CARLSBAD SEAWATER DESALINATION PROJECT

SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD

REGION 9, SAN DIEGO REGION

ORDER NO. R-9-2006-0065

NPDES NO. CA0109223

FLOW, ENTRAINMENT AND IMPINGEMENT MINIMIZATION PLAN

March 9, 2009

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TABLE OF CONTENTS

CHAPTER 3 - DESIGN

CHAPTER 4 - TECHNOLOGY

CHAPTER 5 - QUANTIFICATION OF INTAKE AND MORTALITY OF MARINE LIFE

CHAPTER 6 - MITIGATION

CHAPTER 7 – CONCLUSION

ATTACHMENT 6 - CARLSBAD DESALINATION FACILITY – ENCINA POWER STATION, SUMMARY OF FISH AND TARGET SHELLFISH LARVAE COLLECTED FOR ENTRAINMENT AND SOURCE WATER STUDIES IN THE VICINITY OF AGUA HEDIONDA LAGOON FROM JUNE 2005 THROUGH MAY 2006.

ATTACHMENT 7 - MITIGATION COMPUTATION BASED ON IMPINGEMENT ASSESSMENT - CHRIS NORDBY

ATTACHMENT 8 - NUMBERS AND BIOMASS OF SPECIES COLLECTED DURING 2004/2005 SAMPLING PERIOD

CHAPTER 1

INTRODUCTION

1.1 PURPOSE OF THE PLAN

The San Diego Regional Water Quality Control Board (Regional Board) adopted Order No. R9-2006-0065, NPDES No. CA0109223 (Permit) for Poseidon Resources Corporation's (Poseidon) Carlsbad Desalination Project's (CDP) discharge to the Pacific Ocean via the existing Encina Power Station (EPS) discharge channel. The CDP is planned to operate in conjunction with the EPS by using the EPS cooling water discharge as its source water whenever the power plant is operating.

This Flow, Entrainment and Impingement Minimization Plan (Plan or Minimization Plan) reviews stand-alone operations and also ensures compliance with Section 13142.5(b), which requires industrial facilities using seawater for processing to use the best available site, design, technology, *and* mitigation feasible to minimize intake and mortality to marine life.[1] The Plan was required under Section VI C.2)e of the Permit, and incorporated therein. The Regional Board recognized that future EPS flows may not follow historical trends such that it would be able to meet all of the CDP's intake needs and required Poseidon prepare this Plan to assess the feasibility of site-specific plans, procedures, and practices to be implemented and/or mitigation measures to minimize the impacts to marine organisms when the CDP intake requirements exceed the volume of water being discharged by the EPS.[2] In accordance with Section 13142.5(b), the purpose of the Plan is to minimize the impingement and entrainment of marine life associated with the intake of seawater for desalination because mortality can result from such impingement and entrainment.

When operating in conjunction with the power plant and the power plant is producing sufficient feedwater to support the CDP's operations, the CDP will not cause any additional intake and mortality of marine life above and beyond that associated with the EPS's operations. To the extent the EPS's discharge is insufficient to meet the CDP's intake needs, only incremental additional marine life mortality is expected because the CDP will not increase the volume or the velocity of the power station cooling water intake beyond that provided for in EPS's permit, Order No. R9-2006-0043, NPDES No. CA0001350. In the event the EPS ceases operations, and the CDP independently

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[1] See Permit at F-49. The full text of Water Code Section 13142.5(b) provides: "For each new or expanded coastal powerplant or other industrial installation using seawater for cooling, heating, or industrial processing, the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life."

[2] Permit at Section VI.2.e provides: "The Discharger shall submit a Flow, Entrainment and Impingement Minimization Plan within 180 days of adoption of the Order. The plan shall assess the feasibility of site-specific plans, procedures, and practices to be implemented and/or mitigation measures to minimize the impacts to marine organisms when the CDP intake requirements exceed the volume of water being discharged by the EPS. The plan is subject to the approval of the Regional Water Board and is modified as directed by the Regional Water Board."

operates the seawater intake and outfall for the benefit of the CDP, such independent operation may require additional review pursuant to Water Code Section 13142.5(b), though the mitigation plan incorporated herein at Chapter 6, Part A accounts for a stand-alone operations.[3]

This Plan is developed in fulfillment of the above-stated requirements and contains site-specific activities, procedures, practices and mitigation measures which are planned to be implemented to minimize intake and mortality of marine organisms when the CDP intake requirements exceed the volume of water being discharged by the EPS.

1.2 PLAN ORGANIZATION

The Plan is organized so to sequentially analyze the steps that have been taken by Poseidon to address each of the provisions of Water Code Section 13142.5(b):

- Chapter 2 identifies the best available site feasible to minimize impingement and entrainment of marine life from the Project;
- Chapter 3 identifies the best available design feasible to minimize impingement and entrainment of marine life from the Project;
- Chapter 4 identifies the best available technology feasible to minimize impingement and entrainment of marine life from the Project;
- Chapter 5 estimates potential unavoidable impacts to marine life; and
- Chapter 6 identifies the best available mitigation feasible to minimize any residual impingement and entrainment, and is in addition to those measures addressed through site, design, and technology approaches.

1.3 PLAN DEVELOPMENT

In anticipation that the EPS might not always satisfy the CDP's source water demands, the Regional Board required Poseidon to submit the Plan within 180 days of the adoption of the Permit. The Permit states:[4]

> The Regional Board recognizes that future EPS flows may not follow historical trends. For this reason, it is warranted to require the Discharger prepare a Flow, Entrainment, and Impingement Minimization Plan. The Flow, Entrainment, and Impingement Minimization Plan shall be submitted within 180 days of adoption of the Order. The plan shall assess the feasibility of site-specific plans, procedures, and practices to be

[3] Permit at F-50.
[4] Permit at F-48 and F-49.

implemented and/or mitigation measures to minimize the impacts to marine organisms when the CDP intake requirements exceed the volume of water being discharge by the EPS. The plan shall be subject to the approval of the Regional Water Board and shall be modified as directed by the Regional Water Board.

The Plan has been under development since October 2006. The original Plan was submitted to the Regional Board on February 12, 2007. Shortly thereafter, the Regional Board posted the Plan and related correspondence on its website for public review and comment. Poseidon revised the Plan in response to comments received from the Regional Board and the public and resubmitted it to the Regional Board on July 2, 2007.

The Regional Board posted the revised Plan and related correspondence on its website for public review and comment. To supplement the Plan, Poseidon also submitted to the Regional Board a Coastal Habitat Restoration and Enhancement Plan (CHREP) that included a summary of projects to accomplish the mitigation element of the Plan. On February 19, 2008, the Regional Board provided Poseidon with written comments from its review of the revised Plan and CHREP. In response to Regional Board comments, Poseidon submitted a revised Plan dated March 6, 2008 to the Regional Board. The revised Plan was subject to the approval of the Regional Board.

On April 9, 2008, the Regional Board conditionally approved Poseidon's Plan (Resolution R9-2008-0039) and directed Poseidon to prepare an amendment to the Plan that included a proposal for a mitigation to be developed through an interagency process. On November 14, 2008, following an extensive interagency coordination process, Poseidon submitted the Marine Life Mitigation Plan (MLMP) that had been previously approved by the California Coastal Commission and State Lands Commission for the Regional Board's consideration.

On February 11, 2009, the Regional Board held a hearing to consider the MLMP. Following the hearing, the Regional Board continued the matter to its April 8, 2009 meeting for consideration of a proposed final resolution resolving the requirements of Section VI.C.2(e) of the Permit and granting final approval or disapproval to Poseidon's Minimization Plan and the proposed amendment to that Plan, the MLMP. This proposed resolution would address all required issues associated with these plans, including the findings for the Regional Board to adopt regarding compliance with Water Code Section 13142.5(b). This resolution would supersede Resolution No. R9-2008-0039 conditionally approving Poseidon's Plan. Pursuant to the Regional Board's direction, this final draft of Poseidon's Flow, Entrainment and Impingement Minimization Plan, dated March 9, 2009, has been revised to incorporate the terms of the MLMP, update the information presented, and otherwise conform to the direction received from the Regional Board.

CHAPTER 2

SITE

INTRODUCTION

Pursuant to Water Code Section 13142.5(b), this Chapter identifies the best available site feasible to minimize intake and mortality to marine life from the Project. This Chapter is broken down into five sections:

- *The first section describes the proposed site and existing power plant facilities.*
- *The second section describes alternative sites that were considered and rejected.*
- *The third section describes why the proposed Project location is the best available site feasible to minimize Project-related impacts to marine life.*
- *The fourth section addresses Poseidon's commitment to the preservation of Agua Hedionda Lagoon.*
- *The fifth section concludes that proposed location for the Project is the best available, and there are no feasible and less environmentally damaging alternative locations.*

2.1 PROPOSED SITE

The Carlsbad Desalination Project (CDP) is proposed to be located adjacent to the Encina Power Station (EPS) owned by Cabrillo Power I LLC (Cabrillo). An important consideration for this site selection is the availability of an existing seawater intake and discharge facilities as well as close proximity to the local regional water distribution systems. The desalination plant would be located on a site currently occupied by a surplus fuel oil storage tank. The tank would be removed, and the desalination plant would be constructed in its place. Integration of the operation of the desalination facility with the existing power plant operation would require two main points of interconnection – seawater intake and concentrate discharge.

The EPS withdraws cooling water from the Pacific Ocean via Agua Hedionda Lagoon. After passing through the intake structure (Figure 2-1), trash racks, and traveling screens, the cooling water is pumped through the condensers for the five steam generator units located on site. Depending on the number of generating units in operation, the amount of cooling water circulated through the plant ranges from zero to over 800 MGD.

Figure 2-1 Intake Structure

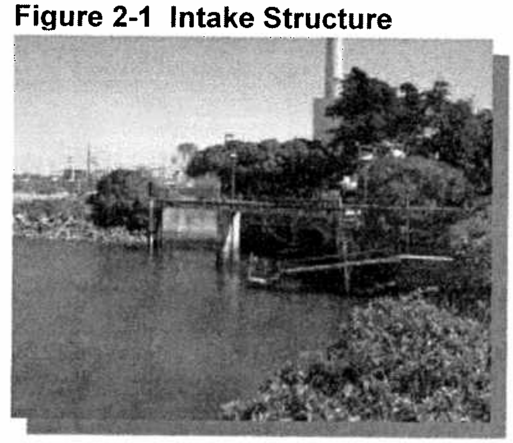

Figure 2-2 Discharge Pond

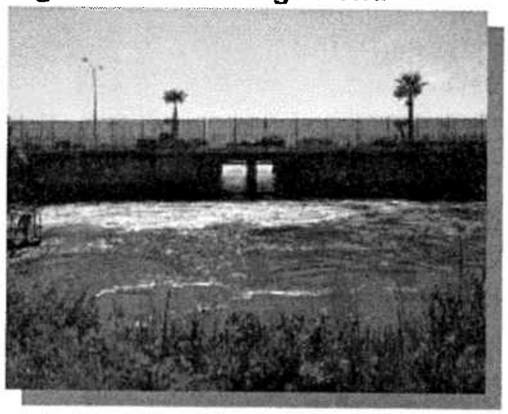

Figure 2-3 Discharge Channel

The primary diversion point for the source of water to the desalination plant will be downstream of the condenser outlet.

The seawater intake will divert seawater from the power plant's cooling water discharge channel to the inlet of the desalination facility. The intake facilities will consist of a diversion structure, pipeline, and a pump station to transport water from the cooling water discharge channel to the inlet of the desalination facility. The pump station will consist of high-volume, low-head vertical turbine pumps.

The EPS discharges seawater to the Pacific Ocean via a discharge pond (Figure 2-2) and channel that extends 500 feet west of Carlsbad Boulevard (Figure 2-3). The concentrated seawater from the desalination process will be mixed with power plant discharge. The discharge facilities will consist of a pipeline (up to 48-inch diameter) from the outlet of the desalination facility back to the existing discharge channel. The discharge point will be located downstream of the diversion point for the intake to prevent re-circulation of the concentrate back to the inlet of the desalination facility.

2.1.1 Existing Power Plant Facilities

The EPS is a once-through cooling power plant, which uses seawater to remove waste heat from the power generation process. Cooling water is withdrawn from the Pacific Ocean via the Aqua Hedionda Lagoon. The cooling water intake structure complex is located approximately 2,200 feet from the ocean inlet of the lagoon. Variations in the water surface level due to tide are from low -5.07 feet to a high +4.83 feet from the mean sea level (MSL). The intake structure is located in the lagoon approximately 525 feet north of the generating units.

The mouth of the intake structure is 49 feet wide. Water passes first trough metal coarse screens (trash racks with vertical bars spaced 3-1/2 inches apart) to screen large debris and marine life. The intake forebay tapers into two 12-foot wide intake tunnels. From these tunnels the seawater flow is split among four six-foot wide conveyance tunnels. Tunnels 1 and 2 deliver seawater to intakes for power plant generation Units 1, 2 and 3. Tunnels 3 and 4 carry cooling water to intakes for power plant generation Units 4 and 5, respectively. Vertical traveling screens are located ahead of each of the intakes of pumps.

Each pump intake consists of two circulating water pump cells and one or two service pump cells. During normal operation, one circulating pump serves each half of the condenser, i.e., when one unit is online, both pumps are in operation.

A total of seven vertical screens are installed to remove marine life and debris that have passed through the trash racks. The screens are conventional through-flow, vertically rotating, single entry-single exit, band-type metal screens which are mounted in the screen wells of the intake channel. Each screen consists of a series of baskets or screen panels attached to a chain drive. The screening surface is made of 3/8-inch stainless steel mesh panels, with the exception of the Unit 5 screens, which have 5/8-inch square openings.

The screens rotate automatically when the buildup of debris on the screening surface causes the water level behind the screen to drop below that of the water in front of the screen and a predetermined water level differential is reached. The screens can also be pre-set to rotate automatically at a present interval of time. The screen's rotational speed is 3 feet per minute, making one complete revolution in approximately 20 minutes. A screen wash system using seawater from the intake tunnel washes debris from the traveling screen into a debris trough. Accumulated debris are discharged periodically back to the ocean via the power plant discharge lagoon. Table 2-1 summarizes the capacity of the individual power plant intake pumps.

The EPS's intake pumping station consists of cooling water intake pumps that convey water through the condensers of the electricity generation units of the power plant and has a total capacity of 794.9 MGD (552,000 gpm). The service water pumps have a combined capacity is 62.1 MGD (43,200 gpm). During temporary shutdown of the power plant generation units, only the cooling water pumps are taken out of service. The service water pumps remain in operation at all times in order to maintain the functionality of the power plant. If the power plant is shut down permanently, service water pumps will no longer be operational.

The volume of cooling water passing through the power plant intake power station at any given time is dependent upon the number of cooling water pumps and service water pumps that are in operation. With all of the pumps in operation, the maximum permitted power plant discharge volume is 857 MGD, or about 595,000 gallons per minute (gpm).

TABLE 2-1

SUMMARY OF EPS'S POWER GENERATING CAPACITY AND FLOWS

Unit #	Date on Line*	Capacity (MW)	Number of Cooling Water Pumps	Cooling Water Flow (gpm)**	Service Pump Water Flow (gpm)**	Total (MGD)
1	1954	107	2	48,000	3,000	73
2	1956	104	2	48,000	3,000	73
3	1958	110	2	48,000	6,000	78
4	1973	287	2	200,000	13,000	307
5	1978	315	2	208,000	18,200	326
Gas turbine	1968	16	0	0	0	0
			Total:	**552,000**	**43,200**	**857**

* Encina Power Station NPDES Permit No. CA0001350, Order No. 2000-03, SDRWCB.
** Encina Power Station Supplemental 316(b) Report (EA Engineering, Science, and Technology 1997).

2.2 ALTERNATIVE SITES

There are only three possible sites in the City of Carlsbad that could accommodate a desalination project of this size. These are: (1) the Encina Power Station (EPS); (2) Encina Water Pollution Control Facility (EWPCF); and (3) Maerkle Reservoir. Among these, EPS is the only site in reasonable proximity to the seawater intake, the outfall, and key delivery points of the distribution system of the largest user of the desalinated seawater – the City of Carlsbad. The EPS site allows the Project to optimize the cost of delivery of the produced water and minimize the environmental impacts associated with construction and operation of the Project. This particular site also offers the advantage of avoiding the construction of major new intake and discharge facilities, which provides significant environmental and cost benefits.

The Project EIR analyzed the viability of alternative sites for the seawater desalination plant within the boundaries of the EPS and alternative sites within the boundaries of the EWPCF.[1] The Coastal Commission Staff requested an evaluation of other potential locations for the desalination facility and its associated infrastructure. As a result, Poseidon added the Maerkle Reservoir site to the list of alternative sites to be considered. The sites evaluated by Poseidon and the City of Carlsbad are the only parcels in the entire City of Carlsbad with compatible land use designations and sufficient space available to accommodate the desalination facility. The merits of each site are summarized below.

[1] See Final EIR – 03-05 for the Precise Development Plan and Desalination Plant Project SCH #2004041081, City of Carlsbad, p. 4.8-17, June 13, 2006, Section 6.0, Alternatives to the Proposed Action, Subsection 6.2 - Alternative Site Location, pages 6-1 and 6-2.

2.2.1 Encina Power Station.

Alternative sites at the EPS were found infeasible because the power plant owner has reserved the remaining portion of the site to accommodate future power plant modifications, upgrades or construction of new power plant facilities.

2.2.2 Encina Water Pollution Control Facility.

The site located within the boundaries of the EWPCF can only accommodate a desalination plant with a 10 MGD production capacity, due to outfall constraints. A desalination plant of 10 MGD production capacity will be inadequate to satisfy the demand of even one of the users of desalinated water from the Project – the City of Carlsbad, with a demand of up to 25 MGD. This deficiency renders the use of the EWPCF site infeasible. In addition, the use of this site would require construction of a 2-mile long, 72-inch diameter intake pipeline to convey the source seawater from the power plant cooling canal to the EWPCF site, which would have significant cost impacts on the Project and additional environmental and traffic impacts resulting from the construction of such a large pipeline. Installation of a new intake at the EWPCF site is cost-prohibitive.

2.2.3 Maerkle Reservoir.

Maerkle Reservoir is the only other area within the City of Carlsbad that offers compatible land use and is of suitable size to accommodate the Project. The Maerkle Reservoir site is owned by the City of Carlsbad and is located 10.6 miles east of the proposed Project site.

For a number of reasons, this location does not provide a feasible alternative site. First, the public rights-of-way between Maerkle Reservoir and the Pacific Ocean do not have sufficient space to accommodate a 72-inch intake pipeline and a 48-inch concentrate line (Poseidon, 2007). Second, it would be extremely disruptive to the public and the environment to acquire sufficient public and private property outside existing public rights-of-way to construct the pipelines. Third, over 100 MGD of seawater would have to be pumped to an elevation of 531 feet for processing, compared to pumping the seawater to an elevation of 70 feet at the proposed site. Fourth, because the Maerkle site is zoned as "Open Space," a "Public Utility" zoning designation would be incompatible with the Carlsbad General Plan and the proposed Project would be in direct conflict with the adjacent residential retirement community of Ocean Hills. Fifth, such a proposal would be in direct conflict with the City of Carlsbad's objective *"[t]o locate and design a desalination plant in a manner that maximizes efficiency for construction and operation and minimizes environmental effects."*

Finally, the additional construction and operating costs associated with piping and pumping the seawater and concentrate over this additional distance would represent a 20 percent increase in the cost of water. Such an increase in cost would render the Project infeasible while providing no measurable benefit to the public or the environment. An additional 10.6 miles of 72-inch seawater supply line would cost approximately $57.1 million. The enlarged pump station to accommodate the additional 461 feet of pump lift required to move the seawater to the alternative site would cost an additional $8.0 million. The additional cost of the 10.6 mile, 48-inch concentrate return line would be $29.6 million. In summary, the alternative Project site at Maerkle Reservoir would result in a $94.7 million (35 percent) increase in the capital budget for the Project (Poseidon, 2006).

Similarly, the alternative Project site at Maerkle Reservoir would result in three significant changes to the Project operating budget arising out of the increase in the amount of energy necessary to pump seawater to an inland location at a higher elevation, which would result in a net increase in operating cost for the Project. First, the cost to pump the seawater from the intake to the alternative plant site would increase $6.7 million per year. Second, the cost to pump the product water from the plant to the intended use area would decrease $3.0 million per year due to the fact that the product water is being pumped from a starting elevation of 511 feet rather than sea level. Finally, the energy recovery opportunity associated with the discharge of the concentrate from 511 feet down to sea level will result in an additional $1.1 million reduction in operating cost. The net increase in operating cost for the alternative Project located at Maerkle Reservoir would be $2.6 million per year (10 percent) (Poseidon, 2006).

The environmental issues associated with the construction of a 10.6-mile, 72-inch intake pipe and a 10.6-mile, 48-inch discharge line, compared to the proposed single 10.6-mile 48-inch product water conveyance pipeline, would be significant. There would be an approximately 225% increase in the volume of material that would need to be excavated. All of this material would need to be trucked offsite for disposal, resulting in over 200% increase in construction-related air quality impacts and traffic impacts over that already accounted for in the Project EIR due to the hauling of pipeline-related excavation material (Poseidon, 2007).

The 72-inch pipeline would likely be constructed in designated open-space or on private property for almost the entire length of the alignment due to the lack of space for additional utilities within existing rights-of-way. Construction-related activities could cause temporary disruption and impacts to an additional 40 feet of private property or public open space along the entire length of the pipeline. Much of this alignment is sensitive habitat such as coastal sage scrub which may prohibit the construction methods that are the basis of the cost estimates provided above. Alternatively, the construction impacts would require mitigation in the form of replacement habitat per the ratios set forth in section 4.3 of the EIR. Tunneling and mitigation costs associated with this alternative could be in the tens of millions of dollars. In addition, the carbon footprint associated with the long-distance water transport would be significant because significant additional energy would be required to accomplish it, thereby increasing greenhouse gas emissions associated with the Project, another potential adverse environmental impact.

For these reasons, the alternative Project location at Maerkle Reservoir is financially and environmentally infeasible. In addition, the alternative location is not properly zoned for a desalination facility.

2.3 BEST AVAILABLE SITE FEASIBLE

The proposed location for the CDP at the EPS is the best available site feasible for the Project for a number of reasons:

- The site is properly zoned and the proposed use is consistent with other uses in the area.

- The location of the proposed desalination facility adjacent to the existing EPS has a number of environmental and cost advantages that cannot be matched at any other location within the service area to which water will be delivered. These advantages are as follows:

  - Least environmental impacts;
  - Lowest energy consumption;
  - Least disruption to public and private property;
  - Lowest construction cost; and
  - Lowest operating cost.

The proposed site is the only feasible location for the proposed Project in the service area and presents a unique opportunity for minimizing environmental impacts in a cost-effective manner. Locating the desalination facility further inland increases costs, which would indirectly increase the cost of the water to consumers, and increases construction-related disruptions to the public and the environment due to the need to construct a 72-inch and 48-inch pipeline instead of a single 48-inch pipeline, with no clear environmental benefit. Any of the proposed alternatives to co-location would require fundamental changes to the Project, which in turn would require complete redesign and re-engineering, as well as new entitlements from the City of Carlsbad and a new NPDES permit from the Regional Board. Poseidon has already invested eight years developing and obtaining permits for the Project. The potential delays posed by the alternative locations also would preclude the successful completion of the Project within a reasonable time. Therefore, such alternatives are not feasible.

The City of Carlsbad determined that, from a land use planning perspective, the best site for the desalination facility in the entire City of Carlsbad was the parcel in the northwest corner of the power plant property where Fuel Oil Tank No. 3 is currently located.[2] This

[2] Final EIR – 03-05 for the Precise Development Plan and Desalination Plant Project SCH #2004041081, City of Carlsbad, p. 4.8-17, June 13, 2006.

location was selected specifically to further the City of Carlsbad Redevelopment Plan goals related to facilitating the conversion and relocation of the power plant east of the railroad tracks and enhancement of commercial and recreational opportunities in the area west of the railroad tracks currently occupied by the existing power plant. This location leaves the majority of the site open for potential redevelopment at some future date and will create no significant impacts to relocation of the power plant to a site to the east of the railroad tracks or infrastructure needed to serve a power plant at this location.[3]

The Coastal Act provides for special consideration of coastal-dependent industrial facilities. Even if a coastal-dependent project is found to be inconsistent with certain Coastal Act goals, it can be approved upon application of a three part test – (1) that alternative locations are infeasible or more environmentally damaging; (2) that adverse environmental effects are mitigated to the maximum extent feasible; and (3) that to do otherwise (i.e., deny the project) would adversely affect the public welfare.[4]

The Coastal Commission determined that Poseidon's proposed seawater desalination facility would be a coastal-dependent industrial facility, as it would need to be sited on or adjacent to the sea in order to function at all.[5] In applying the three tests above, the Commission found (1) that there are no feasible and less environmentally damaging alternative locations available the Project;[6] (2) that the proposed Project as conditioned mitigates its impacts to the maximum extent feasible;[7] and (3) that facility is a necessary part of the region's water portfolio and denial of the Project would adversely affect the public welfare.[8]

2.4 PRESERVATION OF AGUA HEDIONDA LAGOON

Agua Hedionda Lagoon currently supports a wide range of beneficial uses, including recreational activities, such as fishing, and water contact recreation. Nearly all of these uses are directly or indirectly supported by seawater flow and exchange created by circulation of seawater in the lagoon. The existing tidal exchange renews the Lagoon's water quality and flush nutrients, sediment and other watershed pollution, particularly from the Lagoon's upper reaches. In addition, the inflow of fresh supplies of ocean carry waterborne supplies of planktonic organisms that nourish the many organisms and food chains of the Lagoon, including the White Sea Bass restoration program of the Hubbs Sea World Research Institute and the aquaculture operations in the outer Lagoon.

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3 Id.
4 See Coastal Commission Recommended Revised Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, page 114 of 133; http://documents.coastal.ca.gov/reports/2008/8/W4a-8-2008.pdf
5 Id.
6 See Recommended Revised Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, page 115 of 133; http://documents.coastal.ca.gov/reports/2008/8/W4a-8-2008.pdf
7 Id.
8 Id. at 124 and 133.

The Lagoon is connected to the Pacific Ocean by means of a manmade channel that is artificially maintained. Seawater circulation throughout the outer, middle and inner lagoons is sustained both by routine dredging of the manmade entrance to prevent its closure. The name, Agua Hedionda, which means "stinking water" in Spanish, reflects a former stagnant condition that existed prior to the dredging of the mouth of the Lagoon. In the absence of continued dredging, Agua Hedionda Lagoon would be cutoff from tidal exchange in a few years and slowly return to its former condition.

Upon retirement of the EPS, Poseidon has committed to assuming responsibility for stewardship of Agua Hedionda Lagoon and the surrounding watershed, including maintenance dredging of the entrance to the lagoon to prevent its closure and deposit the sand dredged from the lagoon on adjacent beaches. Poseidon's lagoon preservation efforts will be aimed at ensuring the long-term health and vitality of the future water supply of 300,000 San Diego County residents. Agua Hedionda Lagoon and its associated beneficial uses will be the long-term beneficiaries of this preservation strategy.

CHAPTER 3

DESIGN

INTRODUCTION

Pursuant to Water Code Section 13142.5(b), this Chapter identifies the best available design feasible to minimize impingement and entrainment of marine life from the Project. This Chapter is broken down into eight sections:

- *The first section provides a general description of the design features that have been incorporated into the CDP to minimize impingement and entrainment.*
- *The second section describes the desalination plant intake and discharge facilities and modes of operation.*
- *The third section describes the design feature of using the power plant discharge to the maximum extent feasible in order to minimize impingement and entrainment associated with the CDP's operations.*
- *The fourth section describes the design feature of reducing the velocity of seawater through the intake to the maximum extent feasible in order to minimize impingement and entrainment associated with the CDP's operations.*
- *The fifth section describes the design feature of reducing the velocity of seawater through the fine screens to the maximum extent feasible to minimize to minimize impingement and entrainment associated with the CDP's operations.*
- *The sixth section describes the design feature of processing ambient temperature seawater to the maximum extent feasible to minimize temperature-related marine life morality.*
- *The seventh section describes the design feature of eliminating heat treatment to the maximum extent feasible to minimize marine life mortality.*
- *The eighth section summarizes the design features and how they minimize intake and mortality of marine life.*

3.1 DESIGN FEATURES

The Carlsbad Desalination Project (CDP) incorporates a number of design features that would minimize impingement and entrainment associated with the CDP. The CDP is designed to use the existing intake and discharge facilities of the Encina Power Generation Station (EPS). When the EPS is producing electricity and using 304 MGD or more of seawater for once-through cooling, the proposed desalination plant operation would cause a *de minimis* increase in impingement and entrainment of marine organisms.

Under conditions when the EPS operation is temporarily or permanently discontinued, the desalination plant will continue to use the existing power plant intake and discharge facilities. Under this condition, the impingement and entrainment associated with the desalination plant's operations would be significantly lower than those caused by the EPS operations at the same intake flow, because the desalination plant will employ different plant intake design and operations than the power plant. The key differences are summarized below and described in the following sections:

1. **Use of EPS discharge as source water for the CDP.** In 2008 seawater pumping by the EPS would have met 88.6 percent of the CDP's flow requirements, corresponding to 88.6 percent less entrainment and impingement than is anticipated from stand-alone operation of the CDP.

2. **Reduction in inlet screen velocity.** The EPS intake structure has a permitted capacity of 857 MGD. The CDP will be operated at an intake flow of 304 MGD. There is an environmental benefit from operating an intake structure at flows well below the design capacity, as water velocities correspondingly are lower, making it easier for fish and other marine life to swim away from the intake structure. At 304 MGD, the velocity of the seawater entering the inlet channel is at or below 0.5 feet per second (fps), resulting in impingement losses at the inlet screens being reduced to an insignificant level.

3. **Reduction in fine screen velocity**. Under stand-alone operations, the CDP seawater supply would be pumped through an optimum combination of the existing fine screens and condensers serving the power plant so to minimize the velocity and turbulence of the water moving through the system. Lowering velocity and turbulence of the seawater would lessen the physical damage to marine life, resulting in a reduction of impingement and entrainment mortality.

4. **Ambient temperature processing.** One of the factors contributing to entrainment mortality of marine organisms during power plant operations is the increase of the seawater temperature during the once-through cooling process. Under stand-alone operations, the CDP would be designed to use ambient temperature seawater instead of heated seawater, which would eliminate entrainment mortality associated with the elevated seawater temperature.

5. **Elimination of heat treatment.** Periodic heat treatment of the power plant intake and discharge significantly contributes to entrainment and impingement mortality. Under stand-alone operations of the desalination plant, the heat treatment of the intake and discharge would be discontinued and associated entrainment and impingement mortality would be eliminated.

3.2 DESALINATION PLANT INTAKE AND DISCHARGE CONFIGURATION

The seawater desalination plant intake and discharge facilities would be located adjacent to the EPS. A key feature of the proposed design is the direct connection of the desalination plant intake and discharge facilities to the discharge canal of the power generation plant. This approach allows using the power plant cooling water as both source water for the seawater desalination plant and as a blending water to reduce the salinity of the desalination plant concentrate prior to discharge to the ocean.

Figure 3-1 illustrates the configuration of the desalination plant and the EPS intake and discharge facilities. As shown in this figure, under conditions when both the desalination facility and the power plant are operating, seawater collected from Agua Hedionda Lagoon enters the power plant intake facilities, passes through the 3.5-inch inlet screens at the mouth of the intake structure, and subsequently through the vertical travelling screens, and then it is pumped through the plant's condensers. The warm seawater released from the condensers is conveyed to the ocean via the discharge canal. The CDP intake structure would be connected to this discharge canal and would divert an average of 104 MGD of the cooling water for production of fresh water.

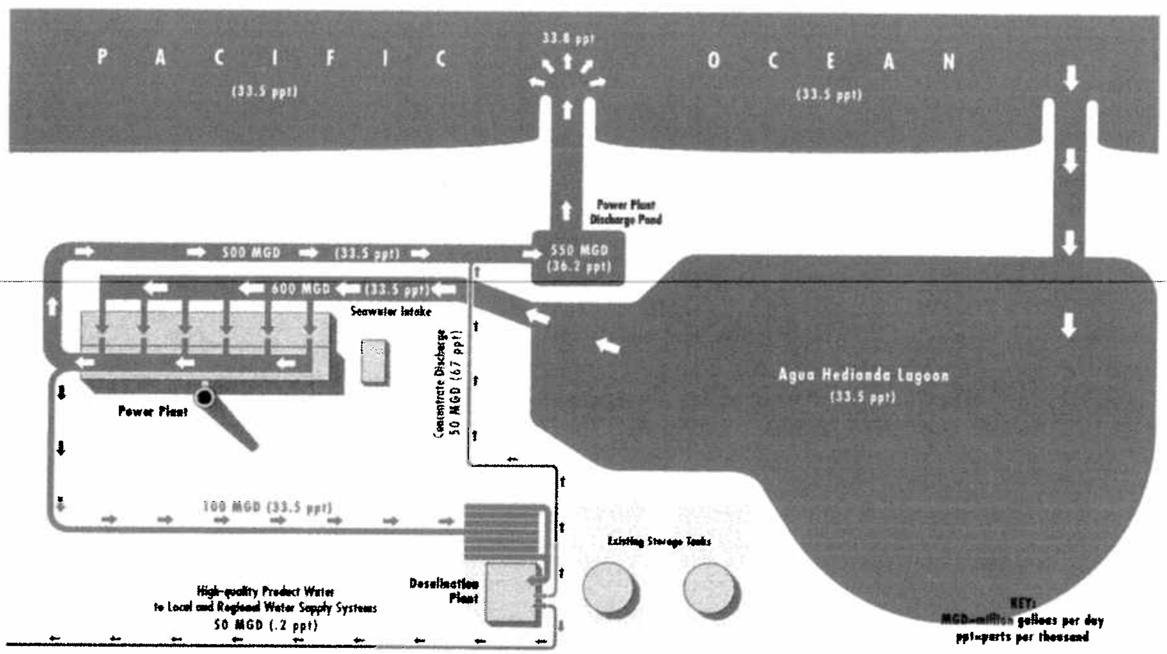


Figure 3-1 –Carlsbad Desalination Plant and Encina Power Station

Approximately 50 MGD of seawater would be desalinated via reverse osmosis treatment and conveyed for potable use. The remaining 54 MGD would have salinity approximately two times higher than that of the ocean water (64.5 ppt vs. 33.5 ppt). This seawater concentrate would be returned to the power plant discharge canal downstream of the point of intake for blending with the cooling water prior to conveyance to the Pacific Ocean. A minimum of 200 MGD of cooling water would be needed to blend with the 54 MGD of concentrate in order to reduce the desalination plant discharge salinity below the limit of 40/44 ppt (daily/hourly average) established by the CDP's Permit. Therefore, the total volume of cooling water required for normal operation of the desalination plant is 304 MGD.

If the power plant discharge flow is equal to or higher than 304 MGD, then the cooling water discharge volume is adequate to sustain desalination plant operations. Under this condition, since no additional seawater is collected for production of drinking water, the incremental impingement and entrainment from the desalination plant operations is minimal, especially taking into consideration that power plant operations are assumed to cause 100 percent mortality of the entrained marine organisms.

Under the conditions of temporary or permanent power plant shutdown, or curtailed power generation that results in cooling water discharge below 304 MGD, the existing power plant intake system would need to be operated to collect up to 304 MGD of seawater for the desalination plant. This seawater will pass sequentially through the power plant inlet screens (bar racks), the fine vertical screens, the power plant intake pumps and the power plant condensers before it reaches the desalination plant intake pump station. The features incorporated in the desalination plant design to reduce impingement, entrainment and flow under such "stand-alone" operating conditions are discussed below.

3.3 USE OF EPS DISCHARGE AS SOURCE WATER FOR CDP

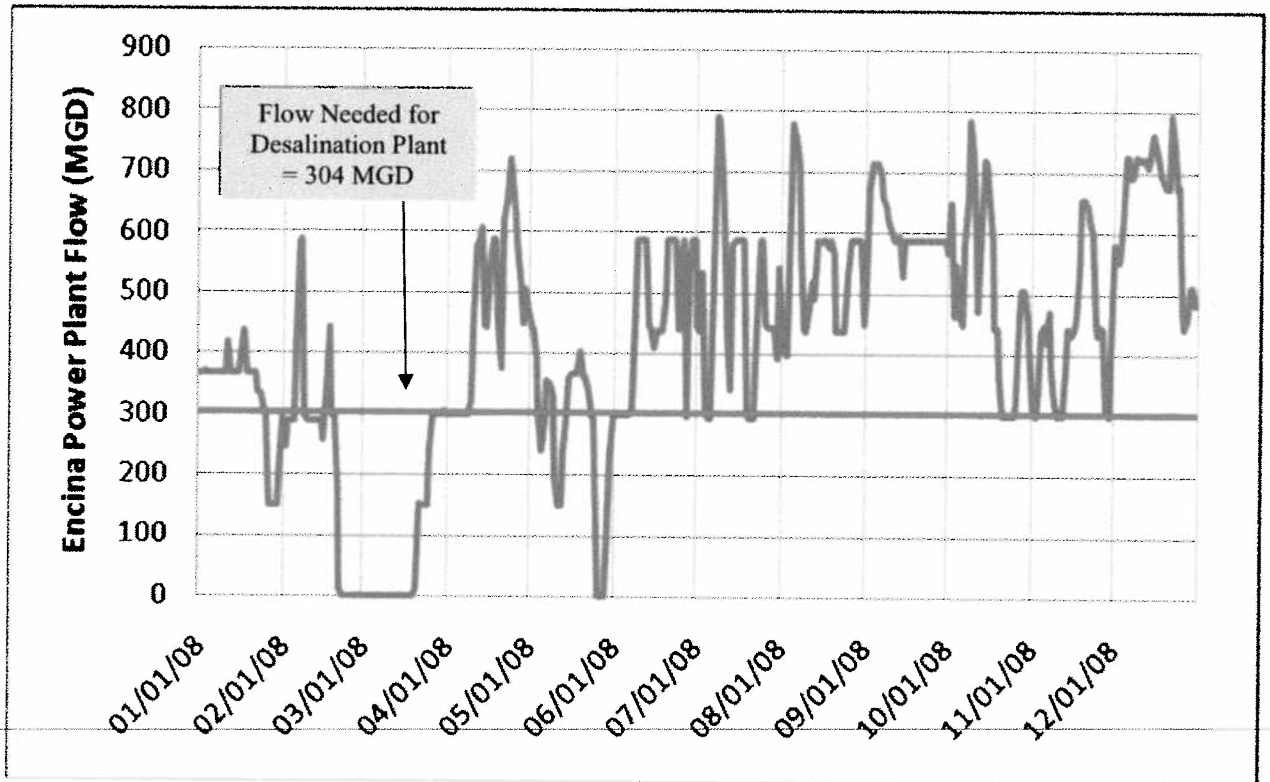
The CDP is designed to use the existing intake and discharge facilities of the EPS. When the EPS is producing electricity and using 304 MGD or more of seawater for once-through cooling, the proposed desalination plant operation would cause a *de minimis* increase in impingement and entrainment of marine organisms.

Under conditions when the EPS operation is temporarily or permanently discontinued, the desalination plant will continue to use the existing power plant intake and discharge facilities. Under this condition, the impingement and entrainment associated with the desalination plant operations would be significantly lower than those caused by the EPS operations at the same intake flow, due to a number of differences in the desalination plant and power plant intake design and operations.

Figure 3-2 provides a comparison of the 2008 EPS cooling water discharge to the flow needed to support the CDP's operations. Under 2008 operating conditions, the EPS discharge would have provided 88.6 percent of the CDP annual seawater intake requirements, and the CDP would have withdrawn an additional 11.4% percent of its source water from the EPS intake to make up the deficit in supply available from the EPS discharge. Under these operating conditions, the entrainment and impingement attributable to the desalination operations would be limited to approximately 11.4% of that identified in Chapter 5 for the stand-alone desalination facility operations. The CDP's direct use of the EPS discharge, coupled with other design and technology features described in Chapters 3 and 4, would result in a substantial reduction in entrainment and impingement.

FIGURE 3-2

2008 EPS COOLING WATER DISCHARGE VERSUS CDP FLOW REQUIREMENTS



3.4 REDUCTION IN INLET SCREEN VELOCITY

The CDP was designed for intake flow of 304 MGD (50 percent recovery) to minimize the impingement and entrainment of marine organisms under stand-alone operations. Higher intake flow, although preferable from a point of view of ease of desalination plant operations, would result in elevated potential for impingement and entrainment.

Impingement losses associated with the collection of seawater at the power plant intake would be reduced when the through-screen velocity at the inlet intake screens (bar racks) is equal to or less than 0.5 fps because this velocity would be low enough to allow some of the marine organisms to swim away from the inlet mouth and to avoid potential harm from impingement.

At the design flow of 304 MGD needed for the CDP's operations, the inlet screen velocity would be less than or equal to 0.5 fps, thereby creating flow conditions that would reduce impingement losses to a less than significant level.

3.5 REDUCE FINE SCREEN VELOCITY

During stand-alone operations, the power plant intake pumps and screens will be operated in modified configuration that minimizes the through-screen velocity and thereby reduces potential impingement of marine organisms that reach these screens.

3.5.1 Description of Power Plant Intake Screen and Pump System

A detailed description of the power plant intake system is provided in Section 2. After the seawater passes through the inlet screens (bar racks) the intake forebay tapers into two 12-foot wide intake tunnels. From these tunnels the seawater enters one of four 6-foot wide conveyance tunnels. Cooling water for conveyance tunnels 1 and 2 passes though two vertical traveling screens to prevent fish, grass, kelp, and debris from entering the intakes for power plant generation Units 1, 2 and 3. Conveyance tunnels 3 and 4 carry cooling water to intakes for power plant generation Units 4 and 5, respectively. Intakes for Unit 4 and 5 are equipped with two and three vertical travelling screens, respectively.

As electrical demand varies, the number of generating units in operation and the number of cooling water pumps needed to supply those units will also vary. Over the period of 2002 to 2005, the EPS has reported combined discharge flows ranging from 99.8 MGD to 794.9 MGD with a daily average of 600.4 MGD. Over the 20.5 year period of January 1980 to mid 2000 the average discharge flow was 550 MGD. In 2007 and 2008, the average annual intake flow was 276 MGD and 424 MGD, respectively. For comparison, the total intake flow needed for stand-alone operations of the desalination plant is 304 MGD.

3.5.2 Typical Mode of the EPS Vertical Screen and Intake Pump Operations

As discussed in the previous section, each of the five power generation units is equipped with two cooling water pumps both of which operate when a given generating unit is producing electricity. All six pumps of power generation units 1, 2 and 3 share two common vertical screens of identical size (3/8-inch) and capacity. The two pumps of unit 4 are serviced by two 3/8-inch screens, and the two pumps of unit 5 are serviced by three 5/8-inch screens located in a common channel upstream of the pumps. With all pumps in operation, the through screen velocity of the vertical screens typically is higher than 0.5 fps, thereby contributing to the impingement of marine organisms that may have reached these screens.

3.5.3 Modified Utilization of the EPS Intake Screens and Pumps During Stand-Alone Operations of the Desalination Plant

Desalination plant operation is independent from the power production process and therefore, the existing EPS intake pumps do not need to be operated coupled with the intake screens of a given unit. This design flexibility of the desalination plant allows a greater number of screens to collect the volume of water needed for the CDP operation. For example, if the power plant needs to generate 287 MW of electricity, typically unit 4 (see Table 2-1) would be used for power generation and both intake pumps and screens associated with this unit would be in service. Under this operational condition, the cooling water flow used would be 307 MGD.

If the desalination plant is operated in stand-alone condition (i.e. no power is generated) then there is greater pump selection flexibility. For example, rather than using two intake pumps of unit 4, the desalination plant would collect a similar amount of seawater by running only one pump of unit 4, and one pump of unit 5. However, in this case approximately the same amount of flow would be screened through five screens (the two screens of unit 4 and the three screens of unit 5), thereby reducing the through-screen velocity to at least one half of the EPS's operational velocity. This significant reduction of the through-screen velocity would reduce the impingement of marine life on the vertical screens as well. Such impingement reduction cannot be achieved if the power plant intake pumps are used to deliver cooling water for power generation because when a given power generation unit is used to generate electricity, then both cooling pumps must be in operation simultaneously to provide an adequate amount of cooling water for the normal operation of the unit. If the power plant discontinues power generation, then cooling pump operation can be decoupled from the operation of the condensers and this in turn allows the same flow through over a two times larger screening area and therefore reduce the through-screen velocity by more than half.

3.6 ELIMINATION OF HEAT-RELATED ENTRAINMENT MORTALITY

The seawater desalination plant will be designed with the flexibility to operate using warm water from the power plant condensers when they are in operation; and cold seawater when the power plant is not generating electricity. This design feature will also avoid the need to preheat the intake seawater in the future if and when the power plant once-through cooling operation is discontinued. Elevated seawater temperature may increase the mortality of the entrained marine life. Since under stand-alone conditions the source seawater will not be heated this entrainment mortality factor will be eliminated.

3.7 ELIMINATION OF HEAT TREATMENT RELATED MORTALITY

Under the current mode of operations, the power plant completes heat treatment of the intake facilities every 6 to 8 weeks for 6 to 8 hours per event. Since seawater is re-circulated during the heat treatment event (i.e. no new seawater is collected or discharged), there is 100% mortality of the marine organisms residing in the intake canals unless they are physically removed prior to exposure to elevated temperature. Desalination plant operations would not require heat treatment of the existing intake and discharge facilities and marine organism mortality associated with the heat treatment events will be eliminated. Instead, the power plant intake and discharge system will be cleaned periodically by circulation of plastic scrubbing balls that will be circulated through the system via the existing pumps in a close cycle process. The scrubbing balls will be introduced at the beginning of the cleaning process and captured at the end of the process. The size of the scrubbing balls is usually 0.5 inches and they will move freely within the channels and piping at relatively low velocity (3 to 5 fps).

3.8 SUMMARY OF DESALINATION PLANT DESIGN FEATURES TO MINIMIZE IMPINGEMENT AND ENTRAINMENT

The design features to be utilized in the CDP's operations to minimize impingement and entrainment of marine organisms are summarized in Table 3-1.

TABLE 3-1

DESIGN FEATURES TO MINIMIZE IMPINGEMENT AND ENTRAINMENT

Category	Feature	Result
1. Design	Use of the EPS discharge as source water for the CDP	Eliminates the entrainment and impingement independently attributable to the CDP when the EPS is discharging 304MGD
2. Design	Reduction in inlet screen velocity	Reduction of impingement of marine organisms
3. Design	Reduction in fine screen velocity	Reduction of impingement of marine organisms
4. Design	Ambient temperature processing	Eliminate entrainment mortality associated with the elevated seawater temperature
5. Design	Elimination of heat treatment	Entrainment and impingement mortality associated with heat treatment would be eliminated

CHAPTER 4

TECHNOLOGY

INTRODUCTION

Pursuant to Water Code Section 13142.5(b), this Chapter identifies the best available technology feasible to minimize the CDP's impingement and entrainment of marine life. This Chapter is broken down into five sections:

- *The first section describes constraints and opportunities associated with inclusion of technology features in the CDP to minimize intake and mortality of marine life.*
- *The second section assesses the feasibility of alternative intake technologies to minimize intake and mortality of marine life.*
- *The third section assesses the feasibility of alternative intake screening technologies to minimize impingement and entrainment.*
- *The fourth section assesses the feasibility of alternative desalination technologies to minimize intake and mortality of marine life.*
- *The fifth section summarizes the feasibility assessment of technology features and the resulting impact they have on minimizing intake and mortality of marine life.*

4.1 FEASIBILITY CONSIDERATIONS

Poseidon conducted a feasibility assessment of the best available technology to minimize entrainment and impingement. This assessment resulted in the identification of those technologies that are feasible for implementation under the site-specific conditions of the proposed CDP. For the purposes of this assessment, we relied upon the definition of feasible set forth in the California Environmental Quality Act (CEQA) Guidelines: *"'Feasible' means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors*" (CEQA Guidelines, Section 15364). This definition is generally consistent with the principles underlying the Porter-Cologne Water Quality Control Act, which includes the term "feasible" in Water Code Section 13142.5(b), but does not define the term in Water Code Section 13050.

Site-specific conditions dictate that a fundamental feasibility constraint associated with potential entrainment and impingement reduction technologies is that the technology must be compatible with both the CDP's and the EPS's operations. On August 22, 2008, the State Lands Commission approved an amendment of the EPS intake and outfall lease to authorize use of these facilities by the CDP. That amendment recognized that entrainment and impingement minimization measures cannot interfere with, or interrupt ongoing power plant operations:[1]

> 12. *Poseidon, without interference with, or interruption of, powerplant scheduled operations and at its sole cost and expense, shall use the best available design, technology, and mitigation measures at all times during with this Lease is in effect to minimize the intake (impingement and entrainment) and mortality of all forms of marine life associated with the desalination facility as determined by the San Diego Regional Water Quality Control Board or any other federal, state, or local entity having applicable jurisdiction.*

When the EPS permanently ceases use of the once-through cooling water system, additional entrainment and impingement technologies may become feasible. While no timeline has been established as to when this might occur, SLC's Lease Amendment requires that in ten years SLC would evaluate the feasibility of the implementation of those additional technologies it determines are appropriate in light of an environmental review it would undertake at that time:[2]

> *14. Within ten years from the effective date of this Amendment, or upon such earlier time as agreed to by the Lessor, or upon notice by Cabrillo that it will no longer require the use of the Lease Premises for the purpose of generating electrical power, Lessor will undertake an environmental review of the ongoing impacts of operation of the desalination facility to determine if additional requirements pursuant to Special Provision paragraph number 12, above, are required. Lessor, at its sole discretion, may hire a qualified independent environmental consultant, at the sole expense of Poseidon, with the intent to analyze all environmental effects of facility operations and alternative technologies that may reduce any impacts found. Lessor may require, and Poseidon shall comply with, such additional requirements as are reasonable and as are consistent with applicable state and federal laws and regulations and as Lessor determines are appropriate in light of the environmental review.*

The CDP design includes the best available technology that has been determined to be feasible for the site-specific conditions and size of this project and to minimize impingement and entrainment of marine organisms in the intake seawater. The selection of the desalination plant intake, screening and seawater treatment technologies planned to be used for this project is based on thorough analysis and investigation of a number of alternative seawater intake, screening and treatment technologies.

The following intake alternatives were analyzed:

- Subsurface intake (vertical and horizontal beach wells, slant wells, and infiltration galleries);
- New open ocean intake;

[1] State Lands Commission October 24, 2007 recommended Amendment of Lease PRC 8727.1
[2] Id.

- Modifications to the existing power plant intake system; and
- Installation of variable frequency drives (VFDs) on seawater intake pumps.

Screening technologies compared to identify the best available technology feasible included:

- Fish net, acoustic and air bubble barriers upstream of the existing intake inlet mouth;
- New screening technologies to replace the existing inlet screens (bar racks) and fine vertical traveling screens;

The following intake technologies were found to be feasible impingement, entrainment and flow reduction technology measures for the site-specific conditions of the CDP:

Installation of VFDs on Desalination Plant Intake Pumps. The desalination plant intake pump station design will incorporate VFDs to reduce the total intake flow for the desalination facility to no more than that needed at any given time, thereby minimizing the entrainment of marine organisms.

The assessment of the various technologies considered for impingement, entrainment and flow reduction is presented below.

4.2 ALTERNATIVE DESALINATION PLANT INTAKE TECHNOLOGIES

4.2.1 Desalination Plant Subsurface Intakes

The feasibility of using subsurface intakes (beach wells, slant wells, horizontal wells, and filtration galleries) was evaluated in detail during the EIR and Coastal Commission review phases of this project. A thorough review of the site-specific applicability of subsurface intakes and a comprehensive hydrogeological study of the use of subsurface intakes in the vicinity of the proposed desalination plant site indicate that subsurface intakes are not viable due to limited production capacity of the subsurface geological formation, the potential to trigger subsidence in the vicinity of the site and the poor water quality of the collected source water. The geotechnical evaluation relied on drilling and testing information and near shore sediment surveys to assess the feasibility of using vertical, slant, and horizontal wells as seawater intake structures for the proposed project.

<u>Vertical Intake Wells</u>: Vertical intake wells consist of water collection systems that are drilled vertically into a coastal aquifer. A well yield of about 2,100 gallons per minute (gpm) would be expected from a properly constructed, large diameter production well at the test well location in Agua Hedionda Lagoon. Modeling results indicate that up to nine vertical wells could be placed in the 700 foot wide alluvial channel, each pumping about 2,100 gpm. Therefore, the maximum production from vertical wells placed under optimum conditions would be about 20,000 gpm (28.8 MGD). Given that the test well was placed in the optimum location, this would represent the upper limit of expected well yields from the alluvial deposits in the coastal basins of San Diego County, which is consistent with historic observations.

To meet the 304 MGD seawater demand of the project, 253 wells of a 1.5 MGD intake capacity each would have to be constructed. As shown in Figure 4-1, the vertical well intake system would impact 7.2 miles of coastline to collect and transport the water to the proposed desalination facility. As a result, the vertical well intake system is not the environmentally preferred alternative.

Use of vertical intake wells is not viable for the site-specific conditions of this project due to the limited transmissivity and yield capacity of the wells. The implementation of this scenario would require installation of very large number of wells (253) for which beach property is not available. The length of beach that would be occupied by desalination plant intake using vertical wells would be over seven miles and the total cost of the implementation of such intake would be approximately $650 million. See Attachment 2 for a detailed cost estimate. In summary, the vertical well intake alternative is not the environmentally preferred alternative, is technically infeasible, and cost prohibitive.

Slant Wells. Slant wells are subsurface intake wells drilled at an angle and extending under the ocean floor to maximize the collection of seawater and the beneficial effect of the filtration of the collected water through the ocean floor sediments. Collection of the 304 MGD of seawater needed for this project would require the use of 76 slant intake wells with a capacity of 5 MGD each. The total length of beach occupied by slant wells would be over 4 miles and the construction costs for implementation of this alternative would exceed $410 million. See Attachment 2 for a detailed cost estimate.

The use of slant wells does not offer any advantage in this setting. The well field for which maximum production rates were calculated for vertical wells is located on a sand spit located approximately 100 ft from Agua Hedionda Lagoon and 300 ft from the Pacific Ocean. Those

Figure 4-1 – Vertical Beach Well Intake System

constant head conditions were taken into account when assessing the yield of this type of subsurface intake.

The use of slant wells increases the screened thickness of saturated sediment slightly (a 45 degree well would result in a 20 percent increase in screened thickness over a vertical well) and places the screened section more directly below the constant head lagoon or ocean boundary condition. The close proximity of the well field to the constant head condition already achieves this, with a little increase in yield resulting from the slant well. Due to the site-specific hydrogeological conditions (low transmissivity of the ocean floor sediments and near shore aquifer) the use of slant wells is also not viable for the CDP. In summary, the slant well intake alternative is not the environmentally preferred alternative, is technically infeasible, and cost prohibitive.

Horizontal Wells. Horizontal wells are subsurface intakes which have a number of horizontal collection arms that extend into the coastal aquifer from a central collection caisson in which the source water is collected. The water is pumped from the caisson to the desalination plant intake pump station, which in turn pumps it through the plant pretreatment system.

The use of horizontal wells, if the alluvial channel can be tapped offshore and the well can be kept inside this alluvial channel, can theoretically produce greatly increased yields by markedly increasing the screened length of the well in contact with permeable sediments.

However, the diameter of the collection arms of the horizontal wells is limited to 12 inches (and most are 8-inch or smaller), in turn limiting the production rate to 1,760 gpm (2.5 MGD) per well. This conclusion was also confirmed by the Dana Point Ocean Desalination Project test well that documented a yield of 1,660 gpm (2.4 MGD) from a 12 inch diameter well in that location. Analysis of the sediment properties indicates that this would be achieved with a horizontal well extending approximately 200 ft below the Pacific Ocean or Agua Hedionda Lagoon. Because of the constant head boundary at the ocean bottom or bottom of Agua Hedionda Lagoon, there would be minimal interference between multiple horizontal wells, but the practicalities of drilling horizontal wells limit the space to no less than about 50 ft. Given the limited width of the alluvial channel, only about 14 horizontal wells could be placed in the channel, for a total production rate of 28,000 gpm (40 MGD), still far below the project demand of 304 MGD. This approach assumes that additional exploration work will prove that elevated TDS concentrations in groundwater in the most permeable strata can be overcome.

Even if ideal conditions for this type of wells are assumed to exist (i.e., each well could collect 5 MGD rather than the 2.5 MGD determined based on actual hydrogeological data), horizontal well intake construction would include the installation of a total of 76 wells. The total length of coastal seashore impacted by this type of well intake would be 4.3 miles. As shown in Figures 4-2 and 4-3, the horizontal intake system would include nine large pump stations located on Tamarack State Beach and would impact 500 acres of shoreline and sensitive nearshore habitat. As a result, the horizontal intake system is not the environmentally preferred alternative. The cost for construction of a horizontal well intake system for collection of 304 MGD of seawater needed for the desalination plant operation is estimated at $438 million. See Attachment 2 for a

Figure 4-2 – Horizontal Drain Intake System

Figure 4-3 – Pump Stations with Horizontal Intakes

detailed cost estimate. In summary, the horizontal intake alternative is not the environmentally preferred alternative, and is technically infeasible, and cost prohibitive.

Subsurface Infiltration Gallery (Fukuoka Type Intake). The subsurface infiltration gallery intake system consists of a submerged slow sand media filtration system located at the bottom of the ocean in the near-shore surf zone, which is connected to a series of intake wells located on the shore. As such, seabed filter beds are sized and configured using the same design criteria as slow sand filters. The design surface loading rate of the filter media is typically between 0.05 to 0.10 gpm/sq ft. Approximately one inch of sand is removed from the surface of the filter bed every 6 to 12 months for a period of three years, after which the removed sand is replaced with new sand to its original depth. As it can be seen on Figures 4-4 and 4-5, the ocean floor has to be excavated to install the intake piping of the wells and pipes are buried at the bottom of the ocean floor.

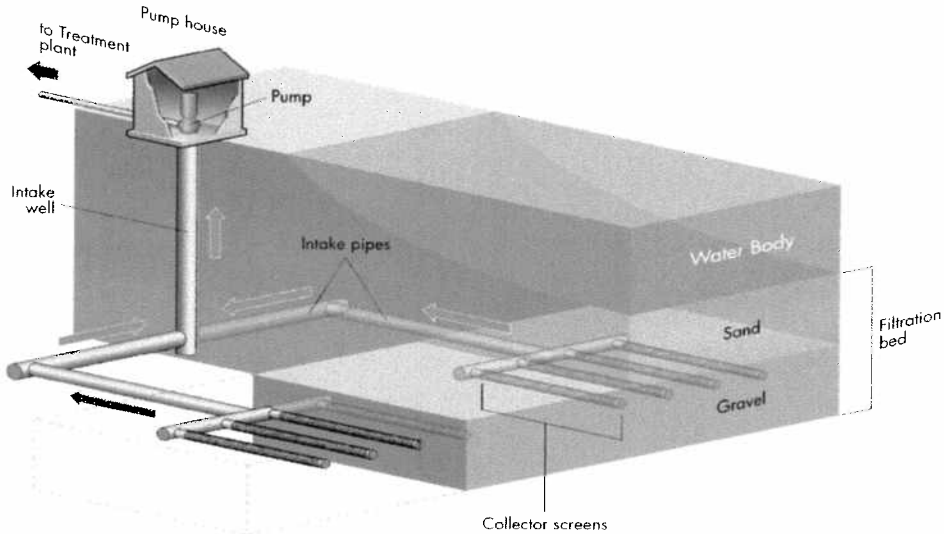


Figure 4-4 – Subsurface Infiltration Gallery (Fukuoka Type Intake)

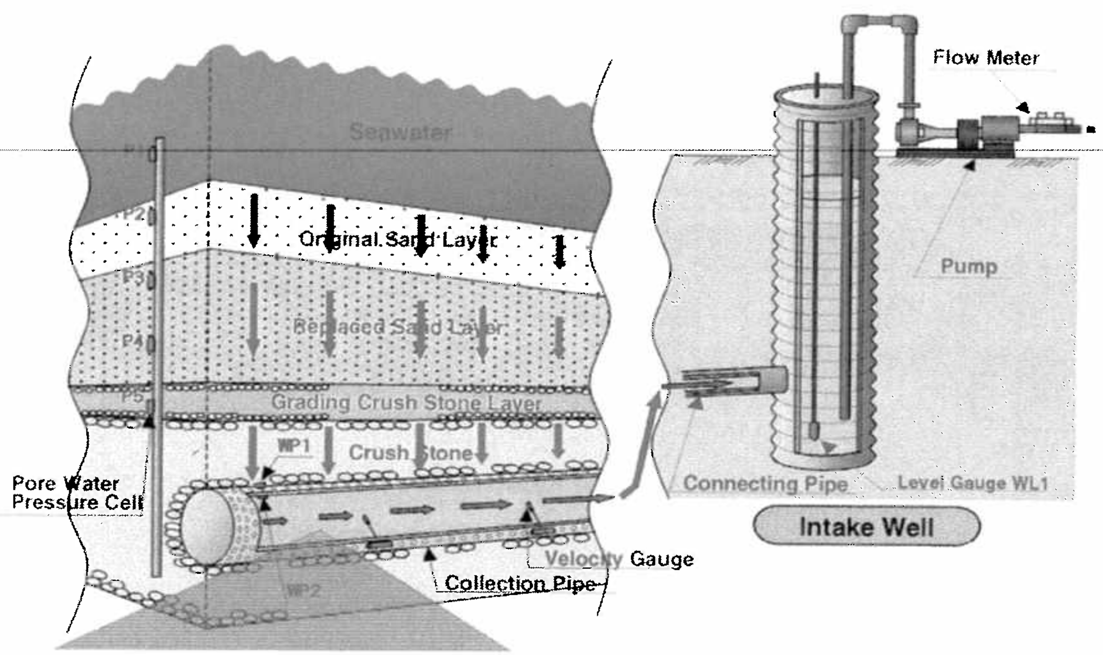


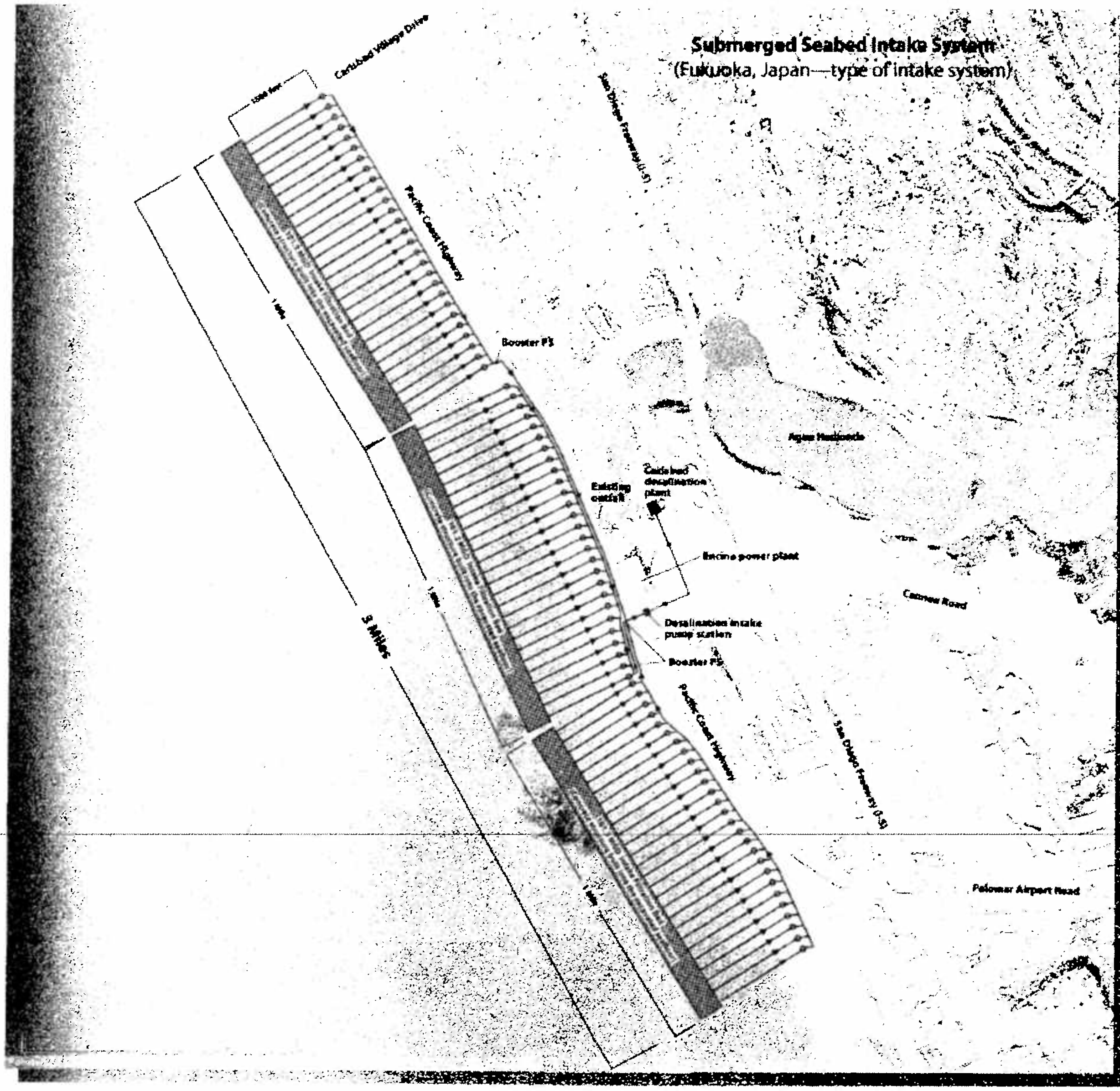
Figure 4-5 – A Cross-Section of Subsurface Infiltration Gallery

For the source water intake feed rate of 304 MGD needed for the CDP the total area of the ocean floor needed to be excavated to build a seabed intake system of adequate size is 146 acres. As shown in Figure 4-6, a submerged seabed intake system sized to meet the needs of the CDP would impact three linear miles of sensitive nearshore hard bottom kelp forest habitat. The excavation of a 146 acre/3-mile long strip of the ocean floor at depth of 15 feet in the surf zone to install a seabed filter system of adequate size to supply the CDP, would result in a very significant impact on the benthic marine organisms in this location. In addition, the subsurface seabed intake system would have a similar effect on Tamarack State Beach. To collect the seawater from the filter bed and transfer it to the CDP, the intake system would require 78 collector pipelines on the ocean floor connected to 78 pump stations that would be installed on the State beach.

The cost for construction of subsurface seabed intake system for collection of the 304 MGD of seawater needed for the desalination plant operation is estimated at $647 million. See Attachment 2 for a detailed cost estimate. In summary, the subsurface seabed intake alternative is not the environmentally preferred alternative, is technically infeasible, and cost prohibitive.

Water Quality Issues for Subsurface Intakes. Based on the results of actual intake well test completed in the vicinity of the EPS, a key fatal flaw of the beach well water quality was the high salinity of this water. The total dissolved solids (TDS) concentration in the water was on the order of 60,000 mg/L, nearly twice that of typical seawater (33,500 mg/L). The test well water also had elevated iron and suspended solids content. The pumping test was extended for nearly a month at 330 gpm (0.5 MGD) to determine if additional pumping would cause the TDS,

Figure 4-6 – Submerged Seabed Intake System



iron and suspended solids concentrations to approach that of the nearby seawater. After 30 days of pumping, the quality of the water withdrawn from the well did not improve significantly.

Summary Evaluation of Subsurface Intake Feasibility. The site-specific hydrogeologic studies used to evaluate the feasibility of the use of alternative subsurface intakes for the CDP demonstrate that the alternative intakes that were evaluated are incapable of providing sufficient seawater to support the CDP. None of the subsurface intake systems considered (vertical wells, slant wells, or horizontal wells) can deliver the 304 MGD of seawater needed for environmentally safe operation of the CDP. The maximum capacity that could be delivered using subsurface intakes is 28,000 gpm (40 MGD), which is substantially below the needed intake flow. Additionally, the quality of the water available from the subsurface intake (salinity twice that of seawater, excessive iron and high suspended solids) would be untreatable. Further, the alternative subsurface intake systems were determined not to be the environmentally preferred alternative. Taking into account economic, environmental and technological factors, the alternative subsurface intakes are not capable of being accomplished in a successful manner within a reasonable period of time; and therefore, have been determined to be infeasible. The Coastal Commission Findings approving the CDP's coastal development permit concur with this conclusion: "find that subsurface intakes are an infeasible alternative."[3]

4.2.2 Construction of New Open Ocean Intake for the CDP

Poseidon also evaluated whether the construction and operation of a new offshore intake to serve the seawater supply needs of the CDP would be a viable alternative to the use of the existing intake at the EPS and whether this approach would result in reduced impingement and entrainment.

Specifically, Poseidon studied whether an offshore intake would reduce the frequency of dredging of Agua Hedionda Lagoon under the stand-alone CDP operation; and whether the construction of a new intake would reduce environmental impacts compared to the use of the existing EPS intake under the stand-alone desalination facility operation. The analysis included the review of the environmental impact report (EIR) for the Agua Hedionda Inlet Jetty Extension Project (Jetty EIR). This EIR identified an offshore intake as an environmentally preferred alternative to the proposed extension of the inlet jetty. Poseidon prepared two studies which demonstrate that the construction of a new offshore intake would not reduce the frequency of dredging of Agua Hedionda Lagoon and it is not the environmentally preferred alternative.

The first study addresses whether an offshore intake would reduce the frequency of dredging of Agua Hedionda Lagoon under the stand-alone desalination facility operation.[4] This study concluded that the dredging frequency needed for normal operation of the stand-alone desalination facility would be approximately once every three years when adhering to present dredging practices. Under the "no power plant and no desalination project" scenario, the

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[3] See Coastal Commission Recommended Revised Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, page 62 of 133; http://documents.coastal.ca.gov/reports/2008/8/W4a-8-2008.pdf

[4] *Comparative Analysis of Intake Flow Rate on Sand Influx Rates at Agua Hedionda Lagoon: Low-Flow vs. No-Flow Alternatives*, Jenkins and Wysal, September 28, 2007

minimum dredging volume required to keep Agua Hedionda Lagoon open to the Pacific Ocean would be about 15 percent less than for the stand-alone desalination facility. This 15 percent reduction however, would not be sufficient to allow the dredge frequency to be extended beyond once every three years due to schedule limitations that prohibit dredging during least tern nesting season. Given the variability in the actual sand transport from year to year and the accuracy of the modeling, there is not any discernable difference between the estimated dredging frequency and related environmental impacts associated with the operation of a stand-alone desalination facility versus the "no power plant, nor desalination project" scenario.

The second study addresses whether an offshore intake would result in fewer environmental impacts than the use of the existing EPS intake under the stand-alone desalination facility operation.[5] Here the authors evaluate the Jetty EIR and conclude that the draft EIR did not adequately evaluate the environmental impacts associated with constructing an offshore intake. The Jetty EIR did not assess the biological impacts of installing a large diameter pipe 1000 feet offshore which, depending on placement, would potentially destroy existing rocky reef outcroppings occurring offshore. The Jetty EIR did not evaluate the down coast effects of an intake structure on habitat, sand flow, or sedimentation.

Further, the Jetty EIR did not adequately evaluate entrainment and impingement effects. Based on the environmental analysis of the area for potential location of a new offshore intake, Poseidon is of the opinion that an offshore intake has the potential to affect a greater diversity of adult and juvenile organisms as well as both phyto- and zooplankton species than are currently impacted by the existing intake at the EPS. The estimated cost of the new offshore intake shown in Figure 4-7 is approximately $150 million (see Attachment 2).

In conclusion, construction of a new open ocean water intake would not result in significant reduction in dredging frequency, would cause permanent construction related impacts to the marine environment and would shift entrainment to a more sensitive area of the marine environment that would affect a greater diversity of species. As compared to the environmental impacts caused by the existing EPS intake, a new offshore intake is not the environmentally preferred alternative. Taking into account economic, environmental and technological factors, the alternatives intake is not capable of being accomplished in a successful manner within a reasonable period of time; and therefore, has been determined to be infeasible. The Coastal Commission draft findings agree with this conclusion: "determined that alternative intakes that might avoid or minimize environmental impacts are infeasible or would cause greater environmental damage."[6]

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[5] *Issues Related to the Use of the Agua Hedionda Inlet Jetty Extension EIR to Recommend An Alternative Seawater Intake for the Carlsbad Desalination Project,* Graham, Le Page and Mayer, October 8, 2007

[6] See Coastal Commission Recommended Revised Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, page 80 of 133; http://documents.coastal.ca.gov/reports/2008/8/W4a-8-2008.pdf

Figure 4-7 – Open Ocean Intake System

4.3 ALTERNATIVE POWER PLANT INTAKE & SCREENING TECHNOLOGIES

A number of alternative intake and screening technologies were evaluated to determine whether they offer a viable and cost-effective reduction of impingement and entrainment associated with the CDP's operations under the conditions of a complete shutdown of EPS operations. As indicated previously, under these conditions, the EPS intake facilities (combination of screens and pumps) will be operated to collect a total flow of 304 MGD which is 38 percent of the installed EPS intake pump capacity.

Under the stand-alone desalination plant operations, the existing power plant intake facilities will be operated at reduced flow and fewer pumps will be collecting water through the same existing intake screening facilities. The velocity of the water flowing into the intake would be reduced to 0.5 fps or less. This alone will substantially reduce the impingement associated with the CDP operations.

Technologies listed in Table 4-1 have been evaluated based upon feasibility for implementation at the facility, including the following:

- Ability to achieve a significant reduction in impingement and entrainment (IM&E) for all species, taking into account variations in abundance of all life stages;
- Feasibility of implementation at the facility;
- Cost of implementation (including installed costs and annual O&M costs);
- Impact upon facility operations.

4.3.1 Fish Screens and Fish Handling and Return System

This alternative would include the replacement of the existing traveling screens within the tunnel system with new traveling screens that have features which could enhance fish survival and are designed with the latest fish removal features, including the Fletcher type buckets on the screen baskets (Ristroph-type screens), dual pressure spray systems (low pressure to remove fish, and high pressure to remove remaining debris), and separate sluicing systems for discarding trash and returning the impinged fish back to the Aqua Hedionda Lagoon (AHL) or the ocean.

TABLE 4-1

POTENTIAL IMPINGEMENT/ENTRAINMENT REDUCTION TECHNOLOGIES

Technology	Reduction Potential	
	Impingement	Entrainment
Modified traveling screens with fish return	Yes	No
Replacement of existing traveling screens with fine mesh screens	Yes	Yes
New fine mesh screening structure	Yes	Yes
Cylindrical wedge-wire screens – fine slot width	Yes	Yes
Fish barrier net	Yes	No
Aquatic filter barrier (e.g. Gunderboom)	Yes	Yes
Fine mesh dual flow screens	Yes	Yes
Modular inclined screens	Yes	No
Angled screen system – fine mesh	Yes	Yes
Behavior barriers (e.g. light, sound, bubble curtain)	Maybe	No

The modified screening system could potentially improve impingement survival. This system however will have a negative effect in terms of entrainment reduction, because the intake pumps will need to collect more source water (3 MGD) to service the dual pressure spray system of the new screens. In addition, a fish return system is required as part of this scenario to transport fish washed from the screens alive back to the water body to a location where they would not be subject to re-entrainment into the intake.

The capital cost associated with this impingement reduction alternative is estimated at: $5.7 million. The annual O&M costs for such system are estimated at $200,000 over the costs of operation of the existing intake screening system.

Poseidon considers this alternative to be infeasible for the following reasons:

- The impingement associated with the CDP's operations has been found by the CEQA lead agency to be insignificant.
- Substantial construction costs for a limited benefit;
- The implementation of this alternative will result in increased entrainment because of the significant volume of additional seawater needed to be collected to operate the screen.

4.3.2 New Power Plant Intake and Fine Mesh Screening Structure

Fine mesh traveling screens have been tested and found to retain and collect fish larvae with some success. Application of fine mesh traveling screen technology for the EPS would require the construction of a complete new screen structure located at the south shore of the lagoon, including both coarse and fine mesh traveling screen systems and fish collection and return systems. This alternative would replace the existing trash rack structure with a much larger screening structure. Major modifications to the existing tunnel system would be required. Additionally, an appropriate and suitable location to return collected fish, shellfish, and their eggs and larvae would have to be constructed.

The demolition of the existing intake structure; removal of the existing screens; construction of a new intake structure; and installation of new coarse and fine mesh screens equipped with fish collection and return systems; would require a total construction expenditure of $53.3 million. Similar to the previous technology, the implementation of this alternative will also require additional intake flow (4 MGD to 5 MGD) for the operation of the coarse and fine mesh screen organism retrieval and return systems. The additional O&M costs associated with the operation of this system are $300,000 per year.

Poseidon considers this alternative infeasible for the following reasons:

- The impingement and entrainment associated with the CDP have been found by the CEQA lead agency to be insignificant.
- Poseidon has committed to restore and enhance at least 37 acres of marine wetlands habitat that significantly overcompensates for the limited impact of the CDPto marine resources.
- Uncertain survival of the captured marine organisms.
- Substantial increase in CDP construction costs for a very limited benefit.

4.3.3 Cylindrical Wedge-Wire Screens – Fine Slot Width

Wedge-wire screens are passive intake systems, which operate on the principle of achieving very low approach velocities at the screening media. Wedge-wire screens installed with small slot openings reduce impingement and entrainment and are an EPA-approved technology for compliance with the US EPA 316(b) Phase II rule provided the following conditions exist:

- The cooling water intake structure is located in a freshwater river or stream;
- The cooling water intake structure is situated such that sufficient ambient counter currents exist to promote cleaning of the screen face;
- The through screen design intake velocity is 0.5 ft/s or less;

- The slot size is appropriate for the size of eggs, larvae, and juveniles of any fish and shellfish to be protected at the site; and

- The entire water flow is directed through the technology.

Wedge-wire screens are designed to be placed in a water body where significant prevailing ambient cross flow current velocities (≥ 1 ft/s) exist. This cross flow allows organisms that would otherwise be impinged on the wedge-wire intake to be carried away with the flow. An integral part of a typical wedge-wire screen system is an air burst back-flush system, which directs a charge of compressed air to each screen unit to blow off debris and impinged organisms back into the water body where they would be carried away from the screen unit by the ambient cross flow currents.

The EPS, located on the tidal Agua Hedionda Lagoon, would not meet the first two EPA criteria discussed above. First, the intake is not located on a freshwater river. Second, there is not sufficient crosscurrent in the lagoon to sweep organisms and debris away from the screen units; so debris and organisms back-flushed from the screens would immediately re-impinge on the screens following the back-flush cycle. For these reasons, Poseidon considers this alternative infeasible.

4.3.4 Fish Net Barrier

A fish net barrier, as it would be applied to the EPS intake system, is a mesh curtain installed in the source water body in front of the exiting intake structure such that all flow to the intake screens passes through the net, blocking entrance to the intake of all aquatic life forms large enough to be blocked by the net mesh. The net barrier is sized large enough to have very low approach and through net velocities to preclude impingement of juvenile fish with limited swimming ability. The mesh size must be large enough to preclude excessive fouling during operation, while at the same time small enough to keep the marine organisms out of the intake system. These conditions typically limit the mesh size such that adult and a percentage of juvenile fish can be blocked. The mesh is not fine enough to block most larvae and eggs. The fish net barrier could potentially reduce impingement; however, it would not meet reduce the entrainment of eggs and larvae.

The fish net barrier technology is still experimental, with very few successful installations. Using a 20 gpm/ft^2 design loading rate, a net area of approximately 30,000 ft^2 would be required for the EPS. Maintaining such a large net moored in the lagoon is not practical. In addition, the fish barrier is a passive screening device, which is subject to fouling and has no means for self-cleaning. This technology would be rapidly clogged with kelp and other debris. The services of a diving contractor would be required to remove the net for cleaning onshore and to replace the fouled net with a clean net on each cleaning cycle. For these reasons, this technology is not practically feasible for implementation at the EPS and further evaluation is not warranted.

4.3.5 Aquatic Filter Barrier

An aquatic filter barrier system, such as the Gunderboom Marine Life Exclusion System (MLES)™, is a moored water permeable barrier with fine mesh openings that is designed to prevent both impingement and entrainment of ichthyoplankton and juvenile aquatic life. An integral part of the MLES is an air-burst back flush system similar in concept to the air burst system used with wedge-wire screen systems to back flush impinged organisms and debris into the water body to be carried away by ambient cross currents.

The MLES has much smaller mesh openings and would block fish eggs and larvae from being entrained into the intake. These smaller organisms would be impinged permanently on the barrier due to the lack of cross currents to carry them away. Consequently, this technology is not feasible for implementation at the existing EPS intake and further evaluation is not warranted.

4.3.6 Fine Mesh Dual Flow Screens

A modified dual flow traveling water screen is similar to the through flow design, but this type of screen would be turned 90 degrees to the direction of the flow so that its two faces would be parallel to the incoming water flow. When equipped with fine mesh screening media, the average 0.5 fps approach velocity to the screen face would have to be met by the dual flow screen design. Water flow enters the dual flow screen through both the ascending and the descending screen faces, and then flows out between the two faces. All of the fish handling features of the Ristroph screen design would be incorporated in the dual flow screen design.

The dual flow screen configuration has been shown to produce low survival rates for fish larvae. This is because of the longer impingement time endured by organisms impinged on the descending face of the screen. This longer impingement time is suspected to result in higher mortality rates than similar fine mesh screens with a flow through screen design.

The primary advantage of this screen configuration is the elimination of debris carryover into the circulating water system. Also, because both ascending and descending screen faces are utilized, there is greater screening area available for a given screen width than with the conventional through-flow configuration.

However, the dual flow screen can create adverse flow conditions in the approach flow to the circulating water pumps. The flow exiting the dual flow screens is turbulent with an exit velocity of greater than 3 fps. Modifications to the pump bays downstream of the screens, usually in the form of baffles to break up and laterally distribute the concentrated flow prior to reaching the circulating water pumps would be required.

The implementation of this technology to the EPS cooling water intake system would require an entirely new intake screen structure similar to the fine mesh through flow intake screen structure discussed previously. The dual flow fine mesh screen configuration offers no advantages in terms reduction of impingement and entrainment mortality as compared to through flow fine mesh traveling screens discussed above and in fact would probably not perform as well as the through flow design. The design concept for the dual flow screen structure would be similar to the through flow fine mesh screen structure with trash racks, coarse mesh traveling screens and fine mesh traveling screens in each screen train. The implementation cost and operation and maintenance costs for this facility would be of the same order of magnitude as for the through flow screen structure. Dual flow screen technology does not offer a significant performance or cost advantage as compared with through flow screen technology. Therefore, the use of this technology for the EPS is not recommended.

4.3.7 Modular Inclined Screens

Modular Inclined Screen (MIS) is a fish protection technology for water intakes developed and tested by the Electric Power Research Institute (EPRI). This technology was developed specifically to bypass fish around turbines at hydro-electric stations. The MIS is a modular design including an inclined section of wedge-wire screen mounted on a pivot shaft and enclosed within a modular structure. The pivot shaft enables the screen to be tilted to back-flush debris from the screen. The screen is enclosed within a self-contained module, designed to provide a uniform velocity distribution along the length of the screen surface. Transition guide walls taper in along the downstream third of the screen, which guide fish to a bypass flume. A full size prototype module would be capable of screening up to 800 cfs (518 MGD) at an approach velocity of 10 ft/sec.

The MIS design underwent hydraulic model studies and biological effectiveness testing at Alden Research Laboratory to refine the hydraulic design and test its capability to divert fish alive. Eleven species of freshwater fish were tested including Atlantic salmon smolt, coho salmon, Chinook salmon, brown trout, rainbow trout, blueback herring, American shad and others. After some refinements in the design were made during this testing, the results showed that most of these species and sizes of fish can be safely diverted.

Following laboratory testing, the MIS design was field tested at the Green Island Hydroelectric Project on the Hudson River in New York in the fall of 1995. In addition to the MIS, the effectiveness of a strobe light system was also studied to determine its ability to divert blueback herring from the river to the MIS. Results for rainbow trout, golden shiner and blueback herring, which were released directly into the MIS module were similar to the laboratory test results in terms of fish survivability. The limited amount of naturally entrained blueback herring did not allow reliable evaluation of test results.

The MIS technology, as tested, does not address entrainment of eggs and larvae. Also, this technology has never been tested for, or installed in, a power station with a seawater intake system. Further research would be required to evaluate the efficacy of this technology for application to a seawater intake system. MIS is not a suitable and proven technology, at this time, for retrofit to the EPS intake system. Therefore, this technology is not found viable the desalination plant intake impact.

4.3.8 Angled Screen System – Fine Mesh

Angled screens are a special application of through-flow screens where the screen faces are arranged at an angle of approximately 25 degrees to the incoming flow. The conventional through-flow screen arrangement would place the screen faces normal or 90 degrees to the incoming flow. The objective of the angled-screen arrangement is to divert fish to a fish bypass system without impinging them on the screens. Most fish would not be lifted out of the water but would be diverted back to the receiving water by screw-type centrifugal or jet pumps.

Using fine screen mesh on the traveling screens minimizes entrainment, but increases potential for impingement of organisms that would have otherwise passed through the power plant condenser tubes. Application of this technology would require construction of new angled screen structure at the south shore of the lagoon similar to the new fine mesh screen intake structure discussed previously. The angled screen facility would not provide a significant performance advantage in terms of reducing impingement and entrainment as compared to the fine mesh screen structure, and would be at least as large and a significantly more complex structure. This facility would be potentially more costly to implement and maintain than the fine mesh screen facility. Therefore, further evaluation of this technology for the EPS is not warranted.

4.3.9 Behavior Barriers

A behavioral barrier relies on avoidance or attraction responses of the target aquatic organisms to a specific stimulus to reduce the potential of entrainment or impingement. Most of the stimuli tested to date are intended to repulse the organism from the vicinity of the intake structure.

Nearly all the behavioral barrier technologies are considered to be experimental or limited in effectiveness to a single target species. There are a large number of behavioral barriers that have been evaluated at other sites, and representative examples these are discussed separately below.

4.3.10 Offshore Intake Velocity Cap

This is a behavioral technology associated with a submerged offshore intake structure(s). The velocity cap redirects the area of water withdrawal for an offshore intake located at the bottom of the water body. The cap limits the vertical extent of the offshore intake area of withdrawal and avoids water withdrawals from the typically more productive aquatic habitat closer to the surface of the water body.

This technology operates by redirecting the water withdrawal laterally from the intake (rather than vertically from an intake on the bottom), and as a result, the water entering the intake is accelerated laterally and is more likely to provide horizontal velocity cues to fish and allow fish to respond and move away from the intake. Potentially susceptible juvenile and adult fish that are able to identify these changes in water velocity as a result of their lateral line sensory system are able to respond and actively avoid the highest velocity areas near the mouth of the intake structure.

This technology potentially reduces impingement of fish by stimulating a behavioral response. The technology does not necessarily reduce entrainment, except when the redirected withdrawal takes water from closer to the bottom of the water body and where that location has lower plankton abundance.

Application of this technology to the EPS, to be fully effective, would require development of an entirely new intake system with a submerged intake structure and connecting intake conduit system installed out into the Pacific Ocean. For the reasons previously discussed, this is not a practically feasible consideration for the EPS. Therefore, further evaluation of this technology is not warranted.

4.3.11 Air Bubble Curtain

Air bubble curtains have been tested alone and in combination with strobe lights to elicit and avoidance response in fish that might otherwise be drawn into the cooling water intake. Generally, results of testing the bubble curtain have been poor based on testing completed by EPRI. Therefore, further evaluation of this technology is not warranted.

4.3.12 Strobe Lights

There has been a great deal of research with this stimulus over the last 15 years to guide fish away from intake structures. EPRI has co-funded a series of research projects and reviewed the results of research in this field as well. In both laboratory studies and field applications, strobe lights were shown to effectively move selected species of fish away from the flashing lights. Most of the studies conducted to date have been with riverine fish species and for projects associated with hydroelectric generating facilities. One early study was conducted at the Roseton Generating Facility on the Hudson River in New York, another study was conducted on Lake Cayuga in New York, and others for migratory stages of Atlantic and Pacific salmon. Few species similar to those occurring in the Agua Hedionda Lagoon have been tested for avoidance response either in the lab or in actual field studies.

Laboratory testing was done for an application of strobe lights for the San Onofre Nuclear Generating Facility. Testing was conducted for white croaker, Pacific sardine and northern anchovy. The testing demonstrated no conclusive results and the Coastal Commission found this device not useful at this station. Therefore, further evaluation of this technology is not warranted.

4.3.13 Other Lighting

Incandescent and mercury vapor lights have also been tested as a behavioral stimulus to direct fish away from an intake structure. Mercury lights have generally been tested as a means of drawing fish to a safe bypass of the intake structure as generally the light has an attractive effect on fish. Tests have not demonstrated a uniform and clearly repeatable pattern of attraction for all fish species. The mercury lights have been somewhat effective in attracting European eel, Atlantic salmon, and Pacific salmon. But results with other species including American shad, blue back herring and alewife had more variable results. One test with different life stages of Coho salmon shows both attraction and repulsion from the mercury light for the different life stages of the coho. Testing with incandescent, sodium vapor and fluorescent lamps was more limited but also had variable and species specific results.

Other lighting systems, as with most all the behavioral barrier alternatives, have not been tested with the species of fish common in Agua Hedionda Lagoon. As a result there is no basis to recommend these lights systems as an enhancement to reduce impingement or entrainment at the EPS.

4.3.14 Sound

Sound has also been extensively tested in the last 15 years as a method to alter fish impingement rates at water intake structures. Three basic groups of sound systems including percussion devices (hammer, or poppers), transducers with a wide range of frequency output, and low frequency or infrasound generators, have all been tested on a variety of fish species.

Of all the recently studied behavioral devices the sound technology has demonstrated some success with at least one group of fish species. Clupeids, such as alewife, demonstrate a clear repulsion to a specific range of high frequency sound. A device has been installed in the Fitzpatrick Nuclear Generating station on Lake Ontario in New York, which has been effective in reducing impingement of landlocked alewives. The results were repeated with alewife at a coastal site in New Jersey. Similar results with a high frequency generator also reported a strong avoidance response for another clupeid species, the blue back herring, in a reservoir in South Carolina.

Testing of this high frequency device on many other species including weakfish, spot, Atlantic croaker, bay anchovy, American shad, blue back herring, alewife, white perch, and striped bass demonstrated a similar and strong avoidance response by American shad and blue back herring. Alewife and sockeye salmon have also been reported to be repelled by a hammer percussion device at another facility. But testing of this same device at other facilities with alewife did not yield similar results.

Although high frequency sound has potential for eliciting an avoidance response by the Alosid family of fish species, there is no data to demonstrate a clear avoidance response for the species of fish common to the Agua Hedionda Lagoon. Therefore there is no basis to use sound as a viable method to reduce impingement of fish at the EPS.

4.3.15 Installation of Variable Frequency Drives on Existing Power Plant Intake Pumps

Under this alternative, VFDs would be installed on the EPS intake cooling water pumps to minimize the volume of water collected for the desalination plant operations. As indicated previously, the total volume of seawater that is required for the normal operation of the desalination plant is 304 MGD. Of this flow, 104 MGD will be collected for production of fresh water, while the remaining 200 MGD of seawater will be used to dilute the concentrated seawater from the desalination plant.

As indicated in Table 2-1, the EPS has ten cooling water pumps of total capacity of 794.9 MGD. Currently, all of these pumps are equipped with constant speed motors. Each of the five existing power generation units is coupled with two cooling pumps per unit and both pumps are operated when a given power generator is in service. Because the individual power generation units are designed to operate efficiently only at a steady-state near constant rate of electricity production and therefore, near constant thermal discharge load, reducing cooling flow by VFDs in order to diminish entrainment would result in an increased temperature of the thermal discharge which in turn would have a detrimental effect on the marine organisms in the discharge area. The installation of VFDs is also limited by physical site constraints. The VFD units would need to be located near the pump motors in the existing concrete pump pit, which would need to be enlarged in order to accommodate this equipment. The cost associated with such major structural modifications along with the cost of the VFDs would exceed $8.5 million. Taking into consideration the limited useful life of the existing power plant, such large expenditures at this time are not prudent.

Under stand-alone operational conditions of the desalination plant, the power plant intake pumps would be operated as described in the previous Chapter (Chapter 3 – Design). The cooling water pump operations will be decoupled from the condenser operations, which would substantially reduce the seawater velocity through screens. Under these conditions, the intake flow of the desalination plant (and associated entrainment) would be controlled by the VFD system of the desalination plant intake pump station. Installing an additional VFD system on the power plant intake pumps would have a negligible benefit.

In summary, installation of VFDs on existing power plant intake pumps would provide limited benefits to marine life while significantly interfering with ongoing power plant operations. Taking into account economic, environmental and technological factors, this alternative has been determined to be infeasible.

4.3.16 Summary Evaluation of Power Plant Intake and Screening Alternatives

Implementation of the alternatives associated with the modification of the existing power plant intake and screening facilities were found to be infeasible because they would interfere with, or interrupt, power plant operations. Such significant modifications of the existing intake, and prolonged periods of power plant downtime are difficult to justify given the limited environmental benefit. The extended disruption to power plant operations and significant expenditures associated with such modifications would not yield commensurate benefits for the following key reasons:

1. **Impingement.** The complex and costly intake modifications to reduce this already minimal impingement are not prudent. In addition, operational modifications of the existing EPS intake system under stand-alone CDP operation would reduce the fine screen-flow through velocity to further minimize impingement.

2. **Entrainment.** The entrainment associated with stand-alone CDP operation is mainly driven by the volume of intake flow needed to produce fresh drinking water. In contrast with power plant operations, where water is not essential to produce electricity, in seawater desalination, seawater has to be collected and used to produce fresh water. Therefore, CDP entrainment effects cannot be avoided completely or minimized drastically by modifying the existing power plant intake facilities. Quite the opposite, many of the impingement reduction scenarios (see Sections 4.3.1, 2 &3 and 4.3. 6, 7&8) could increase the total flow needed for stand-alone desalination plant operations, thereby trading negligible impingement reduction benefits for incremental increase in entrainment.

Taking into account these economic, environmental and technological factors, the power plant intake screening alternatives are not capable of being accomplished in a successful manner within a reasonable period of time, and have been determined to be infeasible.

When the EPS permanently ceases the use of the once-through cooling water system, additional entrainment and impingement technologies may become feasible. While no timeline has been established as to when this might occur, SLC staff is recommending that in ten years Poseidon would be required to evaluate and implement those additional technologies it determines are appropriate in light of an environmental review it would undertake at that time.[7] The draft SLC lease would require, ten years after the lease is issued, that the CDP be subject to further environmental review to ensure its operations at that time are using technologies that may reduce any impacts.

4.4 DESALINATION TECHNOLOGIES FOR IMPROVED SURVIVAL OF MARINE LIFE

Seawater desalination treatment processes and technologies differ significantly from those used in once-trough cooling power generation. In power plant installations, all of the entrained organisms pass through a complex system of power generation equipment and piping, and are exposed to thermal stress caused by high-temperature heat exchangers before they exit the power plant with the discharge. Therefore, typically a 100 percent mortality of marine organisms is assumed during the once-through cooling power generation process. State-of-the art reverse osmosis seawater desalination plants, such as the CDP, differ by the following key features:

1. Seawater is not heated in order to produce drinking water, which eliminates the thermal stress of marine organisms entrained in the source water flow;

[7] State Lands Commission August 22, 2008 Amendment of Lease PRC 8727.1.

2. Marine organisms are captured in the first stage of treatment (pretreatment) and therefore, do not pass through most of the desalination plant facilities, which in turn increases their chance of survival. The captured marine organisms are returned to the ocean.

The CDP will incorporate a number of technologies that would reduce entrainment and increase the potential to capture marine organisms and to successfully return them to the ocean. These technologies are described below.

4.4.1 Installation of Variable Frequency Drives on Desalination Plant Intake Pumps

The desalination plant intake pump station will be equipped with a VFD system to closely control the volume of the collected seawater. As water demand decreases during certain periods of the day and the year, the VFD system will automatically reduce the intake pump motor speed thereby decreasing intake pump flow to the minimum level needed for water production.

As in any other water treatment plant, the desalination plant production would vary diurnally and seasonally in response to water demand fluctuations. If a VFD system is not available, the CDP intake pumps would collect a constant flow corresponding to the highest flow requirements of the CDP. The installation of a VFD system at the intake pump station would reduce the total intake flow of the desalination plant compared to constant speed-design, which in turn would result in proportional decrease in entrainment associated with desalination plant operations.

4.5 SUMMARY OF THE FEASIBILITY ASSESSMENT OF TECHNOLOGY FEATURES TO MINIMIZE IMPINGEMENT AND ENTRAINMENT

As shown in Table 4-2, installation of VFDs on the CDP intake pumps was found to be a feasible technology feature to minimize impingement and entrainment.

TABLE 4-2

DESIGN FEATURES TO MINIMIZE IMPINGEMENT AND ENTRAINMENT

Category	Feature	Result
Technology	Installation of VFDs on CDP intake pumps	Reduce the total intake flow for the desalination facility to no more than that needed at any given time, thereby minimizing the entrainment of marine organisms.

In addition, taking into account economic, environmental and technological factors previously discussed, the following intake technology alternatives are not capable of being accomplished in a successful manner within a reasonable period of time; and therefore, have been determined to be infeasible:

- **Installation of subsurface intakes** (beach wells, slant wells, infiltration galleries, etc.) is infeasible for the site-specific conditions of the CDP because of the limited production capacity, poor water quality of the coastal aquifer, extensive environmental damage associated with the implementation of such intakes and excess cost.

- **Construction of new open ocean intake** in the vicinity of the project site was found more environmentally damaging than the use of the existing intake located in Agua Hedionda Lagoon. This alternative is also cost prohibitive.

- **Major physical or structural modifications to the existing power plant intake** facilities were found to be infeasible because of the very limited potential of impingement and entrainment benefits they could offer as well as practical constraints with their implementation while the power plant is in operation.

- **Installation of variable frequency drives on existing power plant intake pumps** would provide limited benefits to marine life while significantly interfering with ongoing power plant operations. Taking into account economic, environmental and technological factors, this alternative has been determined to be infeasible.

CHAPTER 5

QUANTIFICATION OF INTAKE AND MORTALITY OF MARINE LIFE

INTRODUCTION

This Chapter quantifies the estimated intake and mortality of marine life, i.e., impingement and entrainment, associated with the CDP's stand-alone operations. It includes four sections:

- *The first section describes Poseidon's approach to the quantification of the entrainment and impingement associated with the Project in stand-alone mode.*
- *The second section quantifies the impingement associated with the desalination facility's stand-alone operations.*
- *The third section quantifies the entrainment associated with the desalination facility's stand-alone operation.*
- *The fourth section summaries the assessment of impingement and entrainment associated with the desalination facility's stand-alone operations.*

5.1 ESTIMATES OF PROJECTED IMPINGEMENT AND ENTRAINMENT ARE CALCULATED FOR STAND-ALONE OPERATIONS

As explained in Chapter 2, the CDP will use the EPS's existing intake and discharge facilities. So long as the EPS is operating, the CDP's source water needs will largely be met by using the cooling water effluent discharged by the EPS that would otherwise be discharged directly into the Pacific Ocean as the CDP's source water. To the extent that the flow through the EPS meets or exceeds the needs of the CDP, the CDP's operations will not trigger the need for additional technology or mitigation measures to minimize the intake and mortality of marine life[1].

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[1] Order No. R9-2006-0065, NPDES No. CA0109223, Attachment F – Fact Sheet, VII. B. 4.b. Intake Regulation, p. F-49-50 explains:

> The CDP is planned to operate in conjunction with the EPS by using the EPS cooling water discharge as its source water. When operating in conjunction with the power plant, the desalination plant feedwater intake would not increase the volume or the velocity of the power station cooling water intake nor would it increase the number of organisms impinged by the Encina Power Station cooling water intake structure. Recent studies have shown that nearly 98 percent of the larvae entrained by the EPS are dead at the point of the desalination plant intake. As a result, a *de minimis* of organisms remain viable which potentially would be lost due to the incremental entrainment effect of the CDP operation. Due to the fact that the most frequently entrained species are very abundant in the area of the EPS intake, Agua Hedionda Lagoon and the Southern California Bight, species of direct recreational and commercial value would constitute less than 1 percent of all the organisms entrained by the EPS. As a result, the incremental entrainment effects of the CDP operation in conjunction with the EPS would not trigger the need for additional technology or mitigation to minimize impacts to marine life.

In the event the EPS were to cease operations, however, the CDP will need to independently operate the EPS's seawater intake and outfall for the benefit of its desalination operations. Under this stand-alone mode of operation, the CDP's estimated entrainment will be no greater than that associated with EPS operations at the same intake flow, and the impingement is expected to be lower due to reduced intake velocities and the elimination of heat treatment practices.

5.2 ESTIMATED IMPINGEMENT ASSOCIATED WITH STAND-ALONE OPERATIONS

The impingement assessment provided herein is based on an analysis of the most recent biological data available for the EPS intake structure (Attachment 3). These data were collected and analyzed by Tenera Environmental in accordance with a sampling plan and methodology approved by the San Diego Regional Water Quality Control Board (See Attachment 4).

5.2.1 The EPS'S Impingement

EPS's impingement was calculated by collecting 52 biological samples collected over a 52-week period and noting the EPS's flow volume for each sample day.[2]

The abundance and biomass of fishes, sharks, rays and invertebrates impinged on the EPS traveling screens were documented in an extensive study as part of the 316(b) Cooling Water Intake assessment submitted to the San Diego Regional Water Quality Control Board by Cabrillo Power, LLC in January 2008.[3] All impingement sampling data collected during this study are provided in Attachment 3 of the Minimization Plan. This attachment contains data collected for all individual sampling events, including the dates and times of the sampling events.

Table 5-1 represents the total number and weight of organisms (i.e., bony fishes, invertebrates, and sharks and rays) that were impinged by the EPS's normal operations during the 52-week sampling period of 2004/2005. The last row reveals that, on average, the EPS's operations resulted in the impingement of 7.2 kg per day of fish (fish, sharks and rays) biomass.

TABLE 5-1

Number and weight of fishes (bony fishes, sharks and rays) and invertebrates impinged during normal operations at EPS from June 2004 to June 2005 on the sample days

	Daily Volume (MGD)	Fishes (Bony Fishes & Sharks + Rays)		Invertebrates	
		Number	Weight (g)	Number	Weight (g)
6/24/2004	632	287	4,355.6	7	66.1
6/30/2004	620	419	4,666.3	6	106.4
7/7/2004	671	209	3,590.1	6	54.0

[2] See Attachment 8. Tables A details the numbers and biomass of the fish species collected during the sampling period; Table B provides the same information for invertebrates.

[3] "CLEAN WATER ACT SECTION 316(b) IMPINGEMENT MORTALITY AND ENTRAINMENT CHARACTERIZATION STUDY—Effects on the Biological Resources of Agua Hedionda Lagoon and the Nearshore Ocean Environment—January 2008"

TABLE 5-1

Number and weight of fishes (bony fishes, sharks and rays) and invertebrates impinged during normal operations at EPS from June 2004 to June 2005 on the sample days

	Daily Volume (MGD)	Fishes (Bony Fishes & Sharks + Rays)		Invertebrates	
		Number	Weight (g)	Number	Weight (g)
7/14/2004	856	842	12,377.4	4	272.1
7/21/2004	817	263	7,264.0	3	21.1
7/28/2004	751	255	6,479.3	2	32.5
8/4/2004	676	70	3,951.0	2	7.4
8/11/2004	857	679	11,898.7	7	45.1
8/18/2004	857	86	3,999.7	3	24.9
8/25/2004	626	100	3,809.5	5	26.4
9/1/2004	735	34	1,489.8	2	4.7
9/8/2004	857	250	4,010.0	1	2.5
9/15/2004	771	96	1,348.4	8	62.6
9/22/2004	793	167	2,092.4	6	50.1
9/29/2004	840	122	1,581.4	15	115.9
10/6/2004	823	218	2,908.8	28	116.5
10/13/2004	550	17	323.6	21	118.8
10/20/2004	419	258	2,942.3	16	70.2
10/27/2004	477	206	4,724.5	37	254.0
11/3/2004	477	99	488.5	12	100.1
11/10/2004	550	21	129.0	29	196.6
11/17/2004	544	61	965.6	12	117.9
11/22/2004	550	43	1,350.5	37	156.2
12/1/2004	813	1,947	9,782.8	21	142.5
12/8/2004	784	324	2,899.0	22	335.0
12/15/2004	710	207	2,570.5	20	161.3
12/20/2004	710	66	678.9	20	197.7
12/29/2004	710	1,146	10,427.0	45	189.8
1/5/2005	566	528	7,280.2	40	385.6
1/12/2005	560	5,001	109,526.0	95	2,583.5
1/19/2005	599	600	6,914.1	49	444.0
1/26/2005	632	306	8,330.4	39	414.0
2/2/2005	560	246	3,196.5	26	678.4
2/9/2005	632	227	5,696.6	19	133.5
2/16/2005	497	23	1,186.0	714	2,153.6
2/23/2005	307	1,274	29,531.0	42	4,199.8
3/2/2005	497	48	3,638.2	20	424.6
3/9/2005	497	132	6,586.5	74	629.9
3/16/2005	497	30	887.6	16	62.0
3/23/2005	673	282	7,722.8	65	295.8
3/30/2005	674	240	9,163.4	37	162.5
4/6/2005	673	109	7,150.5	49	343.0
4/13/2005	673	220	11,137.4	184	631.4
4/20/2005	745	96	2,734.5	23	288.1
4/27/2005	745	102	3,891.5	8	24.4

TABLE 5-1

Number and weight of fishes (bony fishes, sharks and rays) and invertebrates impinged during normal operations at EPS from June 2004 to June 2005 on the sample days

	Daily Volume (MGD)	Fishes (Bony Fishes & Sharks + Rays)		Invertebrates	
		Number	Weight (g)	Number	Weight (g)
5/4/2005	706	280	4,241.8	7	28.6
5/11/2005	576	200	6,343.4	11	328.4
5/18/2005	706	312	7,347.4	20	96.6
5/25/2005	632	195	4,444.6	20	107.0
6/1/2005	700	228	5,925.4	19	52.9
6/8/2005	778	234	4,626.6	5	13.0
6/15/2005	563	37	1,912.7	8	24.5
EPS Totals (52 days)	**34,167**	**19,442**	**372,520**	**1,987**	**17,554**
EPS Daily Averages	**657**	**374**	**7,163.8**	**38**	**337.6**

5.2.2 The CDP's Projected Impingement

Since the CDP will use the EPS's intake system, the CDP's stand-alone impingement may be calculated as a weighted average of two values: (1) a proportion of the EPS's impingement for the days on which impingement was flow-related, (i.e., adjusted for the CDP's reduced flow volumes), and (2) the total unadjusted impingement values for days on which impingement was likely not flow-related.

The weighted-average flow proportioned model operates as follows:

Daily Impingement = ((prorated value for normal events x 50) + (outlier average x 2))/ 52

TABLE 5-2

Weighted Flow-Proportioned Impingement Estimate
Based on EPS's 2004/2005 sampling data and a projected flow of 304 MGD

	CDP's Daily Flow Volume (MGD)	Invertebrates		Bony Fishes & Sharks + Rays	
		Number	Weight (g)	Number	Weight (g)

		Concentration (# Inverts / MG)	# Inverts Impinged	Concentration (Grams / MG)	Weight in Grams	Concentration (# Fish & Sharks + Rays / MG)	# Fish & Sharks + Ray Impinged	Concentration (Grams / MG)	Weight in Grams
1/12/2005	***Non-Flow-Related Events**	N/A	95	N/A	2,583.5	N/A	5001	N/A	109,526.0
2/23/2005		N/A	42	N/A	4,199.8	N/A	1274	N/A	29,531.0
6/24/2004	304	0.0097	3	0.1045	31.8	0.4538	138	6.8869	2,093.6
6/30/2004	304	0.0089	3	0.1716	52.2	0.6758	205	7.5267	2,288.1
7/7/2004	304	0.0047	1	0.0805	24.5	0.3114	95	5.3492	1,626.2
7/14/2004	304	0.0037	1	0.3180	96.7	0.9840	299	14.4655	4,397.5
7/21/2004	304	0.0027	1	0.0258	7.8	0.3218	98	8.8884	2,702.1
7/28/2004	304	0.0030	1	0.0433	13.2	0.3398	103	8.6330	2,624.4
8/4/2004	304	0.0082	2	0.0110	3.3	0.1036	31	5.8477	1,777.7
8/11/2004	304	0.0035	1	0.0526	16.0	0.7922	241	13.8827	4,220.3
8/18/2004	304	0.0080	2	0.0291	8.8	0.1003	31	4.6666	1,418.7
8/25/2004	304	0.0027	1	0.0421	12.8	0.1596	49	6.0811	1,848.7
9/1/2004	304	0.0012	0	0.0064	1.9	0.0462	14	2.0258	615.8
9/8/2004	304	0.0104	3	0.0029	0.9	0.2917	89	4.6786	1,422.3
9/15/2004	304	0.0076	2	0.0812	24.7	0.1245	38	1.7485	531.5
9/22/2004	304	0.0179	5	0.0632	19.2	0.2106	64	2.6386	802.1
9/29/2004	304	0.0340	10	0.1379	41.9	0.1452	44	1.8820	572.1
10/6/2004	304	0.0382	12	0.1416	43.1	0.2650	81	3.5364	1,075.1
10/13/2004	304	0.0382	12	0.2159	65.6	0.0309	9	0.5880	178.7
10/20/2004	304	0.0776	24	0.1676	50.9	0.6158	187	7.0227	2,134.9
10/27/2004	304	0.0252	8	0.5326	161.9	0.4319	131	9.9061	3,011.5
11/3/2004	304	0.0527	16	0.2099	63.8	0.2076	63	1.0243	311.4
11/10/2004	304	0.0221	7	0.3572	108.6	0.0382	12	0.2344	71.3
11/17/2004	304	0.0672	20	0.2167	65.9	0.1121	34	1.7746	539.5
11/22/2004	304	0.0258	8	0.2838	86.3	0.0781	24	2.4538	746.0
12/1/2004	304	0.0281	9	0.1752	53.3	2.3936	728	12.0269	3,656.2
12/8/2004	304	0.0282	9	0.4275	130.0	0.4135	126	3.6994	1,124.6
12/15/2004	304	0.0282	9	0.2271	69.0	0.2915	89	3.6194	1,100.3
12/20/2004	304	0.0634	19	0.2784	84.6	0.0929	28	0.9559	290.6
12/29/2004	304	0.0706	21	0.2672	81.2	1.6136	491	14.6816	4,463.2
1/5/2005	304	0.0818	25	0.6810	207.0	0.9325	283	12.8578	3,908.8
1/19/2005	304	0.0617	19	0.7408	225.2	1.0011	304	11.5364	3,507.1
1/26/2005	304	0.0464	14	0.6546	199.0	0.4838	147	13.1717	4,004.2
2/2/2005	304	0.0300	9	1.2105	368.0	0.4389	133	5.7035	1,733.9

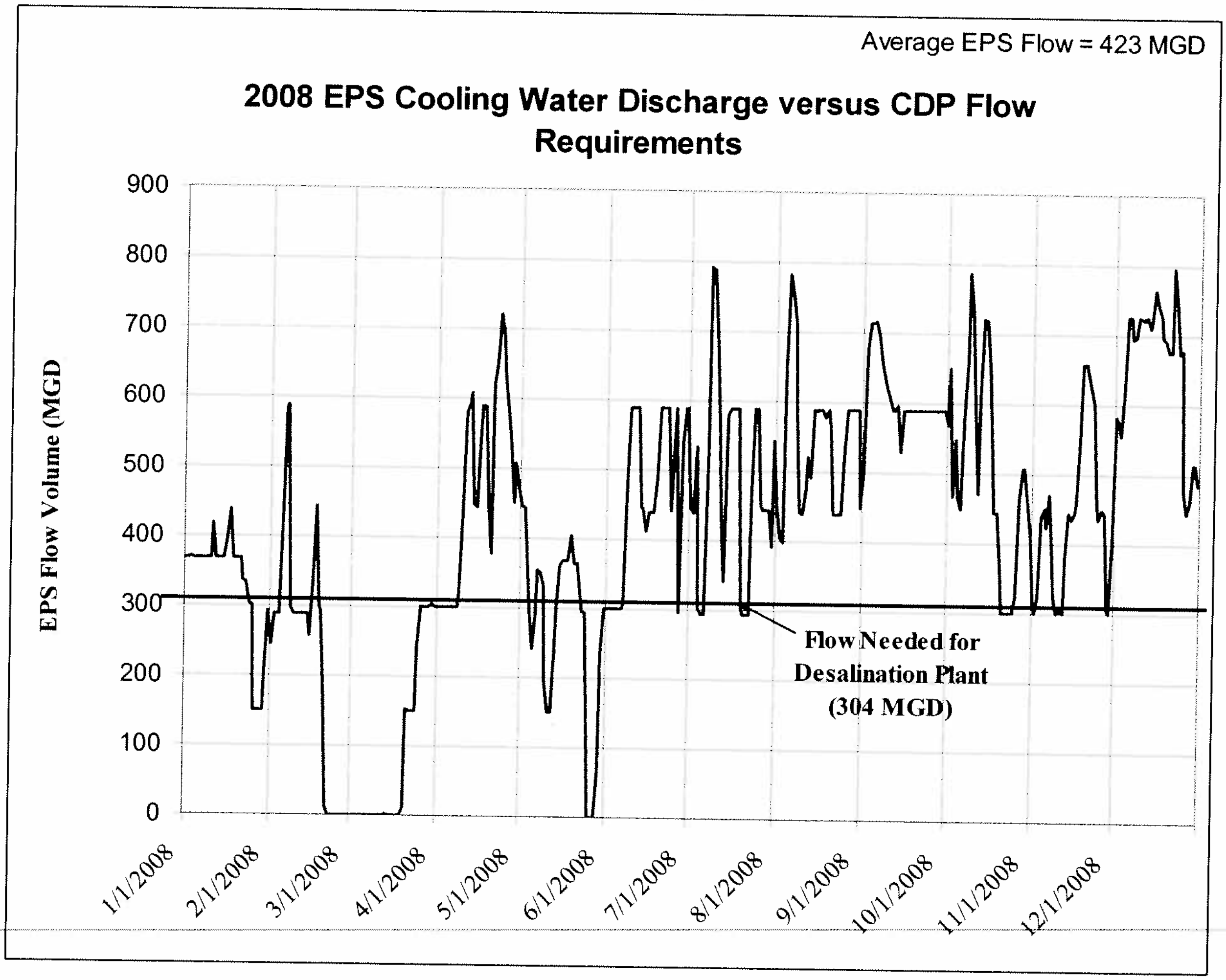
2/9/2005	304	1.4372	437	0.2111	64.2	0.3589	109	9.0072	2,738.2
2/16/2005	304	0.0403	12	4.3349	1317.8	0.0463	14	2.3873	725.7
3/2/2005	304	0.1490	45	0.8547	259.8	0.0966	29	7.3233	2,226.3
3/9/2005	304	0.0322	10	1.2679	385.4	0.2657	81	13.2579	4,030.4
3/16/2005	304	0.0966	29	0.1248	37.9	0.0604	18	1.7866	543.1
3/23/2005	304	0.0549	17	0.4397	133.7	0.4192	127	11.4791	3,489.7
3/30/2005	304	0.0728	22	0.2410	73.3	0.3560	108	13.5914	4,131.8
4/6/2005	304	0.2735	83	0.5098	155.0	0.1620	49	10.6285	3,231.1
4/13/2005	304	0.0309	9	0.9385	285.3	0.3270	99	16.5546	5,032.6
4/20/2005	304	0.0107	3	0.3868	117.6	0.1289	39	3.6716	1,116.2
4/27/2005	304	0.0099	3	0.0328	10.0	0.1370	42	5.2251	1,588.4
5/4/2005	304	0.0191	6	0.0405	12.3	0.3967	121	6.0092	1,826.8
5/11/2005	304	0.0283	9	0.5699	173.2	0.3470	106	11.0073	3,346.2
5/18/2005	304	0.0316	10	0.1368	41.6	0.4420	134	10.4087	3,164.3
5/25/2005	304	0.0271	8	0.1692	51.4	0.3083	94	7.0276	2,136.4
6/1/2005	304	0.0064	2	0.0756	23.0	0.3258	99	8.4662	2,573.7
6/8/2005	304	0.0142	4	0.0167	5.1	0.3010	91	5.9504	1,808.9
6/15/2005	304	0.0556	17	0.0435	13.2	0.0657	20	3.3954	1,032.2
Prorated Value for (50) Flow-Related Events		0.0660	20	0.3670	111.6	0.3809	116	6.9434	**2,110.8**
Average of (2) Non-Flow-Related Events		N/A	69	N/A	3391.7	N/A	3138	N/A	**69,528.5**
Weighted Average		N/A	22	N/A	237.7	N/A	**232**	N/A	**4,703.8**

Table 5-2 shows CDP's estimated stand-alone impingement based on this weighted average approach. The third-to-last row reflects the prorated calculation for the 50 flow-related events (discounted for the CDP's reduced flow of 304 MGD); the second-to-last row reflects the non-prorated average of the two non-flow-related sampling events. The last column provides the resulting calculation of the approach. It indicates that the weighted flow-proportioned approach estimates that CDP's operations would have resulted in the impingement of 4.70 kg per day of fish (fish, sharks and rays) biomass.

5.2.3 Percent of CDP's Flow Needs Met That Would Have Been Met By EPS Discharge in 2008 Had CDP Been Operating in 2008 Based on 2008 EPS Flow Data (Without Corresponding Biological Data)

Figure 5-1 provides a comparison of the 2008 EPS cooling water discharge to the flow needed to support CDP operations. This figure indicates that EPS's average monthly and annual flows continue to exceed the CDP's projected requirement of 304 MGD of seawater in 2008.

FIGURE 5-1



While the EPS average monthly and annual flow exceeded the average monthly and annual flow requirements of CDP, on a daily basis this was not always the case. Table 5-3 represents the amount of additional flow required in each month during 2008 to maintain a continuous 304 MGD flow to the desalination facility. Attachment 1 presents EPS's actual daily flow volumes for 2008.

TABLE 5-3
EPS's 2008 Flow, Daily Analysis

Month	EPS Flow (MG)	Required Flow for Desalination Facility (MG)	Desalination Flow Not Met By EPS (MG)	Percent of Desalination Plant Needs Met	# days deficit between 0.1-10.9 mgd	# days deficit between 11-100 mgd	# days deficit between 101-200 mgd	# days deficit between 201-304 mgd
January	10268	9424	728.5	92.30%	2	1	4	0

TABLE 5-3
EPS's 2008 Flow, Daily Analysis

Month	EPS Flow (MG)	Required Flow for Desalination Facility (MG)	Desalination Flow Not Met By EPS (MG)	Percent of Desalination Plant Needs Met	# days deficit between 0.1-10.9 mgd	# days deficit between 11-100 mgd	# days deficit between 101-200 mgd	# days deficit between 201-304 mgd
February	6558	8816	3117.4	65.00%	3	11	1	9
March	2661	9424	6762.6	28.00%	6	1	4	20
April	14231	9120	35.6	99.60%	8	0	0	0
May	8422	9424	1947.3	79.30%	5	5	4	4
June	13966	9120	34.6	99.60%	7	0	0	0
July	14909	9424	54.6	99.40%	7	0	0	0
August	16840	9424	0	100.00%	0	0	0	0
September	18248	9120	0	100.00%	0	0	0	0
October	15673	9424	22.3	99.80%	5	0	0	0
November	12984	9120	9	99.90%	5	0	0	0
December	20241	9424	0	100.00%	0	0	0	0
Total	**155001**	**111264**	**12711.9**		**48**	**18**	**13**	**33**
		Average		**88.58%**				

Under this operating scenario, the EPS discharge would provide 88.6 percent of the CDP annual seawater intake requirements and the CDP would pump the remaining source water required to support the desalination plant operations from the EPS intake. The CDP's direct use of the EPS discharge and variable frequency drives on the desalination plant intake pumps would result in a substantial reduction in entrainment and impingement from the CDP.

5.3 CALCULATION OF ENTRAINMENT IMPACT

5.3.1 Background Data Used for Preparation of Entrainment Assessment

The entrainment assessment associated with the desalination plant operations is based on comprehensive data collection completed at the existing intake of the EPS following a San Diego Regional Water Quality Control Board (Regional Board) approved data collection protocol during the Period of June 01, 2004 and May 31, 2005 (see Attachment 3). All samples used for the entrainment assessment were collected in front of the EPS intake with a boat-towed plankton net. This is the most up-to-date entrainment assessment available for this facility.

Tenera Environmental estimated the proportional entrainment mortality of the most commonly entrained larval fish living in Agua Hedionda Lagoon by applying the Empirical Transport Model (ETM) to the complete data set from the sampling period of June 01, 2004 and May 31, 2005. The potential entrainment of the CDP was computed based on a total flow of 304 MGD (104 MGD flow to the desalination facility and 200 MGD for dilution of the concentrated seawater).

5.3.2 Entrainment Effects Model

The Empirical Transport Model (ETM) calculated entrainment based on a concept called Area of Production Foregone ("APF"), which is based on principles used in fishery management. The number of days that the larvae are subject to entrainment, or the number of days the desalination facility is operating, is estimated using the size range of the larvae entrained. This number of operating days is then combined with the entrainment mortality (*PE*) to estimate the total mortality due to entrainment for a study period. These estimates for each study period can then be combined to calculate the average proportional mortality due to entrainment for an entire year.

The *ETM* has been proposed by the U.S. Fish and Wildlife Service to estimate mortality rates resulting from cooling water withdrawals by power plants. The *ETM* model provides an estimate of incremental mortality (a conditional estimate in absence of other mortality imposed on local larval populations by using an empirical measure of proportional entrainment (*PE*) rather than relying solely on demographic calculations. Proportional entrainment (*PE*) (an estimate of the daily mortality) to the source water population from entrainment is expanded to predict regional effects on appropriate adult populations using the *ETM*, as described below.

Empirical transport modeling permits the estimation of conditional mortality due to entrainment while accounting for the temporal variability in distribution and vulnerability of each life stage to power plant withdrawals.

The general equation to estimate *PE* for a day on which entrainment was sampled is:

$$PE = \frac{N_{Ei}}{N_{Si}}$$

Where:

N_{Ei} = estimated number of larvae entrained during the day in survey i, calculated as (estimated density of larvae in the water entrained that day) $\times$ (design specified daily cooling water intake volume),

N_{Si} = estimated number of larvae in the source water that day in survey i (estimated density of larvae in the souce water that day) $\times$ (source water volume).

A source water volume is used because: 1) cooling water flow is measured in volume per time, and 2) biological sampling measures larval concentration in terms of numbers per sample volume. Entrained numbers of larvae are estimated using the volume of water withdrawn. A source population is similarly estimated using the source water volume. If one assumes that larval concentrations at the point of entrainment are the same as larval concentrations in the source population volume then it follows that:

$$\hat{PE} = \frac{\hat{V}_{Ei}}{\hat{V}_{Si}},$$

Where :

$\hat{V}_{Ei}$ = design specified daily cooling water intake volume,

$\hat{V}_{Si}$ = estimated source water volume.

The ratio of daily entrainment volume to source volume can thus serve as an estimate of daily mortality. The *PE* value is estimated for each larval duration period over the course of a year by using a source water estimate from an advection model described below.

If larval entrainment mortality is constant throughout the period and a larva is susceptible to entrainment over a larval duration of *d* days, then the proportion of larvae that escape entrainment in period *i* is:

$$(1-\hat{PE}_i)^{\hat{d}}.$$

A larval duration of 23 days from hatching to entrainment was calculated from growth rates using the length representing the upper 99th percentile of the length measurements from larval CIQ gobies collected from entrainment samples during 316(b) study completed by Tenera Environmental. The value for *d* was computed by dividing an estimate of growth rate into the change in length based on this 99th percentile estimate. The minimum size used for computing the larval duration was determined after removing the smallest 1 percent of the values.

It is possible that aging was biased, even though standard lengths of larval fishes (i.e., measurements of minimum, mean, and maximum), and larval growth rates were applied to estimate the ages of the entrained larvae. It was assumed that larvae shorter than the minimum length were just hatched and therefore, aged at zero days. Subsequent ages were estimated using this length. Other reported data for various species suggest that hatching length can be either smaller or larger than the size estimated from the samples, and indicate that the smallest observed larvae represent either natural variation in hatch lengths within the population or shrinkage following preservation. The possibility remains that all larvae from the observed minimum length to the greatest reported hatching length (or to some other size) could have just hatched, leading to overestimation of ages for all larvae.

Sixteen larval duration periods over the course of a year were used to estimate larval mortality (P_M) due to entrainment using the following equation:

$$\hat{P}_M = \frac{1}{16}\sum_{i=1}^{16} 1-(1-\hat{PE}_i)^{\hat{d}}$$

Where:

$\hat{PE}_i$ = estimate of proportional entrainment for the *i*th period and

$\hat{d}$ = the estimated number of days of larval life.

The estimate of the population-wide probability of entrainment ($\hat{PE}_i$) is the central feature of the *ETM* approach. If a population is stable and stationary, then $\hat{P}_M$ estimates the effects on the fully-recruited adult age classes when uncompensated natural mortality from larva to adult is assumed.

Assumptions associated with the estimation of P_M include the following:

1) Lengths and applied growth rate of larvae accurately estimate larval duration,
2) A source population of larvae is defined by the region from which entrainment is possible,
3) Source water volume adequately describes the population, and
4) The currents used to calculate the source water volume are representative of other years.

The ratio of daily entrainment volume to source volume is used as an estimate of daily mortality. The *ETM* method estimates the source population using an estimate of the source volume of water from which larvae could possibly be entrained. It has been noted that if some members of the target group lie outside the sampling area, the *ETM* will overestimate the population mortality.

Recent work by Largier showed the value of advection and diffusion modeling in the study of larval dispersal, which is central to the *ETM* method. Ideally, three components could be considered in estimating entrainable populations: advection, diffusion, and biological behavior. An *ad hoc* approach, developed by the Technical Working Group during the Diablo Canyon Power Plant (DCPP) 316(b) study, modeled the three components using a single offshore current meter. For the present analysis, lagoon and coastal source water populations were treated separately.

Larval populations in the Agua Hedionda lagoon were computed using the lagoon segment volumes, described below. Nearshore populations were defined using the *ad hoc* approach developed by the DCPP Technical Working Group.

5.3.3 Source Water Volume Used for AHL Calculations

Agua Hedionda Lagoon is comprised of three segments: "outer", "middle", and "inner". The lagoon segments were originally dredged to a mean depth of 2.4 m (8 ft) relative to mean water level (MWL) in 1954. The horizontal areas of the outer, middle, and inner segments at MHW are

267,000 m^2 (66 acres), 110,000 m^2 (27 acres) and 1,200,000 m^2 (295 acres), respectively (Table 5-5). The tidal prism of the outer segment was calculated as 246,696 m^3 (200 acre ft) and for the middle and inner segments as 986,785 m^3 (800 acre ft). The individual volumes of the middle and inner tidal prisms were estimated to be 82,860 m^3 and 903,925 m^3 using weighting by areas. The volumes of the three segments below mean water level were computed as the volume below mean high water minus half the tidal prism (Table 5-5).

TABLE 5-5
Volumes of the Outer, Middle, and Inner Segments of the Agua Hedionda Lagoon

	Design Depth (m re: MWL)	Area (m^2 re: MHW)	Volume (m^3 re: MHW)	Volume (MWL) (m^3 MHW-.5 Prism)
Outer	2.4	267,000	791,356	668,006
Middle	2.4	110,000	326,027	284,597
Inner	2.4	1,200,000	3,556,656	3,104,696
Total		**1,577,000**	**4,674,039**	**4,057,299**

Figure 5-1 shows the sampling blocks used to calculate near shore source water volume. Sampling done in five (the "N" blocks) of the nine blocks was assumed to be representative of alongshore and offshore variation in abundances and therefore the volume from all nine blocks was used in calculating source water abundances. The volumes for these sampling blocks were calculated from bathymetric data for the coastal areas around Carlsbad using ArcGIS software. The total volume in these nine blocks was estimated at 283,303,115 m^3 (Table 5-6).

SDG&E completed a three-month deployment (June, August, and November 1979) of two Endeco current meter seaward of the outer lagoon entrance. Highest current speeds occurred further offshore, with 10.06 cm/s being the average current speed. The furthest offshore station was over a bottom depth of about 24.4 m (80 ft) at California State plane 355,800 N and 6,625,000 E. The meter was set –3 m below the surface. SCCWRP reported similar current speeds with median offshore currents at Carlsbad of 8.6 cm/s in winter and 7.0–9.5 cm/s in summer from a mid-depth position over a 45 m bottom from 1979–1990.

TABLE 5-6
VOLUMES OF NEAR SHORE SAMPLING BLOCKS USED IN CALCULATING SOURCE WATER ABUNDANCES

Block	Depth (m re: MWL)	Area (m^2 re: MHW)	Volume (m^3 re: MHW)
N1	-5.3	1,195,366	5,959,236
N2	-6.4	1,653,677	9,840,181
N3	-5.6	1,775,546	9,247,259
SW1	-14.8	1,055,516	15,633,525

N4	-18.5	1,359,040	25,081,478
SW2	-17.9	1,711,379	30,499,399
SW3	-27.8	1,312,832	36,386,864
N5	-38.5	1,661,891	63,329,174
SW4	-42.8	2,046,985	87,325,998
Total		**13,772,232**	**283,303,115**

The three months of currents reported in SDG&E in 1980 were rotated to the coastline direction at the Encina Power Station (36 degrees W of N). The average current vector components were 1.702 cm/s downcoast and 0.605 cm/s offshore.

A current meter was placed in the near shore between Stations N4 and N5. The data from the meter was used to characterize currents in the near shore area that would directly affect the dispersal of planktonic organisms that could be entrained by the power plant. The data were used to define the size of the near shore component of the source water by using the current speed and the estimated larval durations of the entrained organisms.

Source water volume and depths of Agua Hedionda Lagoon were very carefully determined based on recent hydrodynamic studies of Agua Hedionda Lagoon.

5.3.4 ETM Modeling for the CDP

1. The Empirical Transport Model Calculates APF

The Empirical Transport Model ("ETM") is a widely used model to estimate mortality rates resulting from water intake systems.[4] The ETM calculates what is known as the Area of Production Foregone (APF)—a value that represents the number of acres of habitat that must be created or restored to mitigate for the small marine organisms (e.g., fish larvae) that pass through the intake screens and become entrained in a water intake system

2. Model: APF = SWB x Pm

The ETM is an algebraic model that incorporates two basic variables: Source Water Body (SWB) and Proportional Mortality (Pm).

The Source Water Body (SWB) represents the number of acres in which egg and larvae populations are subject to entrainment. The SWB value is limited to the area in which mature

[4] This approach makes it possible to establish a definitive habitat value for the source water, and is consistent with the approach taken by the California Energy Commission and their independent consultants for the AES Huntington Beach Power Generation Plant and the Morro Bay Power Plant (MBPP) in assessing and mitigating the entrainment effects of the proposed combined cycle project. The situation in Morro Bay is very analogous to the proposed Carlsbad Project because both projects are drawing water from enclosed bays.

fish produce eggs and larvae. If mature fish do not spawn in a given area, that area will contain no entrainable organisms—i.e., no eggs or larvae to be drawn into and entrained by the intake system.

Proportional Mortality (Pm) represents the percentage of the population of a marine species in a given water body that will be drawn in and entrained by a water intake system. The Pm ratio is calculated by dividing (a) the number of marine organisms that are entrained in a water intake system by (b) the number of marine organisms in the same water body that are subject to entrainment.

3. Source Water Body (SWB) = 302 acres

The estimated acres of lagoon habitat for these species are based on a 2000 Coastal Conservancy Inventory of Agua Hedionda Lagoon habitat shown in Table 5-7.

TABLE 5-7

WETLAND PROFILE: AGUA HEDIONDA LAGOON

Approximate Wetland Habitat Acreage

Habitat	Acres	Vegetation Source
Brackish / Freshwater	3	Cattail, bulrush and spiny rush were dominant
Mudflat / Tidal Channel	49	Not specified / Estuarine flats
Open Water	253	Eelgrass occurred in all basins
Riparian	11	Not specified
Salt Marsh	14	Not applicable
Upland	61	Not applicable
TOTAL	**391**	

The entrainment associated with the CDP's stand-alone operations will only affect those areas of Agua Hedionda Lagoon that support the three most commonly entrained lagoon fish larvae.[5] These areas include 49 acres of mudflat/tidal channel and 253 acres of open water. Because CDP's operations will only minimally affect species that reside in the other lagoon habitats (e.g., brackish/freshwater, riparian, salt marsh or upland habitats), it is reasonable to exclude those areas from the source water body estimation.

4. Proportional Mortality (Pm) = 0.122

The major sources of variance in *ETM* results have been shown to include variance in estimates of larval entrainment concentrations, source water concentrations, and larval duration, in this order. Variance in estimates of entrainment and source water concentrations of fish larvae is due

[5] Ninety-eight percent of the fish larvae that would be entrained by the CDP stand-alone operations are gobies, blennies and hypsopops.

to spatial differences among stations, day and night diurnal changes, and temporal changes between surveys

Estimates of desalination intake and source water populations for the fish taxa evaluated are presented in Table 5-7 were based on entrainment and source water data for the sampling period of June 10, 2004 to May 19, 2005. The following documents related to Poseidon's Entrainment Study are enclosed.

- Attachment 4 – Proposal for Information Collection Clean Water Act Section 316(b), Encina Power Station, Cabrillo Power I LLC, NPDES Permit No. CA0001350, April 1, 2006

- Attachment 6 – Carlsbad Desalination Facility – Summary of Fish and Target Shellfish Larvae Collected for Entrainment and Source Water Studies in the Vicinity of Agua Hedionda Lagoon from June 2005 through May 2006.

TABLE 5-7
ETM VALUES FOR ENCINA POWER STATION LARVAL FISH ENTRAINMENT FOR THE PERIOD OF 01 JUN 2004 TO 31 MAY 2005 BASED ON STEADY ANNUAL INTAKE FLOW OF 304 MGD

	ETM Estimate	ETM Std.Err.	ETM + SE	ETM - SE
ETM Model Data for 3070 - Gobies	0.21599	0.30835	0.52434	-0.09236
ETM Model Data for 1495 - Blennies	0.08635	0.1347	0.22104	-0.04835
ETM Model Data for 1849 - Hypsopops	0.06484	0.13969	0.20452	-0.07485
AVERAGE	**0.122393**			
ETM Model Data for 3062 – White Croaker	0.00138	0.00281	0.00419	-0.00143
ETM Model Data for 1496 – Northern Anchovy	0.00165	0.00257	0.00422	-0.00092
ETM Model Data for 1219 – California Halibut	0.00151	0.00238	0.00389	-0.00087
ETM Model Data for 1471 - Queenfish	0.00365	0.00487	0.00852	-0.00123
ETM Model Data for 1494 – Spot Fin Croaker	0.00634	0.01531	0.02165	-0.00896
AVERAGE	**0.002906**			

FIGURE 5-2
Nearshore sampling blocks used to calculate source water volumes

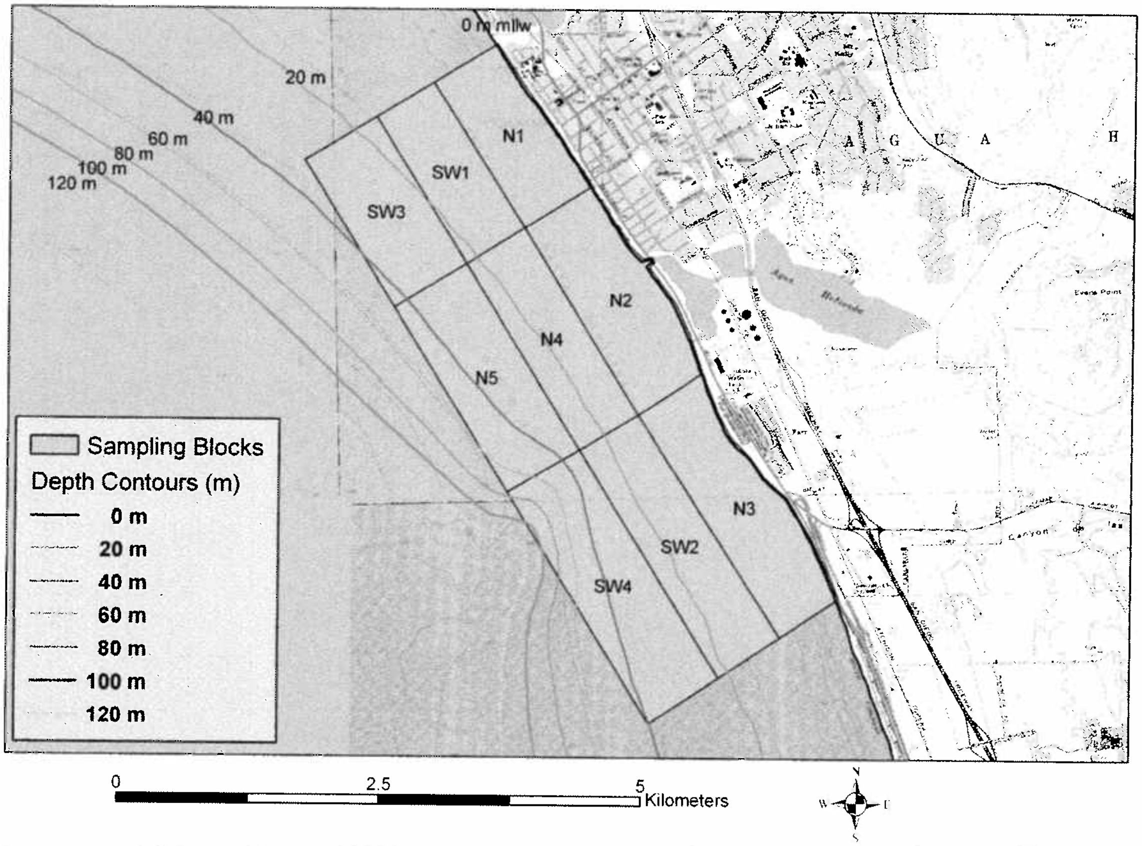


Table 5-7 reveals that the average Pm value for the three most commonly entrained species living in Agua Hedionda Lagoon is 0.1224 (12.2 percent).

5. <u>Initial APF Result = 36.8 acres</u>

Based on a SWB estimate of 302 acres and a Pm calculation of 0.122, Poseidon initially concluded that the entrainment associated with its withdrawal of 304 MGD from Agua Hedionda Lagoon would result in an Area of Production Foregone (APF) of approximately 37 acres.

APF = 302 acres x 0.122 = 36.8 acres.

6. <u>Final APF Result = 55.4 acres</u>

In March 2008, Poseidon provided a copy of its entrainment study to the Coastal Commission as required by Special Condition 8 of the Project's coastal development permit. Coastal Commission staff forwarded the study to Dr. Pete Raimondi [6] for his review and

[6] Pete Raimondi is an independent scientist described by the Coastal Commission as "California's leading expert on entrainment analysis." Dr. Raimondi has been a key participant and reviewer of most of the entrainment studies

recommendations. During the course of his review of Poseidon's entrainment study, Dr. Raimondi made two important revisions that resulted in his upward revision of the APF estimate to 55.4 acres.[7]

First, Dr. Raimondi added open ocean water species (e.g., the northern anchovy) to the entrainment model, even though he recognized that the intake system's entrainment impact on ocean species is very small. By adding ocean species, Dr. Raimondi's approach forces Poseidon to mitigate for a number of species that will be only minimally affected by the Project's operations. The addition of ocean species to the entrainment model adds an extra layer of resource protection to the Project's mitigation obligation.[8]

Second, Dr. Raimondi applied an 80% confidence level APF as the basis for mitigation. This approach ensures that the MLMP plan will fully account for the Project's entrainment impacts. Whereas Poseidon based its APF calculation on a 50% confidence interval—i.e., the level of confidence that past entrainment studies have generally used —Dr. Raimondi used the higher 80% figure. Thus, to an 80% degree of certainty, the mitigation plan comprehensively identifies and accounts for any entrainment impacts.

5.3.5 Significance of Entrainment Impacts

As the CEQA lead agency on the Project EIR, the City of Carlsbad found that the entrainment impacts associated with the stand-alone operation of the proposed desalination facility are insignificant and therefore no mitigation is required.[9]

The Coastal Act applies a different standard of review for projects of this nature. The Coastal Act provides that "[m]arine resources shall be maintained, enhanced, and where feasible restored." [10] Additionally, the adverse effects of entrainment shall be minimized where feasible.[11] In its approval of the Coastal Development permit for the proposed Project, the Coastal Commission found that Poseidon is "using all feasible methods to minimize or reduce its entrainment impacts" and conditioned the Project to include compensatory mitigation to lessen the effects of unavoidable entrainment and impingement impacts. [12] With the inclusion of this Special Condition 8, the Commission found that all project related entrainment will be fully mitigated and that marine resources and the biological productivity of the coastal waters, wetlands and estuaries will be enhanced and restored.[13]

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done along the California coast during the past decade, including those done for the AES Huntington Beach Generating Station, the Morro Bay Power Plant, and Moss Landing Plant.

[7] Recommended Revised Condition Compliance Findings November 21, 2008, page 14.

[8] The incorporation of ocean water species into the ETM has been used to help determine mitigation in several recent California power plant siting cases (e.g., Huntington Beach (00-AFC-13), Morro Bay (00-AFC-12)).

[9] See Final Environmental Impact Report EIR 03-05

[10] Coastal Act Sections 30230.

[11] Coastal Act Sections 30231.

[12] See Coastal Commission draft findings for Poseidon Carlsbad Desalination Project, pages 53 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf

[13] See Coastal Commission draft findings for Poseidon Carlsbad Desalination Project, pages 3 and 4 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf

5.4 SUMMARY AND CONCLUSIONS

The Coastal Commission found that Poseidon is using all feasible methods to minimize or reduce impingement and entrainment. These methods are likely to reduce the Project-related intake and mortality to marine life well below the levels identified herein. Nevertheless, as described in Chapter 6, Poseidon has committed to restore and enhance sufficient coastal habitat to more than compensate for the Project's impingement and entrainment prior to consideration of benefits to be derived from other minimization measures.

Ten years after the lease is issued, the CDP will be subject to further environmental review by the State Lands Commission (SLC) to analyze all environmental effects of facility operations and alternative technologies that may reduce any impacts found. SLC may require additional requirements as are reasonable and as are consistent with applicable state and federal laws and regulations. This approach will ensure that the CDP's stand-alone operations continue to use the best technologies feasible to minimize intake and mortality of marine life, and that impingement and entrainment are minimized to the maximum extent feasible.

CHAPTER 6

MITIGATION

Pursuant to Water Code Section 13142.5(b), the best available site, design, technology, and mitigation measures feasible will be used to minimize marine life intake and mortality associated with an ocean-water intake system. This Chapter describes the mitigation measures associated with the CDP and incorporates a **Marine Life Mitigation Plan ("MLMP")** into this Flow, Entrainment and Impingement Minimization Plan, attached hereto as Part A. The MLMP requires Poseidon to construct up to 55.4 acres of mitigation wetlands to offset intake and mortality of marine life. As explained below, even in the event CDP operates in stand-alone mode, its estimated impingement and entrainment impacts will be fully offset by the mitigation wetlands, not taking into consideration the design and technology measures that will diminish marine life mortality still further. Thus, in combination, by using the best available site, design, technology, and mitigation measures feasible, as described in this Minimization Plan, CDP will not only minimize the intake and mortality of marine life, but it will at least zero out any such losses and will likely result in additional biological productivity. The requirements of Section 13142.5(b) will be met and exceeded under the terms of this Minimization Plan.

- *Section 6.1 introduces and incorporates the MLMP generally.*
- *Section 6.2 explains how the mitigation requirement was established based on the CDP's estimated entrainment and impingement, not taking into account design and technology measures.*
- *Section 6.3 describes how the MLMP works.*
- *Section 6.4 describes the site selection.*
- *Section 6.5 describes the performance measures.*
- *Section 6.6 provides for the Regional Board and Executive Officer's MLMP enforcement and administration authority.*

6.1 MARINE LIFE MITIGATION PLAN

The MLMP, incorporated in this Chapter at Part A, provides for the construction of up to 55.4 acres of highly productive estuarine wetlands in the Southern California Bight, created in two phases. During Phase I, a period expected to correspond with EPS's continued operations, Poseidon will create 37 acres of wetlands. During Phase II, when CDP may be operating in stand-alone mode, the agencies will consider whether Poseidon will be required to create an additional 18.4 acres of wetlands, or whether instead, it may offset some or all of this further mitigation requirement by employing additional technology measures at the intake system, or undertaking dredging in Agua Hedionda Lagoon in a manner that warrants mitigation credit.

6.2 ESTABLISHING MITIGATION REQUIREMENT

Although Water Code Section 13142.5(b) only requires that the Project use the best available site, design, technology, and mitigation measures feasible to *minimize* intake and mortality of marine life, the MLMP takes a more environmentally conservative approach, requiring sufficient mitigation to completely *zero out* intake and mortality, i.e., impingement and entrainment.

6.2.1 COMPARISON OF ESTIMATED IMPINGEMENT AND PROJECTED BIOLOGICAL PRODUCTIVITY OF MITIGATION PLAN

Chapter 5 explains how the CDP's projected impingement was estimated as a flow-proportioned amount of the EPS's impingement for flow-related sampling days plus total impingement for non-flow-related sampling days.[1] CDP's projected impingement when operating in stand-alone mode is approximately 4.70 kg per day, which amounts to approximately 1,715.5 kg per year.[2]

Fish productivity for one acre of wetland of the kind to be established under the MLMP will result in approximately $9.35 g/m^2/yr$.[3] This corresponds to an expected annual productivity of 1,400 kg per year of fish biomass for the 37-acre mitigation site required under Phase I of the MLMP and 2,096 kg per year of fish biomass for 55.4 acres under Phase II – significantly more than the estimated 1,715.5 kg per day associated with the CDP's stand-alone operations. As a result, Phase II mitigation assures that the Project will result in a net productivity of fish biomass.

6.2.2 ENTRAINMENT MITIGATION

Chapter 5 explains how CDP's projected entrainment for stand-alone operations was conservatively estimated based on the Empirical Transport Model (ETM), which estimated the portion of the larvae of each target fish species at risk of entrainment.[4] Multiplying the average percent of populations at risk by the physical area from which the fish larvae might be entrained yields an estimate of the amount of habitat that must be restored to replace the lost fish larvae. This estimate is referred to as the area (acreage) of habitat production foregone (APF).

In order to calculate the APF, the amount of lagoon habitat acreage occupied by the three most commonly entrained lagoon fish larvae[5] was multiplied by the average Proportional Entrainment Mortality (PM) for the three lagoon species identified in Chapter 5 (12.2 percent). The estimated

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1 See Section 5.2 of Chapter 5 and Attachment 5 explaining the approach.

2 As explained in Attachment 5, the range of estimated impingement when using adjusted EPS data is from 1.57 to 4.7 kg/day.

3 Attachment 7, Chris Nordby, Mitigation Computation Based on Impingement Assessment.

4 See Section 5.3 of Chapter 5.

5 Ninety-eight percent of the fish larvae that would be entrained by the CDP stand-alone operations are gobies, blennies and hypsopops.

acres of lagoon habitat for these species are based on a 2000 Coastal Conservancy Inventory of Agua Hedionda Lagoon habitat shown in Table 6-1.

TABLE 6-1

WETLAND PROFILE: AGUA HEDIONDA LAGOON

Approximate Wetland Habitat Acreage

Habitat	Acres	Vegetation Source
Brackish / Freshwater	3	Cattail, bulrush and spiny rush were dominant
Mudflat / Tidal Channel	49	Not specified / Estuarine flats
Open Water	253	Eelgrass occurred in all basins
Riparian	11	Not specified
Salt Marsh	14	Not applicable
Upland	61	Not applicable
TOTAL	**391**	

The areas of Agua Hedionda Lagoon that have potential to be impacted by the CDP operations are those habitats occupied by the three most commonly entrained lagoon fish larvae. These habitats include 49 acres of mudflat/tidal channel and 253 acres of open water. It is not appropriate to include the other lagoon habitats in the APF calculation, such as brackish/freshwater, riparian, salt marsh or upland habitats that are not occupied by the impacted species. By definition, the APF equals the acres of the lagoon habitat that have the potential to be impacted by the intake operations (302 acres) multiplied by the the average PM:

$$APF = 302 \text{ acres} \times 0.122 = 36.8 \text{ acres.}$$

Thus, entrainment effect of the stand-alone operation of the desalination plant extends over 12.2 percent, or 36.8 acres of Agua Hedionda Lagoon. From this, Poseidon concluded that the entrainment caused by the 304 MGD of water withdrawn by the desalination facility would result in an APF of 37 acres in Agua Hedionda Lagoon.

The Coastal Commission adopted a more conservative approach, based on the ETM but using more conservative assumptions and higher confidence levels, to determine the amount of mitigation needed to zero out the CDP's estimated entrainment.[6] The Coastal Commission concluded that by providing up to 55.4 acres of estuarine wetland restoration under the conditions and performance standards prescribed by the MLMP, the CDP's entrainment impacts will be mitigated and marine resources will be maintained, enhanced and restored in conformity with the Coastal Act's marine life protection policies.[7]

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[6] Discussed in detail in Chapter 5 at Section 5.3; see also, http://documents.coastal.ca.gov/reports/2008/12/w16a-12-2008.pdf, see pages 13 and 14 of 18.

[7] Id.

As a result of the Coastal Commission's conservative assumptions, the restoration requirements established in the MLMP will compensate under worst-case conditions[8] when the power plant is no longer operating and the existing pumps are operated solely to deliver 304 MGD of seawater for the operation of the desalination plant and no additional design or technology measures are implemented to further reduce the entrainment impacts of stand-alone operations. This approach will result in over mitigation as long as the power plant continues to operate.

This is because the restored habitat will provide significant environmental benefits that extend well beyond compensating for the entrainment impacts. For example, the APF calculation does not take into account the enormous ecological value of the restored acreage that will accrue to valuable wetland species completely unaffected by the intake, such as the numerous riparian birds, reptiles, benthic organisms and mammals that will utilize the habitat for foraging, cover and nesting. Nor does the calculation consider the myriad of phytoplankton, zooplankton and invertebrate species that are largely unaffected by the intake operations and benefit directly from the restored wetlands.

As a result, the mitigation required under the MLMP assures that the biological loss associated with CDP's stand-alone estimated entrainment will not only be zeroed out, but will result in a net enhancement of the coastal habitat.

Therefore, the requirements of Section 13142.5(b) for stand-alone operations will be met and exceeded under terms of this Minimization Plan. Because additional analysis under Section 13142.5(b) will be required if the EPS ceases to operate, however, impingement and entrainment will reevaluated at that time, and the agencies will have an opportunity to adjust the Project requirements if warranted by additional data or the changed circumstances.

6.3 HOW THE MLMP WORKS

Pursuant to Water Code Section 13225, and the Regional Board's April 9, 2008 Resolution,[9] the MLMP was developed through an interagency process involving several federal and state agencies, including the Regional Board and the Coastal Commission. The MLMP attached hereto is the final version approved by the Coastal Commission and therefore provides enforcement and administrative authority specifically to the Coastal Commission and its Executive Director. By incorporating the MLMP into the Minimization Plan, the MLMP similarly is enforceable by the Regional Board and its Executive Officer. The Regional Board's specific authorities with regard to the MLMP are described in detail in section 6.5 below.

The MLMP describes the completion of specified tasks on a timeframe based upon the Coastal Commission's issuance of a coastal development permit for the CDP – an event that is expected to occur in the second quarter of 2009. Within 9 months of receiving the coastal development permit for the CDP, Poseidon shall submit to the Coastal Commission for its review and

[8] As noted in Chapter 3, the EPS discharge would have provided 88.6 percent of the CDP seawater intake requirements in 2008 and 61% in 2007.

[9] R9-2006-0039.

approval a proposed mitigation site or sites, and a preliminary restoration plan for 37 acres of wetlands for its review and approval.[10] Under this Minimization Plan, Poseidon shall make the same submission to the Regional Board for its review and approval. Poseidon may elect to complete all 55.4 acres of wetlands during this Phase I period, but must complete at least 37 acres. Within 6 months of the Commission's approval of the site and restoration plan, subject to Poseidon's having obtained the necessary permits, Poseidon must begin construction of the wetlands.[11] An application for a coastal development permit for the Phase I site or sites must be submitted to the Coastal Commission within two years of receiving the coastal development permit for the CDP itself. Specific requirements for the coastal development permit applications for Phases I and II are detailed in Section 4.0 of the MLMP.

If Poseidon does not elect to complete 55.4 acres of wetlands in Phase I, it will need to seek a coastal development permit for the additional mitigation wetlands (18.4 acres) within 5 years of receiving the coastal development permit for the Phase I wetlands. In the alternative, Poseidon may seek authorization to substitute intake technology and/or dredging of Agua Hedionda Lagoon for all or a portion of the 18.4 acres.

6.4 SITE SELECTION

The mitigation site or sites may be selected from among the 11 sites identified during the interagency process and listed in the MLMP, or may be one recommended by the California Department of Fish & Game as a high-priority wetlands restoration project, or one proposed by Poseidon and added to the list with the approval of the Coastal Commission's Executive Director and the Regional Board's Executive Officer. The 11 identified sites are: (1) Tijuana Estuary; (2) San Dieguito River Valley; (3) Agua Hedionda Lagoon; (4) San Elijo Lagoon; (5) Buena Vista Lagoon; (6) Huntington Beach Wetland; (7) Anaheim Bay; (8) Santa Ana River; (9) Los Cerritos Wetland; (10) Ballona Wetland; and, (11) Ormond Beach. Additional narrative detail about the sites in incorporated into this chapter at Part B. The selected site(s) must meet the detailed requirements of Section 3.0 of the MLMP, which are not reprinted here.

Sites located within the boundaries of the Regional Water Quality Control Board, San Diego Region, shall be considered priority sites. If Poseidon proposes one or more mitigation sites outside of these boundaries, it first shall demonstrate to the Board that the corresponding mitigation could not feasibly be implemented within the boundaries, such as when the criteria established in Section 3.0 of the MLMP are not satisfied.

Figure 1 is a map showing identified sites within San Diego County. Figure 2 is a map showing sites located within Orange, Los Angeles, and Ventura Counties.

[10] MLMP § 2.0.

[11] MLMP § 4.2.

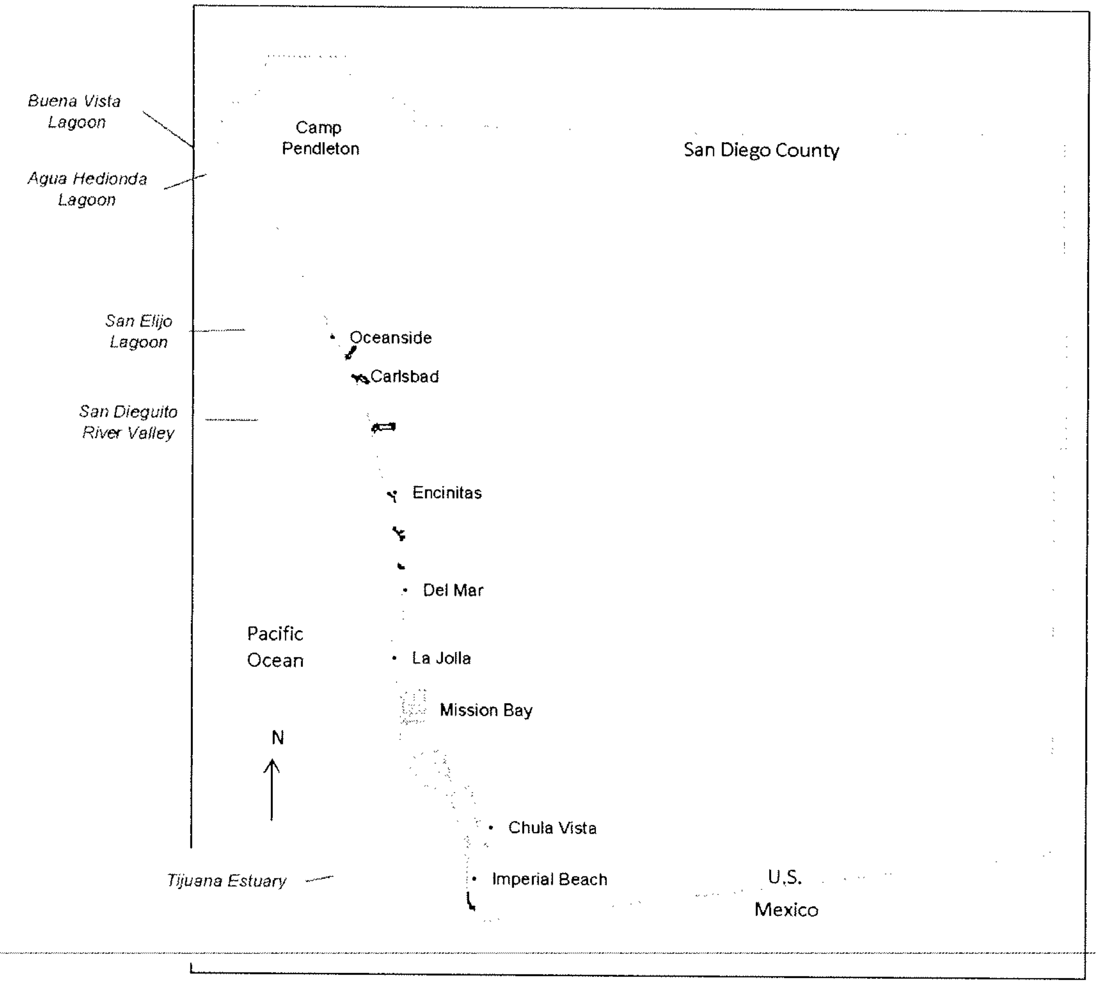

Figure 1 – Location of Mitigation Sites in San Diego County, California

Figure 2 – Location of Mitigation Sites in Orange County, Los Angeles County, and Ventura County, California

6.5 PERFORMANCE MEASURES

In addition to specific standards for mitigation site selection, the performance of the site(s) will be enforced by strict performance standards, which are substantially the same as those approved for mitigation of marine life mortality associated with Southern California Edison's San Onofre Nuclear Generating Station. Among other things, the standards require that, within five years of the start of construction, the wetlands must match habitat values within a 95% confidence level for four undisturbed wetlands to be identified per the MLMP. The performance measures are detailed in Section 5.0 of the MLMP and are not reprinted here.

6.6 REGIONAL BOARD AUTHORITY

The Regional Board's authority with regard to the MLMP shall be very similar to the Coastal Commission's, except where it would lead to unnecessary duplication of effort, or unnecessary burden on Poseidon. The table below identifies each section of the MLMP in which an action by, or in consultation with, the Coastal Commission is contemplated. The specific language of the MLMP referring to the Regional Board's corresponding authority is identified.

MLMP Section	**Coastal Commission Authority**	**Regional Board's Corresponding Authority**
2.0 Site Selection	"In consultation with Commission staff, the permittee shall select a wetland restoration site or sites for mitigation in accordance with the following process and terms."	In consultation with Commission staff <u>and Regional Board staff</u>, the permittee shall select a wetland restoration site or sites in accordance with the following process and terms.
	"Within 9 months of the effective date of this permit, the permittee shall submit the proposed site(s) and preliminary wetland restoration plan to the Commission for its review and approval or disapproval."	Within 9 months of the effective date of the coastal development permit for the CDP, the permittee shall submit the proposed site(s) and preliminary wetland restoration plan to the Commission <u>and the Regional Board</u> for their review and approval or disapproval.
	"Other sites proposed by the permittee may be added to this list with the Executive Director's approval."	Other sites proposed by the permittee may be added to this list with the Executive Director's <u>and Executive Officer's</u> approval.

MLMP Section	Coastal Commission Authority	Regional Board's Corresponding Authority
3.0 Plan Requirements	"In consultation with Commission staff, the permittee shall develop a wetland restoration plan for the wetland site(s) identified through the site selection process."	In consultation with Commission staff and Regional Board staff, the permittee shall develop a wetland restoration plan for the wetland site(s) identified through the site selection process.
4.1 Coastal Development Permit Applications	"The Executive Director may grant an extension to these time periods [for submittal of coastal development applications] at the request of and upon demonstration of good cause by the permittee."	The Executive Officer shall recognize any such extension.
4.3 Timeframe for Resubmittal of Project Elements	"If the Commission does not approve any element of the project (i.e. site selection, restoration plan), the Commission will specify the time limits for compliance relative to selection of another site or revisions to the restoration plan."	If the Commission and the Regional Board do not approve any element of the project (i.e. site selection, restoration plan), the Commission, in concert with the Regional Board, will specify the time limits for compliance relative to selection of another site or revisions to the restoration plan. The Regional Board shall recognize, and shall act consistently with, any such time limits.
5.0 Wetland Monitoring, Management and Remediation	"A monitoring and management plan will be developed in consultation with the permittee and appropriate wildlife agencies, concurrently with the preparation of the restoration plan to provide an overall framework to guide the monitoring work."	No change.
5.4	"Upon completion of construction of the wetland(s), monitoring shall be conducted to measure the success of the wetland(s) in achieving stated restoration goals (as specified in the restoration plan(s)) and in achieving performance standards, specified below. The permittee shall be fully responsible for any failure to meet these goals and standards during the facility's full operational years. Upon	Upon completion of construction of the wetland(s), monitoring shall be conducted to measure the success of the wetland(s) in achieving stated restoration goals (as specified in the restoration plan(s)) and in achieving performance standards, specified below. The permittee shall be fully responsible for any failure to meet these goals and standards during the facility's full operational years. Upon

MLMP Section	Coastal Commission Authority	Regional Board's Corresponding Authority
	determining that the goals or standards are not achieved, the Executive Director shall prescribe remedial measures, after consultation with the permittee, which shall be immediately implemented by the permittee with Commission staff direction. If the permittee does not agree that remediation is necessary, the matter may be set for hearing and disposition by the Commission."	determining that the goals or standards are not achieved, the Executive Director <u>or the Executive Officer</u> shall prescribe remedial measures, after consultation with each other and the permittee, which shall be immediately implemented by the permittee with Commission staff direction. If the permittee does not agree that remediation is necessary, the matter may be set for hearing and disposition by the Commission <u>or the Regional Board or both in a consolidated hearing, as determined by the Executive Director and Executive Officer</u>."
Condition B: Administrative Structure Section 1.0 Administration	"Personnel with appropriate scientific or technical training and skills will, under the direction of the Executive Director, oversee the mitigation and monitoring functions identified and required by Condition A. The Executive Director will retain scientific and administrative support staff needed to perform this function, as specified in the work program. "This technical staff will oversee the preconstruction and post-construction site assessments, mitigation project design and implementation (conducted by permittee), and monitoring activities (including plan preparation); the field work will be done by contractors under the Executive Director's direction. The contractors will be responsible for collecting the data, analyzing and interpreting it, and reporting to the Executive Director. "The Executive Director shall convene a Scientific Advisory Panel	"Personnel with appropriate scientific or technical training and skills will, under the direction of the Executive Director, <u>and in coordination with Regional Board staff</u>, oversee the mitigation and monitoring functions identified and required by Condition A. The Executive Director will retain scientific and administrative support staff needed to perform this function, as specified in the work program. "This technical staff will oversee the preconstruction and post-construction site assessments, mitigation project design and implementation (conducted by permittee), and monitoring activities (including plan preparation); the field work will be done by contractors under the Executive Director's direction. The contractors will be responsible for collecting the data, analyzing and interpreting it, and reporting to the Executive Director. "The Executive Director shall convene a Scientific Advisory Panel to provide

MLMP Section	Coastal Commission Authority	Regional Board's Corresponding Authority
	to provide the Executive Director with scientific advice on the design, implementation and monitoring of the wetland restoration. The panel shall consist of recognized scientists, including a marine biologist, an ecologist, a statistician and a physical scientist."	the Executive Director and the Executive Officer with scientific advice on the design, implementation and monitoring of the wetland restoration. The panel shall consist of recognized scientists, including a marine biologist, an ecologist, a statistician and a physical scientist."
Section 2.0 Budget and Work Program	"The funding necessary for the Commission and the Executive Director to perform their responsibilities pursuant to these conditions will be provided by the permittee in a form and manner reasonably determined by the Executive Director to be consistent with requirements of State law, and which will ensure efficiency and minimize total costs to the permittee. The amount of funding will be determined by the Commission on a biennial basis and will be based on a proposed budget and work program, which will be prepared by the Executive Director in consultation with the permittee, and reviewed and approved by the Commission in conjunction with its review of the restoration plan. If the permittee and the Executive Director cannot agree on the budget or work program, the disagreement will be submitted to the Commission for resolution. The budget to be funded by the permittee will be for the purpose of reasonable and necessary costs to retain personnel with appropriate scientific or technical training and skills needed to assist the Commission and the Executive Director in carrying out the mitigation and lost resource compensation	The funding necessary for the Commission and the Executive Director, and the Regional Board and the Executive Officer, to perform their responsibilities pursuant to these conditions will be provided by the permittee in a form and manner reasonably determined by the Executive Director and the Executive Officer to be consistent with requirements of State law, and which will ensure efficiency and minimize total costs to the permittee. The amount of funding will be determined by each of the Commission and the Regional Board on a biennial basis and will be based on a proposed budget and work program, which will be prepared by the Executive Director and Executive Officer in consultation with the permittee, and reviewed and approved by the Commission and the Regional Board in conjunction with their respective reviews of the restoration plan. If the permittee and the Executive Director cannot agree on the budget or work program, the disagreement will be submitted to the Commission for resolution. If the permittee and the Executive Officer cannot agree on the budget or work program, the disagreement will be submitted to the Regional Board for resolution.

MLMP Section	Coastal Commission Authority	Regional Board's Corresponding Authority
	conditions. In addition, reasonable funding will be included in this budget for necessary support personnel, equipment, overhead, consultants, the retention of contractors needed to conduct identified studies, and to defray the costs of members of any scientific advisory panel(s) convened by the Executive Director for the purpose of implementing these conditions. Costs for participation on any advisory panel shall be limited to travel, per diem, meeting time and reasonable preparation time and shall only be paid to the extent the participant is not otherwise entitled to reimbursement for such participation and preparation. The amount of funding will be determined by the Commission on a biennial basis and will be based on a proposed budget and work program, which will be prepared by the Executive Director in consultation with the permittee, and reviewed and approved by the Commission in conjunction with its review of the restoration plan. If the permittee and the Executive Director cannot agree on the budget or work program, the disagreement will be submitted to the Commission for resolution. Total costs for such advisory panel shall not exceed $100,000 per year adjusted annually by any increase in the consumer price index applicable to California. The work program will include: a. A description of the studies to be conducted over the subsequent	The budget to be funded by the permittee will be for the purpose of reasonable and necessary costs to retain personnel with appropriate scientific or technical training and skills needed to assist the Commission and the Executive Director, and the Regional Board and the Executive Officer, in carrying out the mitigation and lost resource compensation conditions. In addition, reasonable funding will be included in this budget for necessary support personnel, equipment, overhead, consultants, the retention of contractors needed to conduct identified studies, and to defray the costs of members of any scientific advisory panel(s) convened by the Executive Director for the purpose of implementing these conditions. The Executive Officer may offer comment to the Executive Director regarding the scientific advisory panel(s), but will not convene a science panel in addition to that panel convened by the Executive Director. No additional corresponding authority.

MLMP Section	Coastal Commission Authority	Regional Board's Corresponding Authority
	two year period, including the number and distribution of sampling stations and samples per station, methodology and statistical analysis (including the standard of comparison to be used in comparing the mitigation project to the reference sites); b. A description of the status of the mitigation projects, and a summary of the results of the monitoring studies to that point; c. A description of four reference sites; d. A description of the performance standards that have been met, and those that have yet to be achieved; e. A description of remedial measures or other necessary site interventions;	
	f. A description of staffing and contracting requirements; and, g. A description of the Scientific Advisory Panel's role and time requirements in the two year period. The Executive Director may amend the work program at any time, subject to appeal to the Commission."	
3.0 Annual Review and Public Workshop Review	"The permittee shall submit a written review of the status of the mitigation project to the Executive Director no later than April 30 each year for the prior calendar year. The written review will discuss the previous year's activities and overall status of	The permittee shall submit a written review of the status of the mitigation project to the Executive Director <u>and the Executive Officer</u> no later than April 30 each year for the prior calendar year. The written review will discuss the previous year's activities

MLMP Section	Coastal Commission Authority	Regional Board's Corresponding Authority
	the mitigation project, identify problems and make recommendations for solving them, and review the next year's program. To review the status of the mitigation project, the Executive Director will convene and conduct a duly noticed public workshop during the first year of the project and every other year thereafter unless the Executive Director deems it unnecessary. The meeting will be attended by the contractors who are conducting the monitoring, appropriate members of the Scientific Advisory Panel, the permittee, Commission staff, representatives of the resource agencies (CDFG, NMFS, USFWS), and the public. Commission staff and the contractors will give presentations on the previous biennial work program's activities, overall status of the mitigation project, identify problems and make recommendations for solving them, and review the next upcoming period's biennial work program. The public review will include discussions on whether the wetland mitigation project has met the performance standards, identified problems, and recommendations relative to corrective measures necessary to meet the performance standards. The Executive Director will use information presented at the public review, as well as any other relevant information, to determine whether any or all of the performance standards have been met, whether revisions to the standards are necessary, and whether remediation is	and overall status of the mitigation project, identify problems and make recommendations for solving them, and review the next year's program. To review the status of the mitigation project, the Executive Director <u>and Executive Officer</u> will convene and conduct a duly noticed public workshop during the first year of the project and every other year thereafter unless the Executive Director <u>and Executive Officer deem</u> it unnecessary. The meeting will be attended by the contractors who are conducting the monitoring, appropriate members of the Scientific Advisory Panel, the permittee, Commission staff, <u>Regional Board staff</u>, representatives of the resource agencies (CDFG, NMFS, USFWS), and the public. Commission staff and the contractors will give presentations on the previous biennial work program's activities, overall status of the mitigation project, identify problems and make recommendations for solving them, and review the next upcoming period's biennial work program. The public review will include discussions on whether the wetland mitigation project has met the performance standards, identified problems, and recommendations relative to corrective measures necessary to meet the performance standards. The Executive Director <u>and Executive Officer</u> will use information presented at the public review, as well as any other relevant information, to determine whether any or all of the performance standards have been met, whether revisions to the standards are

MLMP Section	Coastal Commission Authority	Regional Board's Corresponding Authority
	required. Major revisions shall be subject to the Commission's review and approval. The mitigation project will be successful when all performance standards have been met each year for a three-year period. The Executive Director shall report to the Commission upon determining that all of the performance standards have been met for three years and that the project is deemed successful. If the Commission determines that the performance standards have been met and the project is successful, the monitoring program will be scaled down, as recommended by the Executive Director and approved by the Commission. A public review shall thereafter occur every five years, or sooner if called for by the Executive Director. The work program shall reflect the lower level of monitoring required. If subsequent monitoring shows that a standard is no longer being met, monitoring may be increased to previous levels, as determined necessary by the Executive Director. The Executive Director may make a determination on the success or failure to meet the performance standards or necessary remediation and related monitoring at any time, not just at the time of the workshop review."	necessary, and whether remediation is required. Major revisions shall be subject to the Commission's <u>and Regional Board's</u> review and approval. The mitigation project will be successful when all performance standards have been met each year for a three-year period. The Executive Director shall report to the Commission upon determining that all of the performance standards have been met for three years and that the project is deemed successful. <u>The Executive Officer shall similarly report to the Regional Board; in making his report, the Executive Officer may rely upon the Executive Director's report.</u> If the Commission <u>and the Executive Officer</u> determine that the performance standards have been met and the project is successful, the monitoring program will be scaled down, as recommended by the Executive Director and approved by the Commission. A public review shall thereafter occur every five years, or sooner if called for by the Executive Director <u>or the Executive Officer.</u> The work program shall reflect the lower level of monitoring required. If subsequent monitoring shows that a standard is no longer being met, monitoring may be increased to previous levels, as determined necessary by the Executive Director. The Executive Director <u>and the Executive Officer</u> may make a determination on the success or failure to meet the performance standards or necessary remediation and related monitoring at any time, not just at the time of the workshop review.

MLMP Section	Coastal Commission Authority	Regional Board's Corresponding Authority
4.1 Dispute Resolution	"In the event that the permittee and the Executive Director cannot reach agreement regarding the terms contained in or the implementation of any part of this Plan, the matter may be set for hearing and disposition by the Commission."	In the event that the permittee and the Executive Director cannot reach agreement regarding the terms contained in or the implementation of any part of this Plan, the matter may be set for hearing and disposition by the Commission. <u>In the event that the permittee and the Executive Officer cannot reach agreement regarding the terms contained in or the implementation of any part of this Plan, the matter may be set for hearing and disposition by the Regional Board.</u>
4.2 Time Extensions	"Any of the time limits established under this Plan may be extended by the Executive Director at the request of the permittee and upon a showing of good cause."	The Executive Officer may provide timely comment to the Executive Director on any such time limits, and shall recognize any time limits extended by the Executive Director.
Condition C: SAP Maintenance	"The permittee shall make available on a publicly-accessible website all scientific data collected as part of the project. The website and the presentation of data shall be subject to Executive Director review and approval."	The permittee shall make available on a publicly-accessible website all scientific data collected as part of the project. The website and the presentation of data shall be subject to the review and approval of the Executive Director and the Executive Officer.

6.7 CONCLUSION

As described in the preceding sections, the mitigation measures of the MLMP are expected to result in biological productively that will offset the potential intake and mortality of marine life from the stand-alone operations of the CDP. The offsetting benefits to marine life associated with the MLMP fully minimize intake and mortality. In fact, with full implementation of the MLMP, a net positive production of marine life is anticipated, underscoring the efficacy of the proposed mitigation measures. In other words, while the CDP has the potential to cause impingement and entrainment, this potential is more than offset by the reasonably anticipated biological productivity of the planned mitigation wetlands.

Compliance with the MLMP will be enforced by the Regional Board and the Coastal Commission as provided in Section 6.6.[12] Thus, Poseidon has met its burden under Water Code Section 13142.5(b) to minimize intake and mortality from the proposed CDP and has incorporated mitigation measures into its project that satisfy this statute fully. In sum, the site, design, technology, and mitigation measures proposed in this Plan represent a balanced approach to minimizing the potential for intake and mortality from the CDP under stand-alone operations, and individually and collectively satisfy the obligation under Section 13142.5(b) to employ best available and feasible measures to minimize such effects.

[12] The MLMP will also be enforced by the State Lands Commission under the terms of the lease for the intake system. State Lands Commission, Amendment of Lease PRC 8727.1., ¶¶ 11-24.

Part A

Marine Life Mitigation Plan

Submitted to the Regional Board November 14, 2008

POSEIDON RESOURCES MARINE LIFE MITIGATION PLAN

INTRODUCTION

Poseidon's Carlsbad desalination facility will be co-located with the Encina Power Station and will use the power plant's once-through cooling intake and outfall structures. The desalination facility is expected to use about 304 million gallons per day (mgd) of estuarine water drawn through the structure. The facility will operate both when the power plant is using its once-through cooling system and when it is not.

This Marine Life Mitigation Plan (the Plan) will result in mitigation necessary to address the entrainment impacts caused by the facility's use of estuarine water. The Plan includes two phases of mitigation – Poseidon is required during Phase I to provide at least 37 acres of estuarine wetland restoration, as described below. In Phase II, Poseidon is required to provide an additional 18.4 acres of estuarine wetland restoration. However, as described below, Poseidon may choose to provide all 55.4 acres of restoration during Phase I. Poseidon may also choose during Phase II to apply for a CDP to reduce or eliminate the required 18.4 acres of mitigation and instead conduct alternative mitigation by implementing new entrainment reduction technology or obtaining mitigation credit for conducting dredging.

CONDITION A: WETLAND RESTORATION MITIGATION

The permittee shall develop, implement and fund a wetland restoration project that compensates for marine life impacts from Poseidon's Carlsbad desalination facility.

1.0 PHASED IMPLEMENTATION

Phase I: Poseidon is to provide at least 37 acres of estuarine wetland restoration. Within two years of issuance of the desalination facility's coastal development permit (CDP), Poseidon is to submit a complete CDP application for a proposed restoration project, as described below.

Phase II: Poseidon is to provide an additional 18.4 acres of estuarine wetland restoration. Within five years of issuance of the Phase I CDP, Poseidon is to submit a complete CDP application proposing up to 18.4 acres of additional restoration, subject to reduction as described below.

2.0 SITE SELECTION

In consultation with Commission staff, the permittee shall select a wetland restoration site or sites for mitigation in accordance with the following process and terms.

Within 9 months of the effective date of this permit, the permittee shall submit the proposed site(s) and preliminary wetland restoration plan to the Commission for its review and approval or disapproval.

The location of the wetland restoration project(s) shall be within the Southern California Bight. The permittee shall select from sites including, but not limited to, the following eleven sites: Tijuana Estuary in San Diego County; San Dieguito River Valley in San Diego County; Agua Hedionda Lagoon in San Diego County; San Elijo Lagoon in San Diego County; Buena Vista

Lagoon in San Diego County; Huntington Beach Wetland in Orange County, Anaheim Bay in Orange County, Santa Ana River in Orange County, Los Cerritos Wetland in Los Angeles County, Ballona Wetland in Los Angeles County, and Ormond Beach in Ventura County. The permittee may also consider any sites that may be recommended by the California Department of Fish & Game as high priority wetlands restoration projects. Other sites proposed by the permittee may be added to this list with the Executive Director's approval.

The basis for the selection shall be an evaluation of the site(s) against the minimum standards and objectives set forth in subsections 3.1 and 3.2 below. The permittee shall take into account and give serious consideration to the advice and recommendations of the Scientific Advisory Panel (SAP) established and convened by the Executive Director pursuant to Condition B.1.0. The permittee shall select the site(s) that meets the minimum standards and best meets the objectives.

3.0 PLAN REQUIREMENTS

In consultation with Commission staff, the permittee shall develop a wetland restoration plan for the wetland site(s) identified through the site selection process. The wetland restoration plan shall meet the minimum standards and incorporate as many as feasible of the objectives in subsections 3.1 and 3.2, respectively.

3.1 Minimum Standards

The wetland restoration project site(s) and preliminary plan(s) must meet the following minimum standards:

a. Location within Southern California Bight;

b. Potential for restoration as tidal wetland, with extensive intertidal and subtidal areas;

c. Creates or substantially restores a minimum of 37 acres and up to at least 55.4 acres of habitat similar to the affected habitats in Agua Hedionda Lagoon, excluding buffer zone and upland transition area;

d. Provides a buffer zone of a size adequate to ensure protection of wetland values, and at least 100 feet wide, as measured from the upland edge of the transition area.

e. Any existing site contamination problems would be controlled or remediated and would not hinder restoration;

f. Site preservation is guaranteed in perpetuity (through appropriate public agency or nonprofit ownership, or other means approved by the Executive Director), to protect against future degradation or incompatible land use;

g. Feasible methods are available to protect the long-term wetland values on the site(s), in perpetuity;

h. Does not result in a net loss of existing wetlands; and

i. Does not result in an adverse impact on endangered animal species or an adverse unmitigated impact on endangered plant species.

3.2 Objectives

The following objectives represent the factors that will contribute to the overall value of the wetland. The selected site(s) shall be determined to achieve these objectives. These objectives shall also guide preparation of the restoration plan.

a. Provides maximum overall ecosystem benefits, e.g. maximum upland buffer, enhancement of downstream fish values, provides regionally scarce habitat, potential for local ecosystem diversity;

b. Provides substantial fish habitat compatible with other wetland values at the site(s);

c. Provides a buffer zone of an average of at least 300 feet wide, and not less than 100 feet wide, as measured from the upland edge of the transition area.

d. Provides maximum upland transition areas (in addition to buffer zones);

e. Restoration involves minimum adverse impacts on existing functioning wetlands and other sensitive habitats;

f. Site selection and restoration plan reflect a consideration of site specific and regional wetland restoration goals;

g. Restoration design is that most likely to produce and support wetland-dependent resources;

h. Provides rare or endangered species habitat;

i. Provides for restoration of reproductively isolated populations of native California species;

j. Results in an increase in the aggregate acreage of wetland in the Southern California Bight;

k. Requires minimum maintenance;

l. Restoration project can be accomplished in a reasonably timely fashion; and,

m. Site(s) in proximity to the Carlsbad desalination facility.

3.3 Restrictions

a. The permittee may propose a wetland restoration project larger than the minimum necessary size specified in subsection 3.1(c) above, if biologically appropriate for the site(s), but the additional acreage must (1) be clearly identified, and (2) must not be the portion of the project best satisfying the standards and objectives listed above.

b. If the permittee jointly enters into a restoration project with another party: (1) the permittee's portion of the project must be clearly specified, (2) any other party involved cannot gain mitigation credit for the permittee's portion of the project, and (3) the permittee may not receive mitigation credit for the other party's portion of the project.

c. The permittee may propose to divide the mitigation requirement between a maximum of two wetland restoration sites, unless there is a compelling argument, approved by the Executive Director, that the standards and objectives of subsections 3.1 and 3.2 will be better met at more than two sites.

4.0 PLAN IMPLEMENTATION

4.1 Coastal Development Permit Applications

The permittee shall submit complete Coastal Development Permit applications for the Phase I and Phase II restoration plan(s) that shall include CEQA documentation and local or other state agency approvals. The CDP application for Phase I shall be submitted within 24 months following the issuance of the Coastal Development Permit for the Carlsbad desalination facility. The CDP application for Phase II shall be submitted within 5 years of issuance of the CDP for Phase I. The Executive Director may grant an extension to these time periods at the request of and upon a demonstration of good cause by the permittee. The restoration plans shall substantially conform to Section 3.0 above and shall include, but not be limited to the following elements:

a. Detailed review of existing physical, biological, and hydrological conditions; ownership, land use and regulation;

b. Evaluation of site-specific and regional restoration goals and compatibility with the goal of mitigating for Poseidon's marine life impacts;

c. Identification of site opportunities and constraints;

d. Schematic restoration design, including:

1. Proposed cut and fill, water control structures, control measures for stormwater, buffers and transition areas, management and maintenance requirements;
2. Planting program, including removal of exotic species, sources of plants and or seeds (local, if possible), protection of existing salt marsh plants, methods for preserving top soil and augmenting soils with nitrogen and other necessary soil amendments before planting, timing of planting, plans for irrigation until established, and location of planting and elevations on the topographic drawings;
3. Proposed habitat types (including approximate size and location);
4. Assessment of significant impacts of design (especially on existing habitat values) and net habitat benefits;
5. Location, alignment and specifications for public access facilities, if feasible;
6. Evaluation of steps for implementation e.g. permits and approvals, development agreements, acquisition of property rights;
7. Cost estimates;

8. Topographic drawings for final restoration plan at 1" = 100 foot scale, one foot contour interval; and
9. Drawings shall be directly translatable into final working drawings.

g. Detailed information about how monitoring and maintenance will be implemented;

h. Detailed information about construction methods to be used;

i. Defined final success criteria for each habitat type and methods to be used to determine success;

j. Detailed information about how Poseidon will coordinate with the Scientific Advisory Panel including its role in independent monitoring, contingency planning review, cost recovery, etc.;

k. Detailed information about contingency measures that will be implemented if mitigation does not meet the approved goals, objectives, performance standards, or other criteria; and,

l. Submittal of "as-built" plans showing final grading, planting, hydrological features, etc. within 60 days of completing initial mitigation site construction.

4.2 Wetland Construction Phase

Within 6 months of approval of the Phase I restoration plan, subject to the permittee's obtaining the necessary permits, the permittee shall commence the construction phase of the wetland restoration project. The permittee shall be responsible for ensuring that construction is carried out in accordance with the specifications and within the timeframes specified in the approved final restoration plan and shall be responsible for any remedial work or other intervention necessary to comply with final plan requirements.

4.3 Timeframe for Resubmittal of Project Elements

If the Commission does not approve any element of the project (i.e. site selection, restoration plan), the Commission will specify the time limits for compliance relative to selection of another site or revisions to the restoration plan.

5.0 WETLAND MONITORING, MANAGEMENT AND REMEDIATION

Monitoring, management (including maintenance), and remediation shall be conducted over the "full operating life" of Poseidon's desalination facility, which shall be 30 years from the date "as-built" plans are submitted pursuant to subsection 4.1(1).

The following section describes the basic tasks required for monitoring, management and remediation. Condition B specifies the administrative structure for carrying out these tasks, including the roles of the permittee and Commission staff.

5.1 Monitoring and Management Plan

A monitoring and management plan will be developed in consultation with the permittee and appropriate wildlife agencies, concurrently with the preparation of the restoration plan to provide an overall framework to guide the monitoring work. It will include an overall description of the studies to be conducted over the course of the monitoring program and a description of management tasks that are anticipated, such as trash removal. Details of the monitoring studies and management tasks will be set forth in a work program (see Condition B).

5.2 Pre-restoration site monitoring

Pre-restoration site monitoring shall be conducted to collect baseline data on the wetland attributes to be monitored. This information will be incorporated into and may result in modification to the overall monitoring plan.

5.3 Construction Monitoring

Monitoring shall be conducted during and immediately after each stage of construction of the wetland restoration project to ensure that the work is conducted according to plans.

5.4 Post-Restoration Monitoring and Remediation

Upon completion of construction of the wetland(s), monitoring shall be conducted to measure the success of the wetland(s) in achieving stated restoration goals (as specified in the restoration plan(s)) and in achieving performance standards, specified below. The permittee shall be fully responsible for any failure to meet these goals and standards during the facility's full operational years. Upon determining that the goals or standards are not achieved, the Executive Director shall prescribe remedial measures, after consultation with the permittee, which shall be immediately implemented by the permittee with Commission staff direction. If the permittee does not agree that remediation is necessary, the matter may be set for hearing and disposition by the Commission.

Successful achievement of the performance standards shall (in some cases) be measured relative to approximately four reference sites, which shall be relatively undisturbed, natural tidal wetlands within the Southern California Bight. The Executive Director shall select the reference sites. The standard of comparison, i.e., the measure of similarity to be used (e.g., within the range, or within the 95% confidence interval) shall be specified in the work program.

In measuring the performance of the wetland project, the following physical and biological performance standards will be used:

a. **Longterm Physical Standards.** The following long-term standards shall be maintained over the full operative life of the desalination facility:

   1. ***Topography.*** The wetland(s) shall not undergo major topographic degradation (such as excessive erosion or sedimentation);
   2. ***Water Quality.*** Water quality variables [to be specified] shall be similar to reference wetlands;
   3. ***Tidal prism.*** If the mitigation site(s) require dredging, the tidal prism shall be maintained and tidal flushing shall not be interrupted; and,

4. ***Habitat Areas.*** The area of different habitats shall not vary by more than 10% from the areas indicated in the restoration plan(s).

b. **Biological Performance Standards.** The following biological performance standards shall be used to determine whether the restoration project is successful. Table 1, below, indicates suggested sampling locations for each of the following biological attributes; actual locations will be specified in the work program:

1. ***Biological Communities.*** Within 4 years of construction, the total densities and number of species of fish, macroinvertebrates and birds (see Table 1) shall be similar to the densities and number of species in similar habitats in the reference wetlands;
2. ***Vegetation.*** The proportion of total vegetation cover and open space in the marsh shall be similar to those proportions found in the reference sites. The percent cover of algae shall be similar to the percent cover found in the reference sites;
3. ***Spartina Canopy Architecture.*** The restored wetland shall have a canopy architecture that is similar in distribution to the reference sites, with an equivalent proportion of stems over 3 feet tall;
4. ***Reproductive Success.*** Certain plant species, as specified by in the work program, shall have demonstrated reproduction (i.e. seed set) at least once in three years;
5. ***Food Chain Support.*** The food chain support provided to birds shall be similar to that provided by the reference sites, as determined by feeding activity of the birds; and
6. ***Exotics.*** The important functions of the wetland shall not be impaired by exotic species.

Table 1: Suggested Sampling Locations

	Salt Marsh			Open Water			Tidal
	Spartina	Salicornia	Upper	Lagoon	Eelgrass	Mudflat	Creeks
1) Density/spp:							
– Fish				X	X	X	X
– Macroinvert-ebrates				X	X	X	X
– Birds	X	X	X	X		X	X
2) % Cover							
Vegetation	X	X	X		X		
algae	X	X				X	
3) Spartina architecture	X						
4) Reproductive success	X	X	X				
5) Bird feeding				X		X	X

6) Exotics	X	X	X	X	X	X	X

6.0 ALTERNATIVE MITIGATION

As part of Phase II, Poseidon may propose in its CDP application alternatives to reduce or eliminate the required 18.4 acres of mitigation. The alternative mitigation proposed may be in the form of implementing new entrainment reduction technology or may be mitigation credits for conducting dredging, either of which could reduce or eliminate the 18.4 acres of mitigation.

CONDITION B: ADMINISTRATIVE STRUCTURE

1.0 ADMINISTRATION

Personnel with appropriate scientific or technical training and skills will, under the direction of the Executive Director, oversee the mitigation and monitoring functions identified and required by Condition A. The Executive Director will retain scientific and administrative support staff needed to perform this function, as specified in the work program.

This technical staff will oversee the preconstruction and post-construction site assessments, mitigation project design and implementation (conducted by permittee), and monitoring activities (including plan preparation); the field work will be done by contractors under the Executive Director's direction. The contractors will be responsible for collecting the data, analyzing and interpreting it, and reporting to the Executive Director.

The Executive Director shall convene a Scientific Advisory Panel to provide the Executive Director with scientific advice on the design, implementation and monitoring of the wetland restoration. The panel shall consist of recognized scientists, including a marine biologist, an ecologist, a statistician and a physical scientist.

2.0 BUDGET AND WORK PROGRAM

The funding necessary for the Commission and the Executive Director to perform their responsibilities pursuant to these conditions will be provided by the permittee in a form and manner reasonably determined by the Executive Director to be consistent with requirements of State law, and which will ensure efficiency and minimize total costs to the permittee. The amount of funding will be determined by the Commission on a biennial basis and will be based on a proposed budget and work program, which will be prepared by the Executive Director in consultation with the permittee, and reviewed and approved by the Commission in conjunction with its review of the restoration plan. If the permittee and the Executive Director cannot agree on the budget or work program, the disagreement will be submitted to the Commission for resolution.

The budget to be funded by the permittee will be for the purpose of reasonable and necessary costs to retain personnel with appropriate scientific or technical training and skills needed to assist the Commission and the Executive Director in carrying out the mitigation and lost resource compensation conditions. In addition, reasonable funding will be included in this budget for necessary support personnel, equipment, overhead, consultants, the retention of contractors needed to conduct identified studies, and to defray the costs of members of any scientific advisory panel(s) convened by the Executive Director for the purpose of implementing these conditions.

Costs for participation on any advisory panel shall be limited to travel, per diem, meeting time and reasonable preparation time and shall only be paid to the extent the participant is not otherwise entitled to reimbursement for such participation and preparation. The amount of funding will be determined by the Commission on a biennial basis and will be based on a proposed budget and work program, which will be prepared by the Executive Director in consultation with the permittee, and reviewed and approved by the Commission in conjunction with its review of the restoration plan. If the permittee and the Executive Director cannot agree on the budget or work program, the disagreement will be submitted to the Commission for resolution. Total costs for such advisory panel shall not exceed $100,000 per year adjusted annually by any increase in the consumer price index applicable to California.

The work program will include:

a. A description of the studies to be conducted over the subsequent two year period, including the number and distribution of sampling stations and samples per station, methodology and statistical analysis (including the standard of comparison to be used in comparing the mitigation project to the reference sites);

b. A description of the status of the mitigation projects, and a summary of the results of the monitoring studies to that point;

c. A description of four reference sites;

d. A description of the performance standards that have been met, and those that have yet to be achieved;

e. A description of remedial measures or other necessary site interventions;

f. A description of staffing and contracting requirements; and,

g. A description of the Scientific Advisory Panel's role and time requirements in the two year period.

The Executive Director may amend the work program at any time, subject to appeal to the Commission.

3.0 ANNUAL REVIEW AND PUBLIC WORKSHOP REVIEW

The permittee shall submit a written review of the status of the mitigation project to the Executive Director no later than April 30 each year for the prior calendar year. The written review will discuss the previous year's activities and overall status of the mitigation project, identify problems and make recommendations for solving them, and review the next year's program.

To review the status of the mitigation project, the Executive Director will convene and conduct a duly noticed public workshop during the first year of the project and every other year thereafter unless the Executive Director deems it unnecessary. The meeting will be attended by the contractors who are conducting the monitoring, appropriate members of the Scientific Advisory Panel, the permittee, Commission staff, representatives of the resource agencies (CDFG, NMFS, USFWS), and the public. Commission staff and the contractors will give presentations on the previous biennial work program's activities, overall status of the mitigation project, identify problems and make recommendations for solving them, and review the next upcoming period's biennial work program.

The public review will include discussions on whether the wetland mitigation project has met the performance standards, identified problems, and recommendations relative to corrective measures necessary to meet the performance standards. The Executive Director will use information presented at the public review, as well as any other relevant information, to determine whether any or all of the performance standards have been met, whether revisions to the standards are necessary, and whether remediation is required. Major revisions shall be subject to the Commission's review and approval.

The mitigation project will be successful when all performance standards have been met each year for a three-year period. The Executive Director shall report to the Commission upon determining that all of the performance standards have been met for three years and that the project is deemed successful. If the Commission determines that the performance standards have been met and the project is successful, the monitoring program will be scaled down, as recommended by the Executive Director and approved by the Commission. A public review shall thereafter occur every five years, or sooner if called for by the Executive Director. The work program shall reflect the lower level of monitoring required. If subsequent monitoring shows that a standard is no longer being met, monitoring may be increased to previous levels, as determined necessary by the Executive Director.

The Executive Director may make a determination on the success or failure to meet the performance standards or necessary remediation and related monitoring at any time, not just at the time of the workshop review.

4.0 ADDITIONAL PROCEDURES

4.1 Dispute Resolution

In the event that the permittee and the Executive Director cannot reach agreement regarding the terms contained in or the implementation of any part of this Plan, the matter may be set for hearing and disposition by the Commission.

4.2 Extensions

Any of the time limits established under this Plan may be extended by the Executive Director at the request of the permittee and upon a showing of good cause.

CONDITION C: SAP DATA MAINTENANCE

The permittee shall make available on a publicly-accessible website all scientific data collected as part of the project. The website and the presentation of data shall be subject to Executive Director review and approval.

PART B: MLMP'S 11 IDENTIFIED SITES

TIJUANA ESTUARY

Tijuana Estuary is located in the extreme southwestern corner of the U.S. in San Diego County (Figure 1). Wetland restoration planning and implementation at Tijuana Estuary has been ongoing for over 20 years, beginning in 1986 with a 495-acre restoration plan for the south arm of the estuary funded by the California Coastal Conservancy. In 2003, the Coastal Conservancy funded a renewed look at restoration of the south arm. Completed in 2008, the Tijuana Estuary-Friendship Marsh Restoration Feasibility and Design Study (Tierra Environmental Services March 2008) identified approximately 250 acres of restored tidal wetlands. Restoration was planned in phases dependent upon funding. Phase 1 includes 39 acres; Phase 2 - 37.2 acres; Phase 3 - 74.9 acres; Phase 4- 31.7 acres; and Phase 5 – 67.3 acres.

An EIR will be required for the project. To date no action has been taken regarding preparation of an EIR. In addition, a number of discretionary permits are required for the project, including, but not limited to, a U.S. Army Corps of Engineers Section 404 permit and a California Coastal Commission Coastal Development Permit. To date, no action has been taken on permit acquisition.

SAN DIEGUITO RIVER VALLEY

San Dieguito Lagoon is located in the City of Del Mar at the terminus of the San Dieguito River (Figure 1). Wetland restoration planning at San Dieguito Lagoon has been on-going since the late 1970s when the City of Del Mar and the California Coastal Conservancy prepared a plan for revitalizing and managing the lagoon and surrounding areas. In the 1991, the California Coastal Commission adopted new operating conditions for the San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 operated by Southern California Edison (SCE). These conditions required SCE to restore 150 acres of tidal wetland as mitigation for impacts to the marine environment from operation of SONGS units 2 and 3. In 2000, the San Dieguito Wetland Restoration EIR/EIS was competed. That document was based on the final Coastal Commission conditions that SCE submit a plan for a total of 150 acres of credit, including creation or substantial restoration of 115 acres of tidal wetland with up to 35 acres credit for perpetual maintenance of the tidal inlet of the lagoon. SCE began construction of the restoration project in 2006.

In 2007, Poseidon Resources identified San Diegutio Lagoon as a potential site to mitigate for impacts to the marine environment from the proposed operation of its Carlsbad Desalination Plant in Carlsbad, California. Conceptual plans for approximately 42 acres of tidal wetland creation were developed and submitted to the Coastal Commission pursuant to Poseidon's application for a Coastal Development Permit. A project-specific EIR and a number of discretionary permits would be required for Poseidon to accomplish mitigation requirements at San Dieguito Lagoon. To date there has been no action on the environmental document or required permits.

SAN ELIJO LAGOON

San Elijo Lagoon is located in the City of Encinitas at Cardiff-by-the-Sea (Figure 1). In 2001, The City of Encinitas funded the San Elijo Lagoon Inlet Relocation Plan (Coastal Environments 2001) that examined three restoration alternatives, including the infrastructure improvements associated with the tidal inlet, railroad and Highway 101. In 2006, the U.S. Army Corps of Engineers prepared the Encinitas/Solana Beach Shoreline Protection and San Elijo Lagoon Environmental Restoration Feasibility Study which included detailed analysis of a selected restoration for the lagoon. This plan was rejected by the resource agencies for not providing analysis of restoration alternatives to compare to the selected restoration plan. Thus, there is currently no accepted plan for restoration at San Elijo Lagoon.

Any restoration plan for San Elijo Lagoon will require a project-specific EIR and the suite of discretionary permits typical of coastal projects. To date, no action has been taken on these required items.

AQUA HEDIONDA LAGOON

Aqua Hedionda Lagoon is located in the City of Carlsbad at the terminus of Aqua Hedionda and Macario creeks (Figure 1). The majority of the lagoon is owned and maintained by Cabrillo Power II, which operates the 900-megawatt Encina Power Station located on the outer basin of the lagoon. The lagoon was created in the early 1950s to provide the Encina plant with seawater for cooling. Poseidon's Carlsbad Desalination Plant (CDP) is located at Aqua Hedionda Lagoon with the intent of using Encina cooling water for desalination while Encina continues to operate. The entire 400-acre lagoon was completely re-dredged in 1998-1999 to an average depth of 8 -11 feet.

In August 2007, Poseidon developed a Request for Expressions of Interest which was sent to a number of organizations associated with the Carlsbad Watershed Network in an attempt to identify mitigation opportunities at Aqua Hedionda Lagoon. Three proposals were received as presented below.

1. Expansion of the Aqua Hedionda Lagoon Ecological Reserve. This project includes the acquisition and preservation of land north of the existing Ecological Reserve.
2. Eradication of Invasive Exotic Plants and Restoration with Native Vegetation. This project was proposed by the Aqua Hedionda Lagoon Foundation.
3. Aqua Hedionda Lagoon Abalone Stock Enhancement. This project proposed creation of a 100,000 abalone stock at the Carlsbad Aquafarm and use of this stock to replenish abalone populations near the lagoon.

It was determined that none of the proposed projects meet the goals and objectives of the Coastal Commission. Thus, there is currently no accepted restoration plan for the lagoon.

BUENA VISTA LAGOON

Buena Vista Lagoon is located between the cities of Oceanside and Carlsbad in San Diego County (Figure 1). The lagoon is comprised of four basins as a result of road and railroad crossings. Constriction of tidal flows from these crossing in conjunction with increased sedimentation from upstream sources and decreased water quality has resulted in a degraded freshwater lagoon. A concrete weir built across the ocean inlet in 1972 controls the minimum water level in the lagoon.

The problem of accelerated sedimentation in the lagoon was acknowledged as early as the 1970s. The Southern California Wetland Recovery Project funded the Buena Vista Lagoon Restoration Feasibility Analysis which was completed in 2004 (Everest International Consultants, 2004). The restoration feasibility analysis identified three primary restoration alternatives: the Freshwater Alternative; the Salt Water Alternative; and, the Mixed Water Alternative, with restored tidally influenced wetlands ranging from 0 to 180 acres.

In 2007, the USFWS and CDFG issued a Notice of Intent to prepare an EIS with the Salt Water alternative identified as the preferred alternative and the Freshwater Alternative and Mixed Water Alternative identified as alternatives considered but rejected. A contractor was selected and work on the EIS was initiated; however, work on that document was halted and there is currently no environmental documentation for the proposed restoration.

ANAHEIM BAY

Anaheim bay is located within the city limits of Seal Beach and Huntington Beach in Orange County (Figure 2). There are approximately 956 acres of wetland habitats associated with the Bay, nearly all of them contained within Seal Beach National Wildlife Refuge located within the Seal Beach Naval Weapons Station. In 1990, approximately 116 acres of wetlands adjacent to the Seal Beach National Wildlife Refuge were restored at Anaheim Bay as mitigation for impacts associated with construction of a 147-acre landfill at the Port of Long Beach.

In 2007, the U.S. Fish and Wildlife Service (USFWS) published a Notice of Intent to prepare a Comprehensive Conservation Plan (CCP) for the refuge. The CCP is intended to act as a "blueprint" for management of the Refuge over the next 15 years. In August 2008, the USFWS published an update on the CCP. That update presented three draft alternatives for the CCP:

- Alternative A – No Action;
- Alternative B – Maximum Salt Marsh Restoration, Continue Current Public Use Program;

- Alternative C – Optimize Upland and Wetland restoration, Improve Opportunities for Wildlife Observation (Preferred Alternative).

Under Alternative C, the preferred alternative, approximately 10 acres of coastal sage scrub habitat, 15 acres of wetland/upland transition habitat, and 8 acres of salt marsh would be restored. The update did not detail the tidal condition of the 8-acre restoration. The selection of Alternative C as the preferred alternative is considered a draft decision, subject to a final decision during public review of the draft document. Restoration of eight acres of salt marsh is not sufficient to meet Coastal Commission requirements as stated on November 14, 2008.

SANTA ANA RIVER

The Santa Ana River wetlands are located south of the Huntington Beach wetlands south of the Santa Ana River mouth (Figure 2). The area consists of approximately 170 acres of wetlands situated in four main sites within the greater Santa Ana River wetlands complex. It is estimated that the historic acreage of wetlands at the mouth of the river was 2,900 acres. The site has been degraded by agriculture, oil extraction activities and other human uses.

In 1987, the Marsh Restoration, Lower Santa Ana River Channel, Orange County, California (Simon Li & Associates 1987) was prepared for the U.S. Army Corps of Engineers (USACOE), Los Angeles District. The restoration plan identified three alternative restoration scenarios for a 92-acre portion of the wetlands owned by the USACOE. The restoration was subsequently implemented in 1989 as mitigation for biological impacts associated with the Lower Santa Ana River Improvement Project. In 1991, Orange County adopted an enhancement plan for South Talbert and Fairview/North Talbert parks, renamed Talbert Nature Preserve in 1995. In 1991, the Orange County Environmental Management Agency (OCEMA) developed a draft Local Coastal Plan (LCP) for restoration on land owned by Mobile Oil. OCEMA did complete processing of the LCP.

There have been no official wetland restoration plans formulated for the Santa Ana River Mouth wetlands since the 1990s. Any restoration activity at this site would require extensive study, land acquisition and infrastructure removal (primarily oil extraction infrastructure), detailed engineering, an environmental document and the usual suite of discretionary permits.

HUNTINGTON BEACH WETLANDS

Huntington Beach Wetlands are located between Brookhurst Street and the Santa Ana River along the Pacific Coast Highway in the City of Huntington Beach (Figure 2). Wetland restoration planning at Huntington Beach Wetlands began in the mid 1980s with the inception of the Huntington Beach Wetlands Conservancy (HBWC). The HBWC and the California Coastal Conservancy collaborated on the restoration of the 27-acre Talbert Marsh, a portion of the Huntington Beach Wetlands, in 1990. In 2005, a report entitled Development and Analysis of Restoration Alternatives was prepared for the HBWC and Coastal Conservancy (Moffatt & Nichol et al. 2005). In 2006, the same authors produced the Huntington Beach Wetlands Conceptual Restoration Plan that identified the preferred restoration plan. A Mitigated Negative Declaration (MND) was prepared pursuant to CEQA in December 2007 and was adopted by the County of Orange in January 2008.

Huntington Beach Wetlands consist of Talbert Marsh (27 acre), Brookhurst Marsh (67 acres), Magnolia Marsh, including Upper Marsh (43 acres), and Newland Marsh (54 acres). As stated previously, Talbert Marsh was restored in 1990. Brookhurst Marsh is currently being restored (Chris Webb, Moffat & Nichol, pers. comm.). Newland Marsh is owned by the California Department of Transportation (Caltrans) and is not currently available for restoration by another entity. Thus, the 43-acre Magnolia Marsh is the only component available for restoration by Poseidon (Chris Webb, Moffat & Nichol, pers. comm.).

An adopted MND exists for the project and seven of eight discretionary permits identified in the Conceptual Restoration Plan have been acquired. Only a County of Orange Flood Control Agency Encroachment Permit remains to be acquired.

BALLONA WETLANDS

Ballona Wetlands, located south of Playa del Rey and east of Jefferson Boulevard (Figure 2), is the last major wetland remaining in Los Angeles County. In 2004, CDFG took title to approximately 540 acres of former wetlands. The State Lands Commission owns approximately 60 acres of created freshwater marsh and muted tidal salt marsh.

In 2005, the California State Coastal Conservancy funded the Ballona Wetlands Restoration Feasibility Study (PWA et al., 2008). This study culminated in the development of five restoration scenarios, ranging from minimal wetland creation coupled with maximum upland restoration to maximum wetland restoration. Maximum wetland restoration would include the removal of Ballona Creek Flood Control Channel, modification of several existing roads, and relocation of pipelines and other infrastructure. The area of tidally-influenced wetland habitat restored varies from approximately 165 to 375 acres.

A project-specific EIR and a number of discretionary permits would be required for restoration at Ballona. To date there has been no action on an environmental document or required permits.

LOS CERRITOS WETLANDS

Los Cerritos Wetlands is a degraded relic wetland area flanking the lower San Gabriel River in Los Angeles County (Figure 2). A number of stakeholders have been involved with restoration planning of the wetlands. In 2005, a conceptual restoration plan for approximately 496 acres at Los Cerritos was prepared by Moffat & Nichol for California Earth Corps, a local stakeholder. The restoration plan includes primarily conceptual-level engineering and hydrology, but does not include analysis of biological resources other resources. The conceptual restoration plan identifies three phases: Phase I (171.9 acres); Phase II (137 acres); and Phase 3 (187.2 acres).

The conceptual plan does not specify acreages of habitats to be created. Of the approximately 496 acres included in the restoration plan, potentially 25% (124 acres) would be restored as subtidal habitat; 55% (273 acres) as intertidal wetlands; and 20% (99) acres a supratidal habitat located above the mean high tide line. However, these numbers are conceptual only. The conceptual plan includes a bridge over the San Gabriel River as well as removal of existing levees and oil extraction infrastructure.

Restoration of Los Cerritos will require additional studies, including refined engineering plans, biological resources impact analysis, preparation of an environmental document, and acquisition of discretionary permits. Acquisition of privately-owned land is fundamental to implementation of the conceptual plan. To date, such acquisition has been an impediment to a unified restoration strategy

ORMOND BEACH

The Ormond Beach Restoration Project is a State Coastal Conservancy-funded project located in Ventura County adjoining the cities of Port Hueneme and Oxnard (Figure 2). Approximately 1,500 acres of Ormond Beach is undeveloped and includes a mix of degraded wetlands, beach and dunes, agriculture, and mixed industry, including an abandoned metals-processing plant and an existing electricity generating plant. A 560-acre duck club with artificially maintained ponds and remnant intertidal habitat exists to the north of Ormond Beach. The goal of the Ormond Beach Restoration Project is the acquisition of 1,100 acres at Ormond Beach and the 560 acres of the duck club for a total restoration of approximately 1,600 acres. While restoration can be accomplished with less than the 1,100 acre goal, the property acquisitions are crucial to reducing total restoration costs and accommodating sea level rise.

To date the Coastal Conservancy has acquired 540 acres at Ormond Beach. Prior to the planned restoration, the Conservancy must acquire 210–340 acres of the Southland Sod Farm. Sale of a portion (210 acres) of this farm has been offered by the owner, contingent upon completion of the City of Oxnard's Specific Plan for Ormond Beach.

The 50-acre Reliant Power Plant is situated on fill that was formerly coastal lagoon. This parcel divides the proposed restoration in half, obstructing potential hydrologic and biological connectivity. This plant is expected to cease operation within the next five years due to fundamental inefficiencies and adverse effects on marine life caused by its intake and outfall (P. Brand, Coastal Conservancy).

The 40-acre Halaco metals processing facility also occupies former coastal lagoon. The goal of the restoration plan is to acquire the Halaco property and restore the former wetlands after the EPA has remediated this Superfund site.

The Ormond Beach Restoration Feasibility Study, funded by the Coastal Conservancy, was not available at the time of this analysis. The plan is expected to be released early 2009. The focus of the Ormond Beach restoration plan appears to be based primarily on land acquisition. Considerable effort will be required prior to restoration, including refined engineering, environmental documentation, and permitting.

CHAPTER 7

CONCLUSION

7.1 PLAN PURPOSE

The Regional Board adopted the Permit for the CDP's discharge to the Pacific Ocean via the existing EPS discharge channel. The CDP is planned to operate in conjunction with the EPS by using the EPS cooling water discharge as its source water whenever the power plant is operating and producing at least 304 MGD of cooling water discharge.

In the event that the EPS were to cease operations, and Poseidon were to independently operate the seawater intake and outfall for the benefit of the CDP, such independent operation will require additional review pursuant to Water Code Section 13142.5(b). Water Code Section 13142.5(b) requires industrial facilities using seawater for processing to use the best available <u>site</u>, <u>design</u>, <u>technology</u>, *and* <u>mitigation</u> feasible to minimize intake and morality of marine life. This Plan reviews stand-alone operations and also ensures compliance with Section 13142.5(b) when the EPS is operating but producing less than 304 MGD, since intake and mortality under that circumstance would be less than when the CDP operates in stand-alone mode.

This Plan is developed in fulfillment of the above-stated requirements and contains site-specific activities, procedures, practices and mitigation plans which Poseidon proposes to implement to minimize intake and mortality of marine organisms when the CDP intake requirements exceed the volume of water being discharged by the EPS.

7.2 PLAN COMPLIANCE

As shown in Table 7-1, the Plan addresses each of the provisions of Water Code Section 13142.5(b):

- Identifies the best available <u>site</u> feasible to minimize impingement and entrainment of marine life from the CDP;
- Identifies the best available <u>design</u> feasible to minimize impingement and entrainment of marine life from the CDP
- Identifies the best available <u>technology</u> feasible to minimize feasible to minimize impingement and entrainment of marine life from the CDP;
- Quantifies impingement and entrainment that may occur even after the application of best available site, design and some technology; and
- Identifies the best available <u>mitigation</u> measures feasible to minimize any residual impingement and entrainment, and is in addition to those measures addressed through site, design, and technology approaches.

Table 7-1 Site, Design, Technology and Mitigation Measures to Minimize Intake and Mortality		
Category	**Feature**	**Result**
1. Site	Proposed location at EPS	Best available site for the CDP, no feasible and less environmentally damaging alternative locations.
1. Design	Use of EPS discharge as source water	Eliminates entrainment and impingement attributable to the CDP when the EPS is discharging at least 304 MGD
2. Design	Reduction in inlet screen velocity	Reduction of impingement of marine organisms
3. Design	Reduction in fine screen velocity	Reduction of impingement of marine organisms
4. Design	Ambient temperature processing	Eliminate entrainment mortality associated with the elevated seawater temperature
5. Design	Elimination of heat treatment	Eliminate mortality associated with heat treatment.
1. Technology	Installation of VFDs on the CDP's intake pumps	Reduce the total intake flow for the desalination facility to no more than that needed at any given time, thereby minimizing the entrainment of marine organisms.
1. Mitigation	Implementation of the MLMP developed pursuant to a state agency coordinated process.	Compensates for unavoidable entrainment and impingement and enhances the coastal environment.

7.3 PROPOSED MITIGATION APPROACH

Poseidon will the best available site, design and technology feasible to minimize or reduce impingement and entrainment associated with the CDP's operations. These ~~methods are likely to reduce the CDP's impingement and entrainment to marine life well~~ below the levels identified in Chapter 5. To minimize unavoidable CDP-related impingement and entrainment of marine life, Poseidon has committed to implementing the MLMP described in Chapter 6.

7.4 REGULATORY ASSURANCE OF PLAN ADEQUACY

There are a number of regulatory assurances in place to confirm the adequacy of the MLMP and resulting restoration. The Regional Board and Coastal Commission have direct jurisdiction over the implementation of the MLMP. In addition, the Regional Board, Coastal Commission, and State Lands Commission will continue to have ongoing jurisdiction over the CDP.

Specifically, the Regional Board's approval will be necessary in order to achieve NPDES permit renewal for the Project in 2011. Poseidon must make additional coastal development permit applications to the Coastal Commission. In addition, ten years after the lease for the intake system is issued, the CDP will be subject to further environmental review by the State Lands Commission to analyze all environmental effects of facility operations and consider alternative technologies that may further reduce intake and mortality of marine life. The State Lands Commission may impose additional requirements as are reasonable and as are consistent with applicable state and federal laws and regulations.

This multi-agency approach means that there are multiple safeguards to ensure that even when the CDP converts to stand-alone operations, it will continue to use the best available site, design, technology and mitigation feasible to minimize intake and mortality attributable to the CDP.

7.5 CONCLUSION

The CDP will use the best available site, design, technology and mitigation measures feasible to minimize the intake and mortality of marine life associated with the intake of seawater to support the CDP's desalination operations.

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- Verification of All Other Permits or Approvals Applied for by Public Agencies
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- City of Carlsbad Resolution No. 420-RP 05-12
- City of Carlsbad Ordinance No. NS-805-SP 144 (H)
- City of Carlsbad Ordinance No. NS-806-PDP 00-02
- Planning Commission Resolution No. 6093 – SUP 05-04
- Planning Commission Resolution No. 6092 – CDP 04-41
- Planning Commission Resolution No. 6090 – DA 05-01 / Development Agreement Finding of Fact
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- Planning Commission Resolution No. 6094 – HMPP 05-08
- Planning Commission Resolution No. 6088 – PDP 00-02
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CARLSBAD SEAWATER DESALINATION PROJECT

SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD

ORDER NO. R9-2006-0065

NPDES NO. CA0109223

FLOW, ENTRAINMENT AND IMPINGEMENT MINIMIZATION PLAN

CERTIFICATION PAGE

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Peter M. MacLaggan
Senior Vice President, Poseidon Resources Corporation

March 9, 2009