term for both the historical average interest rate (7.40 percent) and the then current rate of interest at 6.05 percent. As with the 1992 proposed project, voters did not approve this subsequent project.

The District is not required to obtain voter approval for all proposed water supply projects, according to MPWMD's General Counsel. For example, the issuance of certificates of participation in 1992 for $33.9 million to finance the cost of recycled water project facilities was done without the need for voter approval. Water supply projects undertaken for the common benefit of the District as a whole may not require voter approval, depending on the type of debt to be issued and source(s) of repayment.

Quality of Cost Estimate

The treatment plant capital cost estimate is not very detailed, but the values are considered reasonable for this size facility. O&M costs are considered to be higher than expected, due to a high electrical consumption assumption. An adjustment of this assumption could reduce the total cost of water by approximately $250 per ac-ft. The costs presented for the SCDP do not include any costs for pilot studies of the treatment process.

5.4 Seawater Desalination Vessel (SDV)

Capital Cost

Capital costs for the proposed facilities were presented in a summary document provided by the proponent. The proponent made numerous comments on costs reported in the draft GEI/B-E report, both updating capital cost information and describing contingencies included in suppliers estimates. Some of these estimates are sharply higher than those provided to GEI/B-E in early 2007. For example, the estimate for ship purchase and refurbishment was increased by 95 percent. Proponent's updated anticipated capital costs are summarized in Table 8.

Table 8 – SDV 2006-7 Capital Costs

Seawater Conversion Vessel -- Proponent's Statement of Costs (Seabed Pipeline option)

	Size (mgd)	Unburdened Capital Cost	Eng, OH, Legal, Admin	Contingency	Eng, OH, Legal, Admin	Contingency	Burdened Capital Cost	Notes
Process Equipment	**20**	**$40,310,000**	**0.0%**	**21.6%**	**$0**	**$8,710,000**	**$49,020,000**	1,2,06
Permitting				**25.0%**	**$6,000,000**	**$1,500,000**	**$7,500,000**	
Seawater Conversion Vessel		**$45,980,000**	**15.5%**	**25.0%**	**$7,140,000**	**$13,280,000**	**$66,400,000**	1,3,06
Seabed & Distribution Pipeline	**18**	**$30,630,000**	**18.5%**	**25.0%**	**$5,670,000**	**$9,070,000**	**$45,370,000**	4,07
HDPE Seabed Pipeline	18	$10,800,000	18.5%	25.0%	$2,000,000	$3,200,000	$16,000,000	
3 MG regulating reservoir		$2,109,000	18.5%	25.0%	$390,000	$624,750	$3,123,750	
10 mgd CAW pump station	10	$2,579,000	18.6%	25.0%	$480,000	$764,750	$3,823,750	
8 mgd regional pumping station	8	$2,281,000	18.4%	25.0%	$420,000	$675,250	$3,376,250	
Pipeline to terminal reservoir		$2,461,000	18.7%	25.0%	$460,000	$730,250	$3,651,250	
Regional pipeline		$10,398,000	18.5%	25.0%	$1,920,000	$3,079,500	$15,397,500	
Total	**18**	**$116,920,000**	**16.1%**	**24.0%**	**$18,810,000**	**$32,560,000**	**$168,290,000**	

Notes:

1\ Detail is subject to confidentiality agreement

2\ Intake pump station; Strainers/screens; Pretreatment membranes; RO system (pumps, racks, process chemicals, membrane cleaning system); Post treatment ; Membrane installation

3\ Purchase; Refurbishment; Retrofitting; Power generators; Salinity Dispersion

4\ PBS&J April 2007 memo

5\ Reported manufacturers' contingencies are backed-out from the reported capital cost. Manufacturers' contingencies are reported by WSC as 15.9 percent for the process equipment, and 25 percent for the ship and ship modifications

06\ 2006 cost level

07\ 2007 cost level

Operation and Maintenance Costs

The O&M cost estimate includes power consumption, chemical usage, operation and maintenance of SDV and barges, and membrane replacements. The detailed cost estimate is

subject to a confidentiality agreement between WSC and B-E. The SDV fuel cost estimate is based on receipt of a subsidized price credit on biodiesel fuel. Proponents estimate a power cost of approximately $0.05/kWh with the price credit, and approximately double this amount without the credit. The biodiesel without price credit is provided since price credit may not continue indefinitely. The cost without the price credit is approximately the same as the probable fuel alternative, bunker fuel. Costs associated with pumping water into the regional distribution system were not included in the proponent's cost estimate[46]. Total O&M costs are shown in Table 9.

Table 9 – SDV 2006 Operations and Maintenance Annual Costs

Component	Cost
Power for SDV Operations & pumping to shore	
Chemicals	
Membrane replacement, cleaning, and other spare parts	
Labor for Operation and Maintenance of SDV	
Labor for Operation and Maintenance of Barges	
Total O&M with Membrane Replacement	**$16,262,000**

Financing –Identification & Adequacy

The project proponents are proposing a public/private partnership with the MPWMD and/or with a regional entity, comprised of local water agencies. The form of the contract has not been determined along with the terms and conditions of a potential contract. The project proponents can obtain traditional project financing consisting of a long-term debt portion and a project equity portion, and have proposed the concept of full private funding with a per-acre-foot contractual arrangement with water users. No other details or components have been developed.

Quality of Cost Estimate

The scope of services for this study excludes rigorous analysis of the marine-based components of this proposal. Thus, no representation of the reasonableness of the ship, anchorages, shuttle barges, and seabed pipeline is presented. Costs were provided under a non-disclosure arrangement required by the proponents and are generally summarized and lack detail. Costs provided were for a SDV producing 20 mgd, but included only 18 mgd in distribution capacity. No detail on how the seabed pipeline would be anchored and protected is provided. To avoid visual aesthetic impacts, it is likely the anchoring location would require a substantially lengthened seabed pipeline extending into significantly deeper water which would require materials tolerant of greater pressures at significantly increased cost.

[46] No docking facility or transfer works is required if the seabed pipeline alternative is implemented.

Additional on-shore storage may be needed to provide adequate disinfection contact times. Proponents have supplied bid prices or bid estimates for some major components, which would be expected to be of good quality for these purposes. The capital cost for the ship is assumed amortized over 30 years, which may be unrealistic for the specified 25-year-old ship[47]. Maintenance cost estimates appear low for the operation in the marine environment.

The annual volume reported for this proposal assumes the plant is run at full capacity year-round. This is unlikely unless regulating storage or a supplemental supply is provided to allow the project to meet peak demands. This storage or supply is not identified, so the yield may be reduced, additional costs may be required, or both.

No fatal flaws were identified; however, contingencies for legal, engineering, environmental, and permit activities were not included in the cost estimate. It is recommended that a minimum contingency of 25 percent be used for all project components, and that overhead costs of at least 24 percent (consistent with other projects) be added.

[47] Proponent's comments on the GEI/B-E draft report state they will not be purchasing a 25-year-old ship. Ships used in proponent's cost estimate were 26 and 31 years old.

6 Regional Water Supply Considerations

In this section, each of the four projects is qualitatively evaluated on its potential to:

- Provide regional solutions,
- Expand to meet future needs,
- Impede or preclude future projects, and
- Impact disadvantaged communities.

Table 10 provides a brief summary of each project's size and the areas served.

Table 10 – Summary of Project Size and Areas Served

Project Name	Coastal Water Project	Monterey Bay Regional Desalination Project	Sand City Desalination Project	Seawater Desalination Vessel
Areas served	CAW service territory on the Monterey Peninsula	Monterey Peninsula, Northern Monterey County, P/SMCSD service areas, portions of PVWMAP[2]	CAW service territory on the Monterey Peninsula	CAW service territory on the Monterey Peninsula
Maximum Production Volume	10,430 ac-ft/ year[1]	22,400 ac-ft/year[3,4]	8,400 ac-ft/year	22,400 ac-ft/year[4]
Production Rate	10 mgd	20 mgd	7.5 mgd	20 mgd
Provides 10,730 ac-ft per year Order No. 95-10 replacement supply	Yes	Yes	No	Yes

[1] Expandable to 18,972 ac-ft/ year for a regional project and to serve build-out demand on the Monterey Peninsula.
[2] Pajaro Valley Water Management Agency.
[3] Demands totaling 20,930 ac-ft/ year have been identified.
[4] Providing maximum volume may not be possible unless storage or supplemental sources are provided to meet peak demands.

6.1 Coastal Water Project (CWP)

Currently, the Coastal Water Project (CWP) is progressing as the Basic CWP, which will provide enough desalinated water to comply with SWRCB Order No. 95-10. A larger regional project providing an additional 8,542 acre-feet per year to meet planned growth on the Monterey Peninsula and to supply water to Northern Monterey County, Castroville, and Marina has been studied. An option is under consideration by California American Water (CAW) as part of the CPUC environmental review process to upsize the CWP conveyance

pipelines between Moss Landing and the Monterey Peninsula to allow for future increased deliveries to the Monterey Peninsula.

The CWP and the Monterey Bay Regional Seawater Desalination Project would each provide water to the CAW customer base on the Monterey Peninsula, and, for practical purposes, are mutually exclusive.

If the CWP conveyance pipelines are not upsized as part of the initial project, it will be significantly more expensive to provide incremental capacity to meet future demands on the Peninsula.

There are no disadvantaged communities[48] in the project service area.

6.2 Monterey Bay Regional Seawater Desalination Project (MBRSDP)

The Monterey Bay Regional Seawater Desalination Project (MBRSDP) is envisioned as a regional project, supplying water to the Monterey Peninsula and a large portion of northern Monterey County. Water from the project would be delivered to customers within the Pajaro/Sunny Mesa Community Services District (P/SMCSD) current service area and recently acquired service territories (e.g., Moss Landing), but no other entity has contracted for a supply from the MBRSDP. Contemplated major distribution systems serving areas north, east, and south of the National Refractories treatment plant site could be incrementally added in the future.

The MBRSDP and the CWP share the major customer base on the Monterey Peninsula, and, for practical purposes, are mutually exclusive. That is, only one of these projects would likely be built. The August 5, 2005, Development and Management Agreement between Poseidon Resources and P/SMCSD contains the following provision: "The Parties acknowledge that it is the intention of the Parties to reach an agreement with the California-American Water Company, or its successor in interest, in order to facilitate the development of a single desalination facility in the Moss Landing area." It is not clear whether the MBRSDP would be viable without the CAW customer base.

The larger contemplated projects could have beneficial water quality impacts to disadvantaged communities in northern Monterey County.

[48] The State of California defines a disadvantaged community as one where the median household income is less than 80 percent of the statewide average.

6.3 Sand City Desalination Project (SCDP)

The Sand City Desalination Project, proposed in 2002 by the Monterey Peninsula Water Management District, was sized to provide a replacement supply to meet current water production as limited by SWRCB Order No. 95-10 and to offset a portion of the overdraft of the Seaside Groundwater Basin and is intended to serve only the CAW service area. Because of the unique features of the well intakes, the project should be capable of expansion, provided additional planning of the seawater intake system and distribution and collection systems is performed, and providing trunk mains are constructed with this expansion in mind.

Because the project would serve 40 to 70 percent of the supply contemplated for the MBRSDP and the CWP, removing this large portion of the customer base could make the other desalination projects uneconomic.

There are no disadvantaged communities in the project service area.

6.4 Seawater Desalination Vessel (SDV)

The Seawater Desalination Vessel (SDV) proposed by Water Standard Company is envisioned as supplying water to the Monterey Peninsula, with the potential to serve a large portion of northern Monterey County. Water from the project would be delivered to MPWMD and CAW and to other customers within the Monterey Bay area. A limited amount of proposed distribution system information has been provided by the project proponents, and additional planning, analysis, and design would be required if the project were to proceed.

The SDV, MBRSDP, and the CWP share the major customer base on the Monterey Peninsula, and for practical purposes are mutually exclusive. That is, only one of these projects would likely be built.

The larger contemplated projects could have beneficial water quality impacts to disadvantaged communities in northern Monterey County.

7 Implementability

- Schedule identified
- Permits identified, secured, and/or degree of difficulty
- Easements and agreements identified or secured
- Environmental impacts or environmental documentation

Permits Identified, Secured, and/or Degree of Difficulty

The permits and consultations[49] required for withdrawal of seawater are many. The list in Table 11 of this report is taken from the environmental documentation provided for this review by the proponents of the four projects discussed in this report.

The environmental document reviewed for the Coastal Water Project (CWP) is the Proponent's Environmental Assessment (PEA)[50] submitted by California American Water (CAW) to the California Public Utilities Commission (CPUC) as part of CAW's application for a Certificate of Public Convenience and Necessity (CPCN) to build, own, and operate the CWP.

Documents reviewed for the Monterey Bay Regional Seawater Desalination Project (MBRSDP) state that the temporary pilot plant test facility is exempt from the requirements of the California Environmental Quality Act (CEQA). Pajaro/Sunny Mesa Community Services District (P/SMCSD, the project proponent) states that they will be the lead agency in evaluating CEQA compliance for the full-scale MBRSDP. P/SMCSD anticipates that an Environmental Impact Report will be prepared for the project.

The environmental document reviewed for the Sand City Desalination Project is the Board Review Draft EIR for the MPWMD Water Supply Project, December 2003.

[49] Consultation is used here in a general sense and not in a legal sense used to describe guidance and established national policy for conducting consultation and conferences pursuant to Section 7 of the Endangered Species Act of 1973.

[50] RBF Consulting, *California American Water, Coastal Water Project – Proponent's Environmental Assessment for the Coastal Water Project, CPUC Proceeding A.04-09-019*, July 14, 2005. The PEA is submitted pursuant to CPUC regulations described in Section 2.3.1 (CPUC CEQA Compliance).

Table 11– Regulatory Requirements

Regulatory Requirement	Agency	Project			
		Coastal Water Project	Monterey Bay Regional Seawater Desalination Project	Sand City Desalination Project	Seawater Desalination Vessel
Certificate of Public Convenience and Necessity	California Public Utilities Commission	Yes	No	No	No
California Environmental Quality Act (CEQA)	State of California	Applies to all discretionary activities proposed, implemented, or approved by California public agencies			
SWRCB Order WR 95-10[1]	State Water Resources Control Board	Yes	Yes	Yes	Yes
Well Permit	Monterey County Environmental Health Department	N/A (unless drilling required)	N/A (unless drilling required)	Soil boring/ monitoring well permits	N/A (unless drilling required)
General Plan	City of Sand City	Yes	Yes	Yes	TBD
General Plan	City of Seaside	Yes	Yes	Yes	Yes
Underground Services Alert (USA)		N/A (unless drilling required)	N/A (unless drilling required)	Notification required 3 working days prior to drilling	N/A (unless drilling required)
Monterey Bay National Marine Sanctuary Management Plan	The National Oceanic and Atmospheric Administration (NOAA)	The Monterey Bay National Marine Sanctuary (MBNMS) provides sanctuary approval on RWQCB and other agency permits. Before construction of the proposed project, a Request for National Marine Sanctuary Authorization from MBNMS must be obtained for activities within the sanctuary.			
Central Coast Regional Water Quality Control Board Basin Plan	Central Coast Regional Water Quality Control Board	Yes	Yes	Yes	Yes
Carmel Valley Master Plan	Monterey County	No	No	No	No
Monterey County General Plan	Monterey County	Yes	Yes	Yes	Yes
North County Coastal LCP Land Use Plan	Monterey County	Yes	Yes	No	TBD
Castroville Community Plan	City of Castroville	Yes	Yes	No	TBD
Greater Monterey Peninsula Area Plan	Monterey County	Yes	Yes	Yes	Yes
City of Marina General Plan and LCP	City of Marina	Yes	Yes	No	TBD
Fort Ord Reuse Plan (FORP)	Fort Ord Reuse Authority	Yes	Yes	No	TBD
City of Del Rey Oaks General Plan	City of Del Rey Oaks	Yes	Yes	Yes	TBD
City of Monterey General Plan	City of Monterey	Yes	Yes	Yes	TBD

Table 11– Regulatory Requirements (continued)

Regulatory Requirement	Agency	Project			
		Coastal Water Project	**Monterey Bay Regional Seawater Desalination Project**	**Sand City Desalination Project**	**Seawater Desalination Vessel**
Water Distribution System Permit	Monterey Peninsula Water Management District	Yes	Yes	Yes	Yes
Encroachment and Construction Permits	Monterey County and Cities of Monterey, Del Rey Oaks, Seaside, Sand City, Carmel-by-the-Sea, Pacific Grove	Yes	Yes	Yes	Yes
Coastal Development Permit	California Coastal Commission (CCC)	CCC is one of California's two designated coastal management agencies for the purpose of administering the federal Coastal Zone Management Act (CZMA) in California. The most significant provisions of the federal CZMA give state coastal management agencies regulatory control (federal consistency review authority by USACE) over all federal activities and federally licensed, permitted, or assisted activities, wherever they may occur (i.e., landward or seaward of the respective coastal zone boundaries fixed under state law) if the activity affects coastal resources.			Yes, seabed pipeline
Section 1600 Streambed Alteration Permit and Incidental Take Permits	California Department of Fish and Game (CDFG)	Yes	Yes	Yes	TBD
National Pollutant Discharge Elimination System (NPDES) and Permit/401 Certification[2]	Regional Water Quality Control Board (RWQCB)	Yes	Yes	Yes	Yes
Clean Water Act (CWA)Section 10 and 404 Permits U.S.	Army Corps of Engineers (USACE)	Yes	Yes	Yes	Yes (seabed pipeline)
Endangered Species Act (ESA) Section 7 & Marine Mammal Protection Act Section 9 Consultation[4]	U.S. Fish & Wildlife Service (USFWS) and National Oceanographic and Atmospheric Administration (NOAA) Fisheries/ NMFS	Yes	Yes	Yes	Yes
Fish and Wildlife Coordination Act	US Fish and Wildlife Service	Requires federal agencies to provide equal consideration to fish and wildlife resources in the planning of and proposals for water resource development projects.			

Table 11– Regulatory Requirements (continued)

Regulatory Requirement	Agency	Project			
		Coastal Water Project	Monterey Bay Regional Seawater Desalination Project	Sand City Desalination Project	Seawater Desalination Vessel
Section 2081 of the Fish and Game Code	California Department of Fish and Game	Prohibits "take" of any state-listed species that the State Fish and Game Commission determines to be endangered or threatened.			
California Endangered Species Act (CESA)	State of California	Allows for "take" incidental to otherwise lawful development projects.			
Section 10 of the Rivers and Harbors Act of 1899	US Army Corps of Engineers	Permits to authorize certain structures or work in or affect navigable waters of the United States			
Regional Water Quality Control Board (RWQCB)	State of California Central Coast RWQCB	Develops and enforces water quality objectives and implementation plans that will best protect the beneficial uses of the state's waters, recognizing local differences in climate, topography, geology, and hydrology. This mission is accomplished through the provisions of the National Pollutant Discharge Elimination System (NPDES) program. Section 316(b) of the Federal Clean Water Act.			
Operations in U.S. waters; Navigation	U.S. Coast Guard	TBD	TBD	TBD	Yes
Applies to all parts of a project in contact with the seafloor outside of 3 nautical miles	U.S. Minerals Management Service	No	No	No	Yes
Clean Air Act	U.S. Environmental Protection Agency	No	No	No	Yes
Air quality permitting	Monterey Bay Unified Air Pollution Control District	Yes	Yes	Yes	Yes
Facilities Siting Permits	State Lands Commission	Approve leases for new facilities and intakes using once-through cooling (OTC) systems and imposing certain conditions on lease renewals and extensions for existing facilities. The Commission resolved that intake of large volumes of water for OTC has impacts on coastal organisms by entrainment and impingement			
Local Coastal Plans	Local Agencies	Identify the location, type, densities, and other ground rules for future development in the coastal zone.			

TBD = to be determined by each regulatory agency

[1] Must comply but no permit or approval needed.
[2] Section 316(b) of the Federal Clean Water Act requires the Environmental Protection Agency to ensure that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available to protect aquatic organisms from being killed or injured by impingement (being pinned against screens or other parts of a cooling water intake structure) or entrainment (being drawn into cooling water systems and subjected to thermal, physical, or chemical stress).

[3] Although the HDD seawater withdrawal system may not require a NPDES permit, this will have to be determined.

[4] Review of and comments on USACE and USFWS permits by the U.S. Coast Guard and NOAA Fisheries.

Although there were no specific lists of requirements or regulations identified for this review and the specific status of the regulatory process is not documented at this time, Table 11 lists requirements, reviews, approvals, and permits that may be required as projects progress.

All three terrestrially based projects would have similar permitting requirements. Current permitting activities center around the CPUC for the CWP and permitting for the pilot study for the MBRSDP. CAW has secured permits from Monterey County and the California Coastal Commission for the CWP pilot plant, and construction of the pilot plant is currently underway on the Moss Landing Power Plant site. P/SMCSD has filed applications but to date has not obtained the necessary permits for the MBRSDP pilot plant at the former National Refractories site.

U.S. Environmental Protection Agency Power Plant Regulation (Phase II Section 316(b))

In July 2004, the U.S. Environmental Protection Agency (EPA) published a final rule to implement Section 316(b) of the Clean Water Act[51] for certain existing power producing facilities that have a cooling water intake structure and are designed to withdraw 50 million gallons per day or more of water from rivers, streams, lakes, reservoirs, estuaries, oceans, or other waters of the United States for cooling purposes. The rule constitutes Phase II of EPA's section 316(b) regulation development, and establishes national requirements and procedures for implementing those requirements, applicable to the location, design, construction, and capacity of cooling water intake structures at these facilities. The rule applies to existing facilities that, as their primary activity, both generate and transmit electric power or generate electric power but sell it to another entity for transmission. The national requirements, which will be implemented through National Pollutant Discharge Elimination System (NPDES) permits, are based on the best technology available to minimize the adverse environmental impact associated with the use of cooling water intake structures. EPA's July 2004 final rule establishes performance standards that are projected to reduce impingement mortality by 80 to 95 percent and, if applicable, entrainment by 60 to 90 percent. With the implementation of the July 2004 rule, EPA intends to minimize the adverse environmental impact of cooling water intake structures by reducing the number of aquatic organisms lost as a result of water withdrawals associated with these structures.

The rule's impact on the Moss Landing Power Plant (MLPP) is that they are required to develop a compliance demonstration study that consists of a series of reports to evaluate how past and/or proposed actions will meet the 316(b) rule requirements. The State of California Regional Water Quality Control Board will review and comment on the study. MLPP has

[51] This discussion uses or closely paraphrases text from Federal Register / Vol. 69, No. 131 / Friday, July 9, 2004 / Rules and Regulations.

completed some mitigation but the adequacy of previous actions to meet new requirements is not known at this time.

The assumption in this report is that the MLPP has or will meet all of the new requirements of EPA's Phase II rules. It is also assumed that the new use occurring with the withdrawal of water from the MLPP discharge for the Coastal Water Project and/or the Monterey Bay Regional Seawater Desalination Project will not constitute a new use or change the MLPP's requirements for withdrawal for cooling related to power generation. Potential changes resulting from Phase II rules or any other new regulations are speculative and not included here. However, the potential application to the MLPP adds a measure of risk to co-located projects. Assessment of potential impacts related to entrainment or impingement are only assessed related to extant regulations and requirements for operation of the MLPP.

Resolution of the California State Lands Commission[52]

On April 17, 2006, the California State Lands Commission (Commission) adopted a resolution that expresses its intent not to approve any leases for new power plants using once-through cooling (OTC) systems and imposing certain conditions on lease renewals and extensions for existing facilities. The Commission resolved that intake of large volumes of water for OTC has impacts on coastal organisms by entrainment and impingement. The Commission defined impingement by the occurrence of marine organisms trapped against components of the cooling water system, such as screens, where they die. Entrainment was defined as the induction of smaller marine organisms into and through the cooling water system where most, if not all, of the organisms are destroyed by mechanical damage, temperature increases, or toxic stress. In addition, the Commission resolved that OTC results in biological impacts through thermal discharge. They defined thermal discharge as the release of cooling water at temperatures above ambient conditions resulting in elevation of the temperature of marine waters in the immediate vicinity of the outfall. The Commission found that these effects adversely impact coastal and ocean resources and uses that are within its jurisdiction.

The Commission urged the California Energy Commission and the State Water Resources Control Board to expeditiously develop and implement policies that eliminate the impacts of OTC on the environment from all new and existing power plants in California.

The Commission stated it shall not approve leases for new power facilities that include OTC technologies.

The Commission stated that it will not approve new leases for power facilities, or leases for re-powering existing facilities, or extensions or amendments of existing leases for existing

[52] The information about the California State Lands Commission's resolution is reported at the Commission's "meeting and voting records" for April 17, 2006, on http://www.slc.ca.gov/.

power facilities, whose operations include once-through cooling, unless the power plant is in full compliance, or engaged in an agency-directed process to achieve full compliance with requirements imposed to implement both Clean Water Act Section 316(b) and California water quality law as determined by the appropriate agency, and with any additional requirements imposed by state and federal agencies for the purpose of minimizing the impacts of cooling systems on the environment.

The Commission stated that it will include in any extended lease that includes once-through cooling systems a provision for noticing the intent of the Commission to consider re-opening the lease if the appropriate agency has decided in a permitting proceeding for the leased facility that an alternative, environmentally superior technology exists that can be feasibly installed or if state or federal law or regulations otherwise require modification of the existing OTC system.

The Commission's resolution "calls on public grantees of public trust lands to implement the same policy for facilities within their jurisdiction."

The Commission's Executive Officer stated that copies of this resolution would be transmitted to the Chairs of the State Water Resources Control Board, the California Energy Commission, and the California Ocean Protection Council; all grantees; and all current lessees of public trust lands that utilize OTC.

Proponents state that since MLPP leases its intake site from the Moss Landing Harbor District it would not be affected by the resolution. Whether this is true or not is beyond the scope of this study. However, the impact from this resolution on the MLPP is considered generally the same as those from the Federal rule for the foreseeable future. Generally, the rules are based on how the intake is to be used, not who owns it.

This resolution of the California State Lands Commission, if implemented for all cooling water intakes in California, could adversely impact the feasibility of the Coastal Water Project and the Monterey Bay Regional Seawater Desalination Project. While neither project directly uses OTC, the MLPP relies on OTC. The CWP is proposed to draw feed water from the MLPP cooling water discharge and then return the brine via the cooling water outfall.

Environmental Impacts or Environmental Documentation

Both the CWP and the SCDP have prepared environmental documents in the form of the Proponent's Environmental Assessment and a Board Review Draft Environmental Impact Report, respectively. The MBRSDP has not prepared any environmental documents but they indicate that they are in the process of hiring an environmental consultant.

Of significant concern of any of the projects are impingement and entrainment impacts from the conveyance method for seawater source water. The main causes of injury and loss of fish and any other animals or plants at water intakes are entrainment and impingement. The

extent of any potential impacts is related to the plant and animal species present at the intake. Some animals large enough to not be influenced by the flows at the intake will be adversely impacted. The life stage and size of the organisms relate to potential impacts; weakly swimming or immature fish are more likely to be entrained.

The location, design, and operation of the intake structure affect the level of potential impacts at a water intake. Intakes that are located away from plant and animal habitat can decrease or eliminate entrainment and impingement. Intakes that are subsurface (e.g., Ranney wells) will not impinge or entrain animals in the water column. Intakes that are angled so that natural currents sweep by the intake can develop sweeping velocities that prevent or greatly reduce that possibility of fish or other animals from being impinged or entrained.

Monterey Bay Aquatic Environment

The aquatic environment near the proposed projects described in this implementability study is associated with the Monterey Bay National Marine Sanctuary, the Elkhorn Slough, Moss Landing Harbor, the biological habitats, and threatened and endangered species. The projects are located at or near the intersection of three marine geographical areas: Elkhorn Slough, Moss Landing Harbor, and Monterey Bay. These areas include open water, submerged aquatic vegetation, flats, marshes, intertidal zones, and beaches. An assessment of these environs concluded that eight fish larval species made up 95 percent of the larvae entrained during the 12 months of site surveys.[40] Three of the eight species (approximately 5 percent of the larvae) have commercial or recreational value. They are the Pacific herring *Clupea harengus*, white croaker *Genyonemus lineatus*, and Pacific staghorn sculpin *Leptocottus armatus*. Pacific herring in California have been harvested primarily for their roe, with small amounts of whole herring marketed for human consumption, aquarium food, and bait. The white croaker, although not a highly prized species, has been an important constituent of commercial and sport fisheries in California; most of the commercial catch is sold in the fresh fish market with a small amount used for live bait. The Pacific staghorn sculpin is also not highly prized as a food or sport fish, but is a popular bait fish for the San Francisco Bay Delta striped bass sport fishery.[53]

Easements and Agreements Identified and Secured

The P/SMCSD has executed an agreement with the owner of the National Refractories site. That agreement is the only agreement or easement for use of land that has been executed for any of the projects.

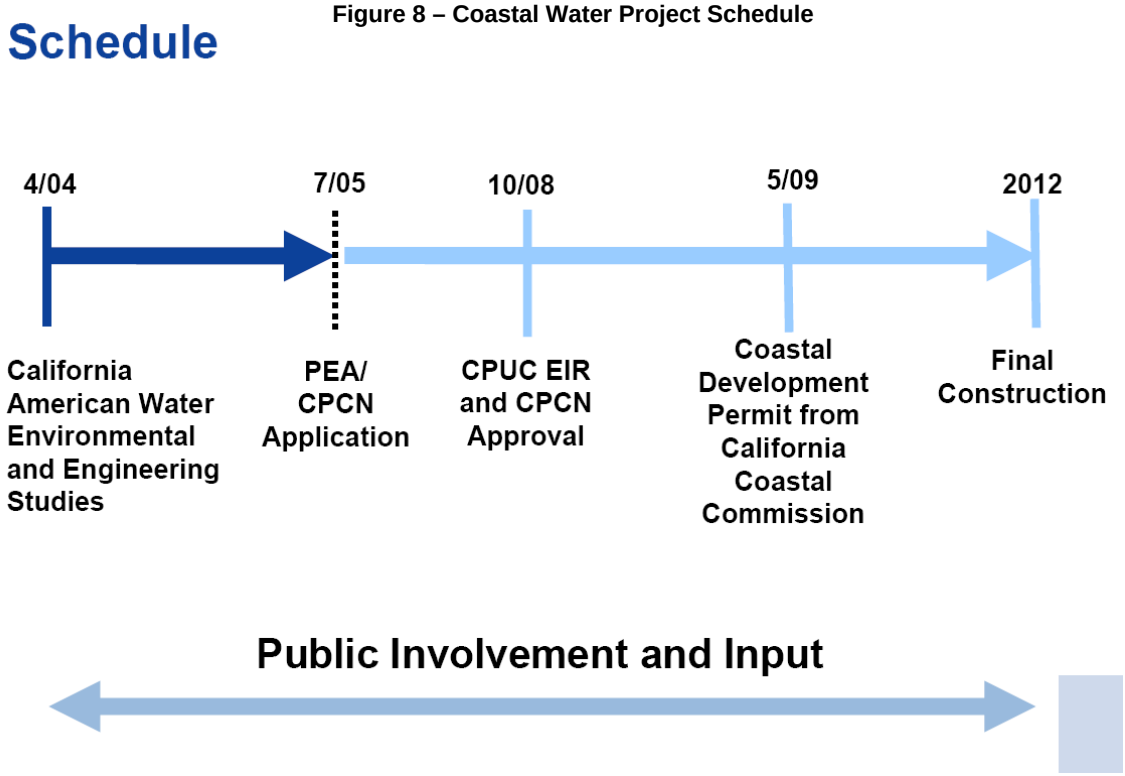
[53]This information is from a 2001 California Department of Fish and Game report cited on page 5.7-10 of the Proponent's Environmental Assessment for the Coastal Water Project, CPUC Proceeding A.04-09-019.

7.1 Coastal Water Project (CWP)

Schedule Identified

Figure 8 presents the project schedule provided by the project proponents in May 2007.

Figure 8 – Coastal Water Project Schedule



Environmental Impacts or Environmental Documentation

The proposed CWP desalination plant would receive raw seawater from the MLPP cooling water return system. The MLPP is currently permitted for up to 1.226 billion gallons per day of seawater intake. Units 1 and 2 of MLPP currently utilize a seawater intake within the northern portion of Moss Landing Harbor. The MLPP utilizes modified traveling screens at its intakes. This intake screening system includes vertical screen panels mounted on a continuous belt. The screen mechanism consists of 3/8-inch (0.9 cm) mesh, a drive mechanism, and a spray cleaning system. A key feature of the CWP is that the source water would come through the Units 1 and 2, which have recently been modernized and operate at a more consistent and higher volume. Seawater is collected at the disengaging basin after it has been pumped through Units 1 and 2. A weir within the disengaging basin controls the water depth and cooling water outflow to the discharge pipelines. Source water for the desalination plant would be diverted from the disengaging basin (which receives water only from Units 1 and 2) prior to discharge into the ocean.[54]

The most recent 316(b) resource assessment of proposed modernization plans for the MLPP concluded that the long-term impact of impingement and entrainment on the populations of marine and estuarine fish, fish larvae, and cancer crab larvae would be relatively minor.[55]

Duke Energy modified the intake system to reduce entrainment and impingement. In addition to the intake modifications, the Regional Water Quality Control Board, the California Energy Commission, and Duke Energy developed a habitat enhancement program called the Elkhorn Slough Enhancement Program. This program is designed to minimize the adverse environmental effects of the intake system on the Elkhorn Slough watershed resources and allow Duke Energy to comply with Section 316(b) of the CWA. The objectives of the Elkhorn Slough Enhancement Program are to implement a conservation acquisition program for Elkhorn Slough and restore wetlands.

The CWP desalination facility would not alter the operations of the MLPP. The volume and velocity of water entering the MLPP intakes would remain unchanged. The proposed desalination facility would not have a separate direct ocean water intake and would use only cooling water that is already screened by the MLPP. Although the desalination facility would have its own screening system (three-millimeter screens), the system would convey any screened organisms back to the MLPP outfall. Thus, there would be no impacts due to impingement as a result of Desalination Facility implementation.

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[54] This description is taken from the CWP Conceptual Design Report (Draft) prepared for California American Water, September 2005.

[55] This conclusion is taken from the Proponent's Environmental Assessment for the Coastal Water Project, CPUC Proceeding A.04-09-019 page 5.7-9.

A nominal amount of additional entrainment mortality may occur as a result of Proposed Project operation. The majority of organisms entrained by the MLPP are killed or severely distressed by the cooling water process.[56] Additionally, any organisms that survive the OTC water process and enter the desalination facility would be killed.

However, the amount of water diverted for the proposed project will represent approximately 1.8 percent of the MLPP's permitted maximum flow of 1.226 billion gallons per day, which is already permitted under the assumption of 100 percent mortality. Due to the relatively small amount of water that would be diverted to the proposed Desalination Facility, impacts from additional entrainment mortality are not anticipated to be significant. In addition, the operation of the MLPP's existing modified intake system (required as part of the 316[b] compliance process) will further minimize entrainment impacts.

Conclusion

The proposed seawater intake for the project is from the cooling water at the Moss Landing Power Plant. The proposed project's desalination facility would not alter the operations of the MLPP. The operation of the CWP would not alter the potential impacts associated with operations of the MLPP. Thus, as long as the MLPP is permitted to operate, the CWP should be able to operate at the proposed levels without adversely impacting the aquatic resources of the associated marine environments.

The PEA includes a summary of environmental impacts and mitigation measures for the proposed project. Many of these environmental impacts are deemed to be significant and would have considerable accompanying mitigation measures.

7.2 Monterey Bay Regional Seawater Desalination Project (MBRSDP)

Schedule

Table 12 presents the general project implementation schedule that is included in the Monterey Bay Regional Desalination Project Conceptual Design Report.

[56]One hundred percent mortality is generally assumed for entrained organisms according to National Pollutant Discharge Elimination System – Final Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities, U.S. Environmental Protection Agency, July 9, 2004.

Table 12 – MBRSDP Schedule

Key Project Implementation Task	Target Completion Date
Environmental Review and Permitting	June 2008
Water Supply Arrangements	January 2007
Design	June 2008
Construction Completion	June 2010
Commercial Operation	July 2010

On March 22, 2006, the Monterey County Director of Planning and Building Inspection approved Coastal Administrative Permit (Resolution #050541) for construction and operation of the MBRSDP Pilot Plant. On April 3, 2006, the Coastal Commission received the County's Notice of Final Action and associated records to start the Coastal Commission's 10-working-day appeal period; appeals were filed during the period. The appellants contend that the project does not conform to the County's Local Coastal Plan.

The Coastal Commission held a June 15, 2006 hearing on the appeals. The Coastal Commission staff has recommended that the Commission, after public hearing, determine that substantial issues exist with respect to the grounds on which the appeals have been filed. The appellants have raised substantial issues in that project approval and conditioning by the County through issuance of a Coastal Administrative Permit does not conform to the applicable LCP policies.[57]

Environmental Impacts or Environmental Documentation

The proposed water intake for the Monterey Bay Regional Seawater Desalination Project (MBRSDP) is from two sources: (1) direct pumping from the Moss Landing Harbor via the existing National Refractories intake, and /or (2) the heated power plant cooling water from the MLPP. The MLPP cooling water is the preferred source of water for the desalination plant because of its higher water temperature. The MBRSDP is expected to rely on water from the National Refractories intake when the MLPP is not operating.

The proposed MBRSDP is described in two stages. The first is a pilot plant test desalination facility. This facility is stated to be exempt from the requirements of the California Environmental Quality Act.[58]

[57] California Coastal Commission, Staff Report and Recommendation on Appeal Substantial Issue, May 25, 2006.

[58] Monterey Bay Regional Desalination Project, Report of Waste Discharge Application for Renewal, NPDES Permit CA0007005, National Refractories Ocean Outfall, November 1, 2005.

P/SMCSD will be the lead agency for evaluating compliance of the proposed full-scale MBRSDP with CEQA requirements. The P/SMCSD states in its report of waste discharge, application for renewal, Monterey Bay Regional Desalination Project (NPDES Permit CA0007005) (November 1, 2005), that the evaluation will comply with CEQA requirements. Its report also states that an Environmental Impact Report will be prepared.

National Refractories – One of the proposed water intakes for the MBRSDP is the existing National Refractories seawater intake system. For the full-scale MBRSDP facility the heated cooling water from the MLPP represents a preferred source since reverse osmosis treatment is more efficient when using warm water.[59] There was no detailed description of the National Refractories seawater intake system available for this report and the operational assumptions are uncertain. We were provided with an underwater video survey of the exterior of the National Refractories outfall and diffuser.[60] It appears that the outfall has been damaged by earthquake activities and its condition and repairs are uncertain.

The assumption in this report is that the National Refractories intake operated for the MBRSDP has met or will meet all of the new requirements for withdrawal of seawater. It is also assumed that the new use occurring with the withdrawal of water for the MBRSDP will not constitute a new use or change the National Refractories intake's requirements for withdrawal. Potential changes resulting from new rules or any other new regulations are speculative and not included here. Potential impacts due to entrainment or impingement are only assessed when related to extant regulations and requirements for operation of the National Refractories intake.

Moss Landing Power Plant – The MLPP is located on the east shore of Moss Landing Harbor. Moss Landing Harbor is on the California coast between Santa Cruz and Monterey, California. The MLPP has two separate water intake structures. The older intake that provided water for Units 1 through 5 of the MLPP is currently unused. The intake for Units 6 and 7 is currently used and is the proposed intake for water for the Monterey Bay Regional Seawater Desalination Project. The intakes are screened with 3/8 inch (0.9 cm) mesh. Water that is pumped into the MLPP and used to cool the thermal units will then be used by the MBRSDP.

The potential impacts of water intake operations have been summarized in the "Moss Landing Power Plant Modernization Project 316(a) Resource Assessment"[61] The results of the field studies indicated that no evidence was found to indicate that cooling water system operations will result in an adverse impact on the populations of fish and invertebrates inhabiting Moss Landing Harbor, Elkhorn Slough, and Monterey Bay. Most of the

[59] ibid

[60] The date of the video is February 2001, provided by Moss Landing Marine Laboratories staff, April 2006.

[61] The conclusions reported here are from text beginning on page 7-36 of this April 28, 2000, Duke Energy report.

organisms entrained and impinged are species that are widely distributed by ocean currents in Monterey Bay and along the Pacific coast. The risk of localized population effects is reduced by the broad extent and movement of these species. The larvae of species that are entrained have very high mortality rates and the percentage of these larvae is small. The report concludes that existing and proposed modernization operations impacts have been and will continue to be undetectable.

Conclusion

The proposed water intake for the MBRSDP is from two sources: (1) direct pumping from the Moss Landing Harbor via the existing National Refractories intake, and /or (2) the heated power plant cooling water from the MLPP. The availability and potential impacts of operating the National Refractories outfall are uncertain because of damage to the outfall. The results of the field studies at the MLPP indicate that cooling water system operations will not result in any adverse impacts on the populations of fish and invertebrates inhabiting Moss Landing Harbor, Elkhorn Slough, and Monterey Bay.

7.3 Sand City Desalination Project (SCDP)

Schedule

This project currently has no activity and there are no scheduled activities.

Environmental Impacts or Environmental Documentation

The Board Review Draft EIR for the MPWMD Water Supply Project (December 2003) provides a significant amount of information on the project and its impacts. The Sand City Desalination Project is described in the Board Review Draft EIR and in the report titled "Sand City Desalination Project Feasibility Study" (April 16, 2004). The project is sized at 8,400 ac-ft per year (7.5 mgd) of treated water to comply with State Water Resources Control Board Order WR 95-10 under current community water demand. To meet this objective, the project would include either an array of horizontal directionally drilled (HDD) or radial collector wells for seawater collection (feedwater source) located along the coastal beachfront of Sand City, and a brine disposal system using either HDD wells along the coast in former Ford Ord or a pipeline to the Monterey Regional Water Pollution Control Agency's wastewater treatment plant facility north of Marina (regional outfall).

Figures showing the proposed seawater collection system layouts for HDD wells and radial collector wells are included in the feasibility study. For a project using HDD collector wells, the collector wells would consist of relatively shallow angled (typically, 15 degrees from horizontal) blank well casing extending from the surface entry point, beneath the sand dunes and 200 feet (~70m) west of the mean tide line. West of this point, (i.e., seaward of the shoreline) the wells would consist of near-horizontal perforated screen, at a minimum depth below the sea floor of 15 to 30 feet (~5 to 10 m) in the offshore portion of the aquifer

referred to as Older Dune Sand Aquifer, or coastal aquifer, or in permeable offshore marine sediments.

Because the intake for the seawater is below the sea floor, it is assumed that there are no potential impacts from impingement or entrainment resulting from seawater withdrawal.

Conclusion

The Sand City Desalination Project would include either an array of horizontal directionally drilled (HDD) or radial collector wells for seawater collection (feedwater source) located along the coastal beachfront of Sand City. Because the intake for the seawater is below the sea floor, it is assumed that there are no potential impacts from impingement or entrainment resulting from seawater withdrawal.

For brine discharge, the project would utilize either HDD wells along the coastal portion of former Fort Ord north of Sand City, or the outfall from the regional wastewater treatment facility north of the Marina. The Board Review Draft EIR stated that the HDD wells option would have less-than-significant environmental impacts on Monterey Bay aquatic resources. Discharge to the outfall would be subject to the regional facility's NPDES permit.

The Board Review Draft EIR includes a summary of environmental impacts and mitigation measures for the proposed project. Many of these environmental impacts are deemed to be significant and would have considerable accompanying mitigation measures.

7.4 Seawater Desalination Vessel (SDV)

Schedule

Project proponents have stated that water delivery will commence three years after contractual agreements are signed. In our opinion, this seems optimistic given the uncertainties in the permitting process. No other scheduling information was provided.

Environmental Impacts or Environmental Documentation

Air Quality Permitting Requirements

With respect to air quality issues, the Water Standard Company has provided conceptual project information on the Seawater Desalination Vessel (SDV), such as its approximate age, construction, equipment and configuration, approximate location, hours of operation, and water product transfer options. The materials also note potential emission sources such as gas turbine engines (main but not auxiliary), fuel mix (biodiesel capability), power supply, and pumps. The information provided features the "green" nature of the technology used for the SDV but downplays the air permitting issues that may correspond with construction and operation of the plant. In addition, some optional scenarios (e.g., a seabed pipeline versus shuttle vessels for transfer to mass storage) appear intermittently in the materials and would

be expected to have greatly varying air quality requirements. Most of the information needed for an adequate air quality permitting assessment is not compiled specifically for that purpose; rather, it is scattered throughout the materials. The proponents acknowledge that more detailed information will be made available once costs and other feasibility concerns are sorted out. While it is reasonable that air emissions controls can be achieved through this proposal, it is also recommended that a legal and regulatory analysis of air quality requirements be conducted when the project is described more clearly.

For example, file materials prepared by PBS&J suggest that air permits for construction of the treatment vessel and docks and piers will not be an issue. Other materials explain the basis for this assumption—the treatment vessel will not be refurbished locally, and docks and piers will not be necessary. Nevertheless, the materials do not discuss the potential construction permitting requirements for laying a seabed pipeline that may include air quality emissions from barges and drill rigs. These construction-related emissions were considered in a Minor New Source Review air permit application to EPA Region IX for a proposed deepwater port near Ventura, California called "Cabrillo Port." In addition, the assumption that terminal storage for water needs to be constructed appears in the Water Standard Company "Proponent's Statement," dated April 11, 2007, but is not considered part of the proposed alternative package. Proponent's supplied materials indicate that no permanent mooring or turrets will be constructed; but these assumptions are not carried forward to the Proponent's Statement[62]. Each of these components would need to be clarified to assess construction-related air emissions and permitting requirements.

In addition, Section 30253(3) of the California Coastal Act requires that an off-shore vessel operating within 24 nautical miles of the California coast must be "consistent" with requirements imposed by Air Resources Board (state) and the local air district, in this case, Monterey Bay Unified Air Pollution Control District (MBUAPCD). The 2006 PBS&J letter to the CPUC does not directly address the air quality impacts listed in the original NOP for the Moss Landing Desalination Plant/Coastal Water Project, although some may continue to apply in the SDV alternative. In addition to construction-related permitting, a key issue will be related to power generation for the SDV. The materials generally explain that the GE LM2500 gas turbines will power the equipment on-board. These engines are used routinely on cruise ships and commercial aircraft, which are regulated as mobile sources of air pollution. Nevertheless, it would be appropriate to obtain a legal opinion on the applicability of certain stationary source requirements (including federal New Source Performance Standards) to the gas turbines and the on-board equipment drawing power from the turbine while it is operating at a location fixed by mooring or satellite. To complete the SDV

[62] Proponent's comments on the draft GEI/B-E report include: "For clarification, at the time the PBS&J report was prepared, seabed pipelines were not an option and dynamic positioning was the preferred alternative. Switching from barge delivery to pipeline has occurred during discussions with Monterey over the past year. WSC will be in full compliance for seabed construction.

assessment, it would also be useful to have more information on the pumps and any auxiliary engines associated with them, as well as on-board generators for crew facilities[63].

As noted above, the Minor New Source Review permit application for the proposed Cabrillo Port is a recent example of agency review and applicable air requirements for off-shore vessels. For the Cabrillo Port application, the U.S. EPA Region IX proposed to address permitting of the emission sources in the coastal waters off Ventura through an Authority to Construct issued under District Rules, which would also incorporate applicable federal and state requirements. The port was required to analyze emission controls to determine Best Available Control Technology (BACT) under District rules (which included Selective Catalytic Reduction (SCR) and oxidation catalysts). (The deepwater port would have individual diesel-fired equipment on-board, but information on the SDV suggests that all power would come from the main engine, which burns marine gas-oil or biodiesel.) EPA did not expect to require the purchase of emissions offsets and the area would be designated as "unclassified/attainment" for the purposes of federal New Source Review/Prevention of Significant Deterioration requirements. Several commitments regarding fuel use and the offset of onshore diesel emissions were included in the policy statement. It is noted, however, that this proposed air permit and the EPA Region IX policy for the deepwater port was challenged by the Environmental Defense Center in Santa Barbara (April 6, 2007) as "violating the Clean Air Act." It was also alleged to be inconsistent with District and ARB requirements for the use of BACT and demonstrating the use of emission offsets. The review of this application suggests that air permitting issues for the SDV are potentially complex and may be contentious.

The SDV information appears to be sensitive to issues related to fuel use and greenhouse gas emissions. Both U.S. EPA and the ARB are pressing for more regulation of fuels used by marine vessels, and greenhouse gas emissions concerns are highly visible in light of AB 32. The SDV information states in some places that only biodiesel will be used for both the "mother ship" and the shuttle vessels. In the Proponent's Statement, on the other hand, biodiesel capabilities are noted but not identified as the only fuel. It will be important to clarify the fuel mixture commitments in the SDV proposal[64].

SDV proponents have made a number of public statements to the effect that local regulatory agencies favor or support the ship-based desalination concept, the intake and discharge schemes, and the seabed pipeline. Telephone discussions with representatives of the Monterey Bay National Marine Sanctuary, the California Coastal Commission, and the Monterey Bay Aquarium Research Institute reveal a more measured assessment. In

[63] Proponent's comments on the draft GEI/B-E report emphasize the ship's main engine would not be used to produce power as all power would be generated from the gas turbines.

[64] Proponent's comments on the draft GEI/B-E report state their intent to burn biodiesel; however if biodiesel is not available the turbines could use marine gasoil.

summary, each of these agencies or organizations believes the SDV approach may have merit and should be studied further, but none are offering endorsement, and all believe the permitting challenges have been significantly underestimated by SDV proponents.

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Materials Submitted by or On Behalf of Proponents of Seawater Desalination Vessels

January 18, 2007

1. December 1, 2006 quote from General Electric for LM 2500 – 60 Hz 14000 KWe turbine-generator set
2. July 6, 2005 letter from B&P International to Andrew Gordon, WSC, transmitting insurance estimate (see also item 50)
3. Pall Corp "Operating cost estimate" for 20 mgd seawater conversion vessel, marked "California Metropolitan Waterworks"[65]
4. Capital cost estimate for 20 mgd desalination equipment
5. Capital cost estimate for 20 mgd seawater conversion vessel & barges
6. Tanker barge cost estimate
7. Estimate to purchase & refurbish ship and barges
8. GE fuel cost estimate

March 7, 2007

9. March 31, 2006 spreadsheet, "V Ships USA LLC Operational Budget Summary in US$" additional operating costs (included in item 49)

March 9, 2007

10. PBS&J, November 10, 2005 "Mobile Marine Desalination Environmental Documentation and Project Permitting Requirements Study, Version 2.0"

March 11, 2007

11. George N. Somero (Director—Hopkins Marine Station of Stanford University) 2/27/07 letter nominating concept for Stockholm Industry Water Award.

[65] see also item 48

SCV Data from Andrew Gordon, Water Standard Company

March 26, 2007

12. Pall Corporation Process Description with process diagram and schematics for racks and skid details

March 27, 2007

13. Slide presentation from Bureau Veritas[66], a ship classification society[67]
14. Slide presentation for Sofec Mooring Systems

March 29, 2007

15. MPWMD Desal Matrix with SCV data added (marked "FINAL for 9/18/06 Meeting")
16. PBS&J, November 10, 2005 "Mobile Marine Desalination Environmental Documentation and Project Permitting Requirements Study, Version 2.0" (duplicate of item 10)

April 23, 2007

17. April 18, 2007 memo from Skip Griffin, PBS&J, "Planning Level Opinion of Probable Cost, Seabed Pipeline, Monterey Bay. (See also item 31, dated April 2007 but not provided until October 17, 2007)

April 10, 2007

18. PBS&J Permitting Study (duplicate of item 10)
19. Pall 20 MGD Detailed Process Description w/Process Flow Diagrams, MF Racks and RO Skid Details (duplicate of item 12)
20. Bureau Veritas information (duplicate of item 13)
21. Mooring Systems Technology for Desalination Vessels (duplicate of item 14)
22. Matrix submitted to MPWMD on behalf of Water Standard Company (duplicate of item 15)
23. Schedule to Readiness and Environmental Benefits (one page each)

[66] http://www.bureauveritas.com/webapp/servlet/RequestHandler?mode=PT&pageID=34469.55088&nextpage=siteFrameset.jsp

[67] Mr. Gordon's 3/27/07 note states; "not only is WATER STANDARD regulated by all Federal, State and local Agencies, we are also governed by a classification society that has the equivalent power and control of the FAA, but in marine operations.

April 11, 2007

24. Water Standard Company Proponent's Statement April 11, 2007

August 13, 2007

25. August 13, 2007, 14 pages of comments in matrix Page/Issue/Report Statements/ Comments/Rebuttal format
26. July 25, 2007 letter from Jeffery M. Seibert, Pall Corporation to Amanda Brock, Water Standard Co, "GEI Evaluation of Seawater Desalination Projects Proposed for the Monterey Peninsula"
27. (Removed with proponent's concurrence)
28. George N. Somero (Director—Hopkins Marine Station of Stanford University) 2/27/07 letter nominating concept for Stockholm Industry Water Award (duplicate of item 11)
29. June 6, 2007, Beveridge and Diamond (B & D) for Water Standard Co. "Draft Matrix of Key Environmental Authorizations, Water Standard Company Seawater Desalination Vessel (SDV)"

October 17, 2007

30. October 25,2006 letter from Skip Griffin, PBS&J to Mr. Jensen Uchida, CPUC, "Seawater Conversion Vessels – An Alternate Desalination Plan for the Coastal Water Project (CWP)"
31. April 2007 PBS&J memo "Facilities Required to Connect a Seawater Desalination Vessel to the California-American Water System, Supplemental Information for California Public Utilities Commission in Response to CPUC Notice of Preparation for Coastal Water Project" (see also item 17)
32. April 10, 2007 e-mail memorandum from Skip Griffin to Andrew Gordon and Amanda Brock, "Meeting w CA Health Dept on April 11th"
33. July 25, 2007 letter from Jeffery M. Seibert, Pall Corporation to Amanda Brock, Water Standard Co, "GEI Evaluation of Seawater Desalination Projects Proposed for the Monterey Peninsula" (duplicate of item 26)
34. (Removed with proponent's concurrence)
35. (Removed with proponent's concurrence)
36. (Removed with proponent's concurrence)

November 1, 2007

37. Revised Cost Summary, undated. High level summary only, showing vendor sources, but without line item detail or back-up source information.
38. October 2007, SOFEC, "Operational Experience And Technical Description For An External Turret System For Water Standard Company For Use In Monterey Bay, California"

November 12, 2007

39. November 12, 2007 e-mail "SDV Documents" explaining vessel anchoring interpolation.
40. March 23, 2007, SeaTec, "Proposal to Water Standard for Engineering Support Services For the Floating RO Plant Ship Conversion"
41. July 11, 2005 e-mail from Eldon Robinson, Bureau Veritas, to Andrew Gordon, WSC, "Bureau Veritas Costs"
42. April 30, 2007 e-mail from Mike Robinson, Bureau Veritas, "Class Society Ongoing Inspection Costs"
43. February 16, 2007 letter from Ron Mack, SOFEC, "Budgetary Cost Estimate for a Spread Mooring System for a Floating Desalination Facility (Saudi Arabia and Dubai)
44. February 16, 2007 e-mail from Ron Mack, SOFEC, "SOFEC Turret Mooring Prices $15 million instead of $45 million!"
45. November 7, 2006 quote from General Electric for LM 2500 – 60 Hz combined gas turbine and steam electric drive system (COGES)[68]
46. December 2005 catalog cut, "GE Energy Lease Pool Systems" including LM2500 turbine
47. April 18, 2007 memo from Skip Griffin, PBS&J, "Planning Level Opinion of Probable Cost, Seabed Pipeline, Monterey Bay (duplicate of item 17)
48. Undated document titled "Pall Cost Calculations[69]" presenting operating cost tables
49. March 31, 2006 spreadsheet, "V Ships USA LLC Budget Proposal" additional operating costs (see also item 9)
50. January 30, 2007 B&P International letter to Amanda Brock, WSC transmitting marine insurance estimates (see also item 2)

[68] See also data item 1, which has a later date for a single system – this quote is for two systems and totals approx three times the cost

[69] see also item 3

Appendix A - Responses to Comments on June 26, 2006 Report

Written comments were submitted regarding the June 26, 2006 report by Bookman-Edmonston/GEI Consultants, titled "Seawater Desalination Projects Evaluation." The following are responses to those comments. Documents listing the comments follow these responses.

Response to Poseidon Resources Comments, Dated June 28, 2006

Comment 1. The following text was added to the report:

Poseidon Resources, according to a June 28, 2006 email, stated that they have not selected the filtration media that would be used in a pilot study or in a full-scale plant for the MBRSDP. The DynaSand specification, included in the elevation drawings as submitted to the Monterey County Planning Department, was to show the physical dimensions of the largest available filtration technology. Poseidon Resource stated that DynaSand was used to preserve (1) maximum planning flexibility, and (2) the opportunity to study all available technologies in the pilot study. However, the concern of the potential selection of DynaSand remains.

Comment 2. The following text was added as a footnote to the report:

In a June 28, 2006 email, a representative of Poseidon Resources stated that it has been working closely with CDHS on permitting large-scale desalination projects in California and has received conditional approval for a project in Huntington Beach. Poseidon Resources believes that it understands what is required to obtain CDHS approval for the MBRSDP. These statements were not verified.

Comment 3. The following text was added as a footnote to the report:

In a June 28, 2006 email, a representative of Poseidon Resources stated that it has been working closely with CDHS on permitting large-scale desalination projects in California and has received conditional approval for a project in Huntington Beach. Poseidon Resources believes that it understands what is required to obtain CDHS approval for the MBRSDP. These statements were not verified.

Comment 4. The following footnote was added to the report.

In a June 28, 2006 email, a representative of Poseidon Resources stated that monthly water quality monitoring has been conducted since October 2005. The program has included collecting seawater samples from the Moss Landing Harbor. The samples were tested for

300 constituents, which included pesticides and other agricultural runoff constituents, as regulated under the California Ocean Plan and the state and federal Safe Drinking Water Acts. Poseidon Resources concluded from the testing program that pesticides and agricultural runoff will not be a factor. The data provided by Poseidon Resources do not support this conclusion.

Comment 5. The following footnote was added to the report.

In a June 28, 2006 email, Poseidon Resources stated that product water quality control is critical to the success of the MBRSDP. It intends to follow protocols developed as part of comprehensive studies developed for other California Poseidon Resources desalination plants for the MBRSDP.

Comment 6. In a June 28, 2006 email, Poseidon Resources stated that the representation of Tampa Bay Desalination project was not accurate. Poseidon Resources states that Tampa Bay Water exercised its option to purchase the project from Poseidon Resources when construction was 30 percent complete. At the time, according to Poseidon, the project was on schedule, within budget, would have been completed according to design, and would have met performance specifications. Furthermore, it states that testimony of water agency staff and outside experts confirm these conclusions and that these conclusions are part of the public record. Poseidon correctly states that Tampa Bay Water bought out their interests during construction, not after operational failure. Also, Poseidon contends that field design changes caused the failure of the plant. However, any determination that the plant would have operated successfully if Poseidon had retained control through the end of construction is conjecture. It is the understanding of the GEI Consultants/Separation Process/Malcolm-Pirnie team that independent reviews following the failure recommended major pretreatment process changes in order to achieve design performance criteria. Furthermore, Tampa Bay Water staff may have indicated that Poseidon design met specifications at the time of the purchase; however, they did not choose to retrofit the plant to the original Poseidon design following the failure. Doubt remains today whether there is much confidence in the Poseidon design.

Response to Poseidon Resources Comments, Dated July 14, 2006

Comment 1. The O&M costs for the Local CWP were included in the CAW report *Draft-Conceptual Design Report* (2005). The O&M costs for regional CWP were included in the RFB Consulting report, *Coastal Water Project – A Water Supply Solution for our Coastal Communities – Volume 1 – Draft – Preliminary Project Description*. The O&M costs for local CWP were prepared in 2005 dollars with an annual cost of $8.84M. The O&M costs for the regional CWP were prepared in 2004 dollars with an annual cost $10.484M. The regional CWP O&M costs include avoided annual costs of $1.046M and the cost estimates do not include the costs of operating the Tarpy Flats pumping facilities. Additional data were not available for updating these costs.

Response to California American Water Letter, Dated August 30, 2006

Response to Comment 1 – The ASR components have been included in the total cost of the CAW CWP. These costs are reflected in the cost summary tables.

Response to Comment 2 – The expected seasonal demands to be met by the MBRSDP were not included in the material provided by Poseidon Resources/PSM; however, the identified annual demand was provided (20,930 ac-ft per year). Poseidon Resources/PSM also stated that MBRSDP would enable the Monterey Peninsula area to comply with SWRCB Order No. 95-10. The identified annual production of 22,400 ac-ft per year for the MBRSDP is reasonable production for a desalination plant with a planned capacity of 20 mgd. Given the information provided by Poseidon Resources, the planned annual yield of the MBRSDP will be 20,930 ac-ft per year and no information has been provided to suggest otherwise. However, the annual yield determination can be modified if additional information is made available.

Response to Comment 3a – The comment states that CAW buying water from the MBRSDP would cost $1,800 per acre-foot as opposed to $1,352 per acre-foot. Information regarding the wholesale pricing of the MBRSDP desalinated water was not provided, and, as such, $1,800 per acre-foot cannot be proved or disproved.

Response to Comment 3b – The comments states that the annualized cost of the entire CWP is $20M. This calculation could not be verified and we have calculated the annualized cost of the CWP, with ASR, as $23M, with a unit cost of $1,980 per acre-foot. Without ASR, the annualized cost is $20M, with a unit cost of $1,944 per acre-foot.

Response to Comment 4 – The final report includes the ASR component of the CWP.

Response to Comment 5 – To our knowledge, we were provided the best available, most comprehensive cost estimates of the MBRSDP and SCDP. As acknowledged in the report, the level of detail of the cost estimates was not uniform. Significant effort was expended to obtain the project costs and it was determined that the costs were reasonable for the different projects. Based on this, it was determined that a comparison between the projects is reasonable. As for the MBRSDP cost estimate, it is stated in the text that cost for water transmission and storage is $31M. The extent that Poseidon Resources/PSM has or has not included all of the costs associated with (1) getting their product water to their customers, and (2) building and operating the necessary water storage facilities cannot be determined, but it is assumed that all of the costs are included.

Response to Comment 6 – None of the information provided to the B-E team supports the position that MBRSDP could not meet the requirements of SWRCB Order No. 95-10.

Response to Comment 7 – Comment noted.

Response to Comment 8c – Poseidon Resources has stated that the NPDES permit for the intake and outfall at the National Refractories site expired May 2006. It is unclear whether a permit renewal was submitted prior to expiration or whether the intake and outfall will fall under a new NPDES permit. Technically, the permit should not be renewed since Poseidon is not using the facility for the same purpose or standard industrial classification (SIC) code, and the former operation is closed. However, the differences between a renewed/transferred permit and a new permit application for the desalination plant may be more of an administrative issue than a critical issue, since the proponents have stated that they are developing fish screens, a fish return system, and modifying the intake to allow for low-intake velocities. Thus, Poseidon has indicated that it will do what is required for a new intake and permit; however, there is no preliminary design information provided to evaluate the adequacy or potential success of its efforts.

Response to Comment 9 – Noted. Current language adequately addresses this issue.

Response to Comment 10 – Noted.

Response to Comment 11 – The June 2006 report adequately represents all of the proposed MPWMD desalination projects and adequately compares the projects, as based on the supplied information. Each project was evaluated on its own merits and no attempts were made to change the projects so that they had similar production amounts. Also, whether a project fully met the requirements of SWRCB Order No. 95-10 was not a consideration in the evaluation of the individual projects.

Response to Comment 12 – The ASR aspect of the CWP has been included in the final report.

Appendix B- Responses to Comments on July 10, 2007 Report