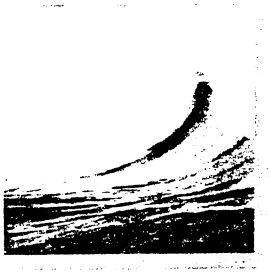
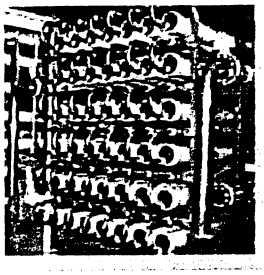
APPENDIX E

POSEIDON RESOURCES

Orange County Desalination Project



WATERSHED SANITARY SURVEY REPORT



Prepared By

Archibald & Wallberg Consultants

November 2001 – Revised January 2002

TABLE OF CONTENTS

EXECUTIVE SUMMARY ES-1

THE TREATMENT PLANT ES-1
THE WATERSHED ES-1
Contaminant Sources ES-2
WATER QUALITY ES-3
RECOMMENDATIONS ES-4
Real-Time Monitoring ES-5
Raw and Finished Water Quality Monitoring ES-5
Watershed Management Strategies ES-5

CHAPTER 1 INTRODUCTION 1-1

BACKGROUND 1-1
OBJECTIVES 1-1
REPORT ORGANIZATION 1-2

CHAPTER 2 WATERSHED AND WATER SUPPLY SYSTEM 2-1

DELINEATION OF THE WATERSHED 2-1
Intake Structure 2-3
Santa Ana River and Talbert Marsh Storm Water 2-3
Talbert Marsh Flushing at Spring Tides 2-4
Recirculation of Power Plant Discharge 2-6
Orange County Sanitation District Wastewater Discharge 2-9
Watershed Boundaries 2-11
WATERSHED DESCRIPTION 2-13
THE WATER SUPPLY SYSTEM AND TREATMENT PLANT 2-13
Source Water 2-14
Treatment Process 2-14
Pretreatment 2-14
Dechlorination 2-15
pH Adjustment 2-15
RO Process 2-15
Chemical Conditioning 2-16
Disinfection 2-16
Distribution 2-16

CHAPTER 3 POTENTIAL CONTAMINANT SOURCES 3-1

SURVEY METHODS 3-1
PROTECTION ZONES 3-1
POTENTIAL CONTAMINANT SOURCES 3-3
Huntington Beach Power Plant Activities 3-3
Description 3-3
Description of Cooling Water System 3-5

Cycle Water Discharges *3-6*
Storm Water Discharges *3-8*
Wastewater Discharges *3-8*
Hazardous Materials Spills *3-9*
Leakage From the Discharge Vault into the Intake Well *3-9*
Significance/Vulnerability Assessment *3-12*
Wastewater Collection, Treatment, and Discharges 3-12
Description *3-12*
Significance/Vulnerability Assessment *3-14*
Urban Runoff 3-14
Description *3-14*
Significance/Vulnerability Assessment *3-15*
Recreation 3-16
Description *3-16*
Significance/Vulnerability Assessment *3-16*
Oil and Gas Activities 3-16
Description *3-16*
Significance/Vulnerability Assessment *3-16*
Red Tides 3-17
Description *3-17*
Significance/Vulnerability Assessment *3-17*
ANTICIPATED GROWTH AND PROJECTED CHANGES IN SOURCES OF CONTAMINANTS 3-17
Significance of Potential Contaminant Sources 3-17

CHAPTER 4 WATER QUALITY 4-1

DRINKING WATER REGULATIONS 4-1
Surface Water Treatment Regulation 4-1
Drinking Water Source Assessment and Protection Program 4-2
Contaminants of Concern 4-2
EXISTING WATER QUALITY 4-3
Monitoring Programs 4-3
Power Plant Intake Monitoring *4-3*
Poseidon Monitoring *4-3*
MBC Monitoring *4-4*
Power Plant Outfall Monitoring *4-4*
Poseidon Monitoring *4-4*
MBC Monitoring *4-5*
Nearshore Ocean Data *4-5*
Evaluation of Monitoring Data 4-6
Electrical Conductivity and Total Dissolved Solids *4-6*
Turbidity *4-9*
Metals *4-9*
Inorganic Chemicals *4-9*
Aesthetic Characteristics *4-10*
Radiological Contaminants *4-11*
Organic Chemicals *4-11*

Disinfection Byproduct Precursors *4-11*
Microbiological Contaminants *4-12*
Bacteria in the Intake Well *4-12*
Bacteria in the Discharge Vault and Waste Streams *4-16*
Evaluation of Ability to Meet Surface Water Treatment Regulation Requirements 4-19
PATHOGEN REMOVAL AND INACTIVATION 4-20
Treatment Plant Performance 4-20
Pathogen Removal *4-20*
Pretreatment *4-20*
Reverse Osmosis *4-21*
Disinfection *4-21*
Dissolved Solids, Metals and Organics *4-21*
SYSTEM RELIABILITY AND MONITORING 4-21
Real-Time Monitoring 4-22
Reverse Osmosis Pretreatment *4-22*
Reverse Osmosis *4-22*
Start-Up Monitoring 4-22
Microbiological Monitoring *4-22*
Inorganic Contaminants *4-23*
Asbestos *4-23*
Organic Contaminants *4-23*
Aesthetic Monitoring *4-23*
Unregulated Contamination Monitoring *4-23*

CHAPTER 5 WATERSHED MANAGEMENT STRATEGIES _____ 5-1
NOTIFICATION OF SPILLS AT POWER PLANT SITE 5-1
NOTIFICATION OF HEAT TREATMENT AND NON-ROUTINE OPERATIONS OR DISCHARGES TO THE COOLING WATER SYSTEM 5-1
MONITORING SYSTEM 5-1

CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS _____ 6-1
CONCLUSIONS 6-1
Sources of Water 6-1
Contaminant Sources 6-1
Water Quality 6-3
RECOMMENDATIONS 6-3
Real-Time Monitoring 6-4
Raw and Finished Water Quality Monitoring 6-4
Watershed Management Strategies 6-4

LIST OF REFERENCES

APPENDIX A _____ DRINKING WATER SOURCE ASSESSMENT

LIST OF TABLES

Table 2-1 Model Results for Santa Ana and Talbert Marsh Storm Water 2-4

Table 2-2 Model Results of Recirculation Study 2-7

Table 3-1 Cycle Water Discharges to the Huntington Beach Power Plant Cooling Water System 3-7

Table 4-1 Treatment Requirements for *Giardia* Cyst and Virus Reduction Based on Total Coliform Levels 4-2

Table 4-2 Comparison of Intake Well Monitoring Data to Primary Maximum Contaminant Levels 4-8

Table 4-3 Comparison of Monitoring Data to Secondary Contaminant Levels 4-9

Table 4-4 Bacterial Quality of Power Plant Waste Streams 4-17

Table 4-5 Median Monthly Coliform Densities 4-20

Table 4-6 Filtration Removal Credits 4-21

Table 4-7 Summary of MS2 Virus Removal by RO Membranes San Diego AQUA 2000 Program 4-22

Table 4-8 Manufactures Specifications for RO Membranes Tested San Diego AQUA 2000 Program 4-22

Table 4-9 CT Requirements 4-23

Table 4-10 Orange County Desalination Plant Virus Removal/Inactivation Capabilities 4-24

Table 4-11 Real-Time Monitoring Parameters 4-25

LIST OF FIGURES

Figure 2-1 Regional Location 2-1

Figure 2-2 Location Map for Source Water Modeling Analysis Due to Fluxes from Farfield Sources 2-3

Figure 2-3 Dilution of Santa Ana River/Talbert Marsh Channel Plume at Depth of Infall Velocity Cap, February 1998 2-5

Figure 2-4 Total Coliform Dilution from Talbert Marsh Tidal Flush, August 9, 1994, 11:50 PDT 2-6

Figure 2-5 Dilution of Depth of Velocity Cap, Combined Cooling and Storm Water Discharge, Storm Water = 1.66 MGD, Combined Discharge = 128.4 MGD, 22-28 February (7 day ave.) 2-8

Figure 2-6 Dilution of Depth Velocity Cap, Combined Cooling and Storm Water Discharge, Storm Water = 1.66 MGD, Combined Discharge = 506.6 MGD, 22-28 February (7 day ave.) 2-9

Figure 2-7 Dilution Factor at Depth of Velocity Due to OCS Deep Outfall Operating at 480 MGD, El Niño Conditions (August 1997) 2-11
Figure 2-8 Orange County Desalination Plant Watershed 2-12
Figure 2-9 Project Site 2-13
Figure 2-10 Process Flow Schematic 2-15
Figure 3-1 Orange County Desalination Plant Watershed and Protection Zone 3-2
Figure 3-2 Power Plant Site Layout and Conceptual Site Layout of Desalination Plant 3-4
Figure 3-3 Discharges to the Huntington Beach Power Plant Cooling Water System 3-5
Figure 4-1 Sampling Locations 4-3
Figure 4-2 Nearshore Monitoring Locations 4-5
Figure 4-3 TDS in Intake Well and Discharge Vault 4-7
Figure 4-4 TDS and EC During January 2001 Storm Event 4-7
Figure 4-5 Ammonia Concentration in the Intake and Discharge Vault 4-10
Figure 4-6 Bacteria Densities in the Intake Well 4-13
Figure 4-7 Bacteria Densities in the Intake Well, June 2001 4-13
Figure 4-8 Bacteria Densities in the Intake Well, August 2001 4-14
Figure 4-9 Comparison of Total Coliform Densities at AES Intake Well and Ocean Near Intake Structure, June 2001 4-15
Figure 4-10 Comparison of Total Coliform Densities at AES Intake Well and Ocean Near Intake Structure, August 2001 4-15
Figure 4-11 Bacterial Densities in the Discharge Well 4-16
Figure 4-12 Intake Well and Discharge Vault Total Coliform Densities 4-17
Figure 4-13 Intake Well and Discharge Vault Total Coliform Densities, June 2001 4-18
Figure 4-14 Intake Well and Discharge Vault Total Coliform Densities, August 2001 4-18
Figure 4-15 Summary of Virus Removal by Various Membrane Studies 4-21

EXECUTIVE SUMMARY

Poseidon Resources Corporation (Poseidon) plans to construct and operate a reverse osmosis (RO) desalination plant in the City of Huntington Beach (City). Up to 50 million gallons per day (MGD) of treated water from this plant will be blended with other supplies to provide supplemental water to Orange County. The source of water for the desalination plant will be seawater drawn in through the cooling water intake of the AES L.L.C. Huntington Beach Power Plant (Huntington Beach Power Plant). This sanitary survey was conducted to assess the quality of the source water that will be treated at the desalination plant and the potential contaminant sources in the watershed. This document is developed to address the California Department of Health Services (DHS) requirements for a watershed sanitary survey and source water assessment.

THE TREATMENT PLANT

The treatment plant will be located in the southeast portion of the City at the AES Huntington Beach Power Plant. The power plant currently generates power in two generating units; however, two more units will be operational within the next few months. With all four units operating the power plant will divert up to 507 MGD of water from the Pacific Ocean for once-through cooling. The water is drawn into the power plant through an intake structure located 2,292 feet offshore in 34 feet of water. The cooling water is pumped through the condensers serving each of the generating units to cool and condense spent steam for recirculation as boiler feed water. Approximately 100 MGD of seawater will be drawn from the cooling water discharge and conveyed to the desalination plant to produce 50 MGD of drinking water. The pretreated water will pass through RO membranes at a reduced pressure creating a more energy efficient operating system at 45 percent to 50 percent recovery. The total dissolved solids (TDS) objective for the finished water is 250 to 350 mg/L. The concentrated seawater byproduct will be returned to the power plant's cooling water system, where it will be diluted and conveyed to the outfall structure in the Pacific Ocean. Poseidon will obtain and comply with a National Pollutant Discharge Elimination System (NPDES) permit for the concentrated seawater byproduct discharge.

The finished water will be blended with other water supplies and distributed to customers in Orange County. The specific distribution system has not yet been identified. The plant is expected to operate more than 90 percent of the time.

THE WATERSHED

The watershed for the desalination plant was determined based on modeling studies that investigated the potential for various sources to impact water quality at the seawater intake. The modeling studies showed that seawater is the source of water to the desalination plant. Water quality at the intake to the Huntington Beach Power

Plant is not influenced by storm water discharges from the Santa Ana River and Talbert Marsh. Similarly, flushing of Talbert Marsh during summer El Niño conditions has no impact on water quality at the intake. The modeling studies also showed that wastewater from the Orange County Sanitation District (OCSD) outfall does not reach the intake to the power plant and the discharge from the power plant is not recirculated into the intake.

The watershed and protection zones for the Orange County Desalination Project were delineated based on the modeling results and the guidance provided by DHS Guidance Document on the California Drinking Water Source Assessment and Protection Program (DWSAP).

Watershed *The watershed for the desalination plant has been defined as the Pacific Ocean within a circle with a radius of 2500 feet centered on the intake structure for the power plant. The terrestrial portion of the watershed consists of the power plant site, the land that drains to the power plant site, and the land that is between the power plant and the ocean.*

Zone A *This is the zone that has the most potential to impact water quality at the intake to the desalination plant. It has been defined as the power plant site because activities at the power plant and discharges to the cooling water system upstream of the desalination plant intake have the most potential to impact water quality at the plant.*

CONTAMINANT SOURCES

There are few contaminant sources with the potential to impact the water quality at the intake to the desalination plant. Contaminant sources in the watershed which have been judged to be insignificant are wastewater, urban runoff, oil and gas extraction activities, recreation, and red tides. Activities at the Huntington Beach Power Plant have the most potential to impact raw water quality due to the proximity to the desalination plant intake and the nature and volume of materials stored and used on the site.

Process Wastewater and Drainage *Currently, the power plant process wastewater, and drainage from the power plant yard, generating unit floors, and the adjoining watershed are discharged upstream of the desalination plant intake. The quality of these discharges is poor with respect to microbial contaminants. Poseidon will reroute these discharges so they enter the power plant outfall line downstream of the discharge vault and the intake to the desalination plant so they will not pose a risk to water quality at the intake.*

Leakage From Discharge Vault *There is a source of bacteria and ammonia to the intake well that has not been completely identified. The increase in bacteria and ammonia concentrations between the ocean intake and the intake well may be due*

to leakage from the adjoining discharge vault. The discharge vault occasionally has concentrations of bacteria that exceed the detection level of 24,000 MPN/100 mL and ammonia concentrations as high as 1.7 mg/L due to the waste streams that enter it. It is anticipated that when the waste streams are rerouted during construction of the desalination plant, the quality of water in the discharge vault will improve since it will no longer be receiving the process wastewater and urban drainage that currently lead to the high levels of bacteria and ammonia. If leakage from the discharge vault has caused the bacteria and ammonia concentrations to increase over the levels found in the ocean, the quality of the intake well water should improve when the current discharges to the vault are rerouted.

Cycle Water Discharges *The power plant cycle water discharges do not pose a significant risk due to the nature of the chemicals present in the discharges and the small volumes compared to the cooling water volume.*

Heat Treatment *Periodic heat treatment may pose a significant risk to water quality at the desalination plant intake. Currently all of the process wastewater, power plant floor and yard drainage, and offsite urban drainage are routed to the discharge vault. During heat treatment, water from the discharge vault is recirculated through the power plant. Since Poseidon will reroute the waste streams during construction of the desalination plant, the discharge vault water quality should improve. However, the heat treatment water will include the concentrated seawater discharge from the desalination plant and could possibly contain higher than normal quantities of cycle water. Poseidon will not take water into the desalination plant during heat treatments.*

Catastrophic Spills *Although AES has had no reportable spills in recent years, there is always the potential for a spill of oil or a hazardous chemical. Due to the configuration of the cooling water system and safeguards that route most of the plant drainage to oil/water separators and the retention basins, small spills at the power plant will not reach the cooling water system. Although highly unlikely, there is the potential for a large spill due to a natural disaster such as an earthquake or explosion. Under this scenario, the operation of the desalination plant will be curtailed and possibly discontinued until the spill's effect on water quality is mitigated.*

WATER QUALITY

Water quality data were obtained from several sources and analyzed for this sanitary survey. The desalination plant will be able to treat the water from the Pacific Ocean to meet all drinking water standards and provide the customers in Orange County with a healthful, safe drinking water.

Compliance with Maximum Contaminant Levels

The water in the power plant intake well is generally of high quality. All contaminants were below the primary maximum contaminant levels (MCLs) established by the DHS in several samples collected from the intake well. As expected in seawater, the concentrations of TDS, chloride, and sulfate are substantially higher than the secondary MCLs. The desalination plant will treat the water to remove metals, organics, and salts to levels below drinking water standards. Testing will be conducted upon plant start-up to confirm that drinking water standards are met in the treated water.

Although the total organic carbon concentration in the treated water is predicted to be less than 0.1 mg/L, the predicted bromide concentration of 270 ug/L may create the potential for the formation of brominated disinfection byproducts (DBPs) in the distribution system if the water is blended with other supplies of incompatible water quality and disinfection practices. The desalination plant disinfection strategy will be adjusted to that of existing water sources to minimize DBP formation in the distribution system. Poseidon will conduct an analysis of DBP formation when the distribution system and blending options are identified to conform with DBP regulations.

Pathogen Removal Requirements

Based on the coliform data and the watershed sanitary survey, 3-log removal/inactivation of Giardia and 4-log removal/ inactivation of viruses appears appropriate during dry weather conditions. This level of removal will likely be appropriate during wet weather conditions, particularly since the waste streams that have high levels of bacteria will be rerouted so that they will have no impact on intake water quality. In addition, the plant will also have to provide 2-log removal of Cryptosporidium to meet the requirements of the Interim Enhanced Surface Water Treatment Rule. The desalination plant will be able to comply with these removal requirements.

RECOMMENDATIONS

The following recommendations for collecting water quality data and for tracking activities in the watershed were made by the consultant conducting the sanitary survey. Poseidon has committed to conducting the water quality monitoring to ensure that the water delivered to consumers meets all drinking water standards. The results of the monitoring will be promptly shared with DHS. Poseidon has also committed to the recommended watershed management practices.

REAL-TIME MONITORING

Continuous monitoring of key water quality parameters, such as electrical conductivity (EC), pH, and turbidity of the product water at the desalination plant will be conducted to assist in process control and assure product water quality. Both the pretreatment and the RO unit performance will be monitored.

Reverse Osmosis Pretreatment	*Real-time monitoring of the RO pretreatment process will be directed toward identifying problems that could impact the operation of the RO system.*
Reverse Osmosis	*Due to the importance of the RO unit performance, several parameters covering the system's feed, product, and reject streams will be monitored real-time. Software will be used to normalize the data for each parameter and identify deviations from predetermined operational criteria.*

RAW AND FINISHED WATER QUALITY MONITORING

Extensive monitoring will be conducted during the start-up phase of operation to ensure that the treatment plant is performing adequately and to further evaluate some of the potential contaminants that are found in the source water.

Microbiological Monitoring	*Poseidon will conduct hourly monitoring during a significant storm event during the fall and winter of 2001/2002 to better characterize the quality of water at the intake during storms.*
Drinking Water Contaminant Monitoring	*Poseidon will collect a sample of the treated water and analyze it for the inorganic and organic chemicals and physical parameters that are regulated by DHS through primary and secondary MCLs. Poseidon will then conduct the routine monitoring for these chemicals required by Title 22 Drinking Water Regulations.*
Unregulated Contaminants Monitoring	*Poseidon will collect quarterly samples of the finished water for the first year of operation of the desalination plant for unregulated chemicals listed in Title 22 Table 64450 to comply with DHS regulations.*

WATERSHED MANAGEMENT STRATEGIES

Activities at the Huntington Beach Power Plant have the greatest potential to impact intake water quality. Poseidon will work with AES to ensure early detection and mitigation of any potential water quality problems.

Notification of Spills at Power Plant Site	*Prior to plant start-up, Poseidon will meet with AES environmental staff to discuss the need to protect the desalination plant intake from petroleum products or chemicals used at the power plant site. Although there are many precautions taken to avoid spills of hazardous materials at the power plant, Poseidon will request that AES notify them of any*

spills that reach the cooling water system so that the desalination plant intake water quality is closely monitored.

Notification of Heat Treatment and Non-routine Operations or Discharges to the Cooling Water System

During the periodic heat treatments at the power plant, water from the discharge vault is recirculated through the power plant. Although Poseidon will reroute the process wastewater and urban drainage downstream of the discharge vault during construction of the desalination plant, the heat treatment water will contain concentrated seawater discharge from the desalination plant and could contain additional cycle water discharges. Poseidon will not take water into the desalination plant during heat treatment. Poseidon will meet with AES to gain a better understanding of the frequency and duration of heat treatments. Poseidon will request that AES notify them of any planned heat treatments so that precautions can be taken to avoid taking this recirculated water into the desalination plant. Poseidon will also request that AES notify them of any non-routine operations or discharges to the cooling water system.

Monitoring System

Poseidon will install equipment capable of detecting contaminants that could damage treatment processes in the intake line of the desalination plant as another line of defense in case there are spills at the power plant site that are not detected at the source. When contaminants are detected by the monitoring system, the treatment plant will automatically adjust operations or shut down.

CHAPTER 1
INTRODUCTION

The California Surface Water Treatment Regulation (SWTR) requires public water supply systems using surface water sources to conduct a sanitary survey of the watershed and update the sanitary survey every five years. A sanitary survey involves an evaluation of watershed contaminant sources, source water quality, treatment plant capabilities and treated water quality to assess the ability of a water agency to provide safe drinking water that meets all drinking water standards. A sanitary survey identifies and recommends activities to protect and improve the source water quality. This sanitary survey also satisfies the requirements of the Drinking Water Source Assessment and Protection (DWSAP) Program recently developed by the Department of Health Services (DHS). The DWSAP requires a delineation of the watershed and identification of protection zones, if appropriate, an inventory of contaminant sources, and an analysis of the significance of those sources to drinking water quality at the intake.

BACKGROUND

Poseidon Resources Corporation (Poseidon) plans to construct and operate a reverse osmosis (RO) desalination plant at the AES Huntington Beach L.L.C. Power Plant (Huntington Beach Power Plant) in the City of Huntington Beach. The desalination plant will have the capacity to provide up to 50 million gallons per day (MGD) of drinking water, which will be blended with other supplies and delivered to communities in Orange County. The source of water for the desalination plant will be the discharge from the condenser cooling system at the Huntington Beach Power Plant. The cooling water is seawater drawn into the power plant via an intake structure that is located 2,292 feet offshore in water that is 34 feet deep. The DHS determined that a watershed sanitary survey was needed to investigate potential contaminant sources in the Pacific Ocean in the vicinity of the intake structure and at the power plant site.

OBJECTIVES

This sanitary survey is intended to accomplish the following objectives:

- *Examine and describe contaminant sources which could potentially affect water quality at the proposed RO plant;*
- *Identify activities that should be tracked to protect source water quality;*
- *Determine the appropriate levels of Giardia and virus removal at the water treatment plant;*
- *Fulfill the sanitary survey and DWSAP requirements of DHS.*

REPORT ORGANIZATION

This report is organized in the following manner:

Chapter 1	*Introduction*
Chapter 2	*Watershed and Water Supply System* – This chapter provides an overview of the watershed characteristics and a description of the proposed treatment plant.
Chapter 3	*Potential Contaminant Sources* – This chapter identifies protection zones and describes the contaminant sources in the watershed and assesses the significance of these sources to water quality at the intake of the treatment plant.
Chapter 4	*Water Quality* – Drinking water regulations are discussed and the water quality characteristics of the source water are described. A recommendation is made on the appropriate levels of removal of *Giardia* and viruses based on the water quality data and the characteristics of the watershed.
Chapter 5	*Watershed Management Strategies* – Activities to be tracked by Poseidon are identified in this chapter.
Chapter 6	*Conclusions and Recommendations* – This chapter contains the key findings from this sanitary survey and a list of recommendations.

CHAPTER 2
THE WATERSHED AND WATER SUPPLY SYSTEM

This chapter provides an overview of the characteristics of the watershed and a description of the water treatment plant.

DELINEATION OF THE WATERSHED

For most surface water sources, the watershed is easily defined as the land area draining to the intake. For a seawater source, the watershed is not as easily defined. The source of water to the Orange County Desalination Plant will be cooling water drawn into the AES L.L.C. Huntington Beach Power Plant (Huntington Beach Power Plant) via an intake structure that is located 1,904 feet offshore in the Pacific Ocean. A hydrodynamic modeling study was conducted by oceanographers at Scripps Institution of Oceanography to determine if there are any fresh surface water sources that influence the quality of water at the intake structure (Jenkins and Wasyl, 2002). If a significant amount of fresh water is found at the intake, the watershed for the desalination plant would be defined as the inland drainage areas that discharge in the vicinity of the intake and influence water quality at the intake. Conversely, if there are no freshwater sources detected at the intake, the watershed would be defined as the Pacific Ocean in the vicinity of the intake.

Figure 2-1 shows the general location of the project. Figure 2-2 shows the location of the Huntington Beach Power Plant, the intake structure, and surface water sources in the vicinity of the intake structure that could potentially impact water quality at the intake. As shown on Figure 2-2, the Santa Ana River flows into the ocean approximately 8,300 feet from the Huntington Beach Power Plant intake structure. The Talbert Marsh, which receives urban runoff from the City of Huntington Beach (City) and several other communities, discharges to the ocean about 1,300 feet upcoast from the mouth of the Santa Ana River. The modeling studies examined worse case conditions during storm events for the river and marsh and a worse case spring tide condition when the marsh would receive the greatest tidal flushing. The modeling studies also examined the recirculation of the power plant discharge into the power plant intake and the dispersion of the waste field from the Orange County Sanitation District (OCSD) deep ocean outfall, located 5 miles offshore of the Santa Ana River at a depth of 195 feet. As with the discharges from the river and marsh, worse case scenarios were modeled for the power plant and OCSD discharge. The model results are summarized in this section and discussed in more detail in the final modeling study report (Jenkins and Wasyl, 2002).

Figure 2-1 Regional Location

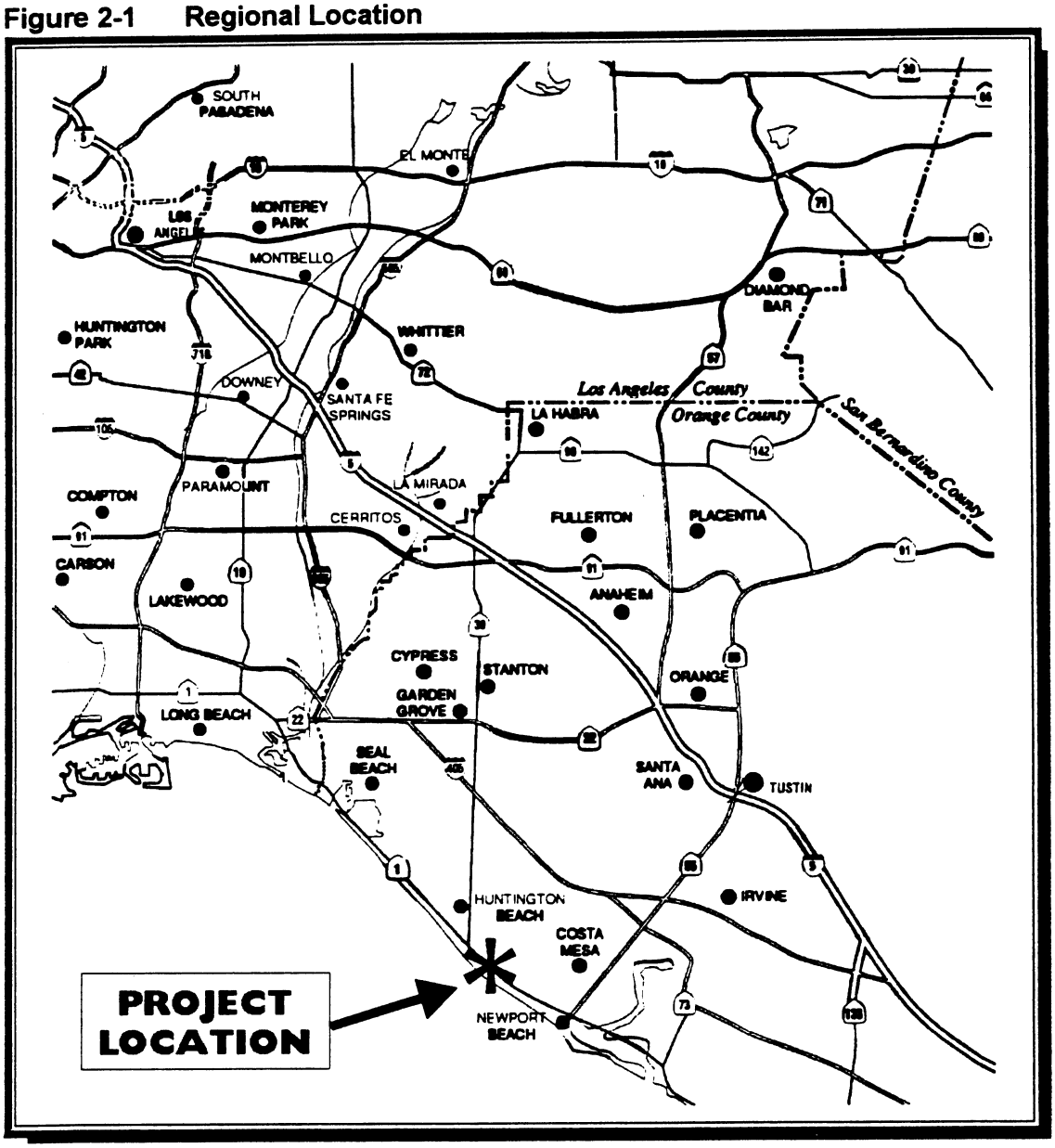
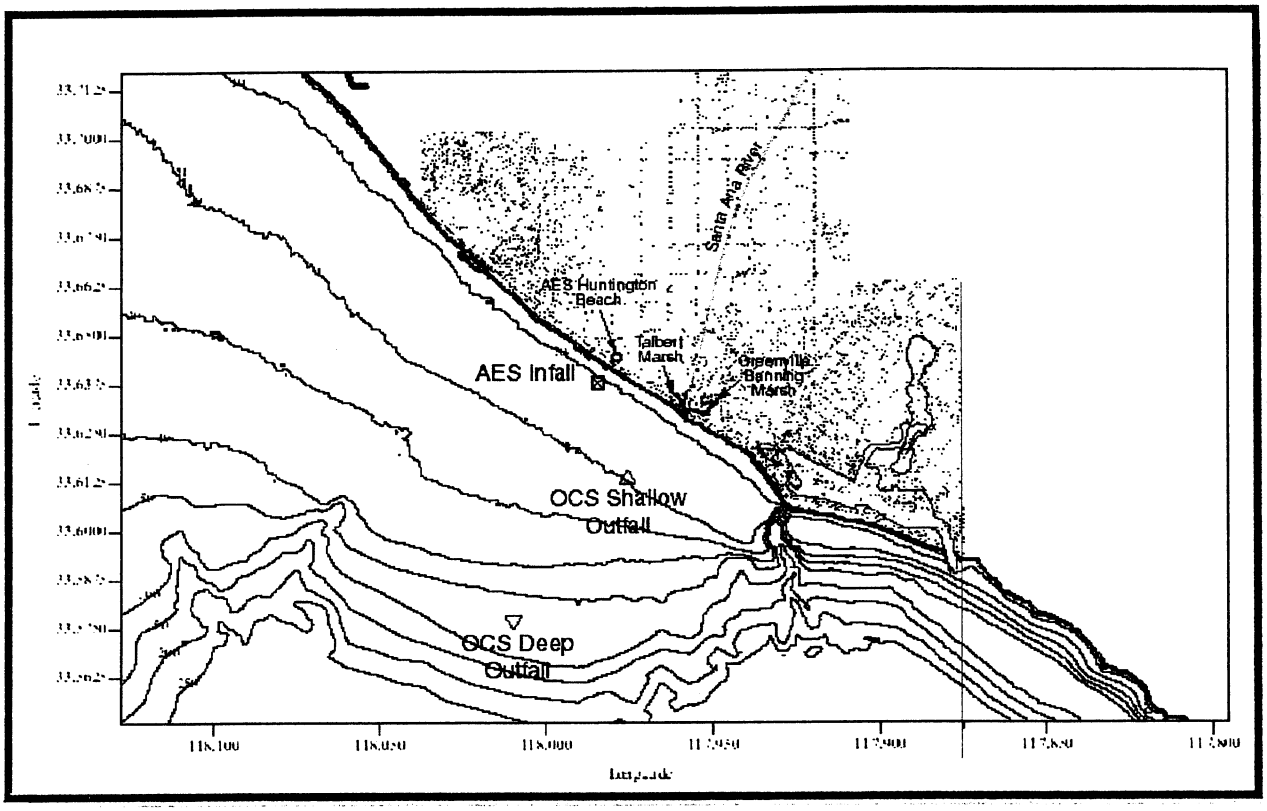


Figure 2-2 Location Map for Source Water Modeling Analysis Due to Fluxes from Farfield Sources



INTAKE STRUCTURE

The configuration of the power plant intake plays a major role in the amount of dilution that occurs at the intake. As stated previously, the intake structure is located 1,904 feet offshore in water that is 34 feet deep based on mean sea level (MSL). Water is drawn through a velocity cap atop a rectangular intake tower located 15.8 feet above the ocean floor and 18.3 feet below the ocean surface. The maximum mean water velocity at the intake is 2.0 feet per second. The water velocity at the ocean surface above the intake velocity cap, based on mean lower-low tide elevation, is nil.

SANTA ANA RIVER AND TALBERT MARSH STORM WATER

The Santa Ana River drains a highly urbanized watershed of 1700 square miles and discharges to the ocean 8,300 feet from the intake to the power plant. The Greenville Banning Marsh is located east of the Santa Ana River and drainage from the marsh flows into the Santa Ana River through a diversion channel. The Huntington Beach and Talbert flood control channels discharge into the Talbert Marsh, which discharges to the ocean approximately 1,300 feet upcoast from the Santa Ana River. Due to naturally occurring conditions in the ocean, the discharges from the river and

marsh generally flow downcoast and away from the power plant intake. In addition, since freshwater is less dense than seawater, the river and marsh discharges float on the surface of the sea. However, there are short-term reversals in the downcoast transport when water from the river and marsh flows upcoast. Under these conditions, storm winds and waves can mix the river and marsh plumes downward into the water column near the shoreline.

Storm water discharges from the Santa Ana River and Talbert Marsh would have the greatest potential to impact water quality at the power plant intake if an extreme storm event coincided with an El Niño winter and maximum pumping of cooling water into the power plant. Although it is unlikely that all of these events would coincide, this was considered to be the worse case scenario for determining if the Santa Ana River and Talbert Marsh contribute freshwater to the power plant intake. El Niño conditions were combined with storm flows from February 1998 and the maximum pumping of 507 million gallons per day (MGD) at the power plant when all four generating units are running.

The model results under worst case conditions are shown on Figure 2-3 and presented in Table 2-1. Source water drawn into the intake during a 24-hour extreme runoff period would be comprised of only 0.0003 percent water from the Santa Ana River and Talbert Marsh and the remaining 99.9997 percent would be seawater. This corresponds to a dilution factor of 316,000:1. The results for a 7-day extreme runoff period and a 30-day extreme runoff period show much greater dilution factors at the intake. Based on these results, the Santa Ana River and Talbert Marsh have been shown to not be sources of supply at the power plant intake during storm events.

Table 2-1 Model Results for Santa Ana River and Talbert Marsh Storm Water

Event	Freshwater at Intake, %	Seawater at Intake, %	Dilution Factor
24-hour Extreme Runoff	0.0003	99.9997	316,000:1
7-day Extreme Runoff	0.0001	99.9999	1,000,000:1
30-day Extreme Runoff	Not detectable	100	10,000,000:1

TALBERT MARSH FLUSHING AT SPRING TIDES

The Talbert Marsh may also be a concern during the dry weather season due to flushing of the marsh during spring tides. During dry summer weather with low waves, the mouth of the Talbert Channel may close intermittently to tidal exchange due to the formation of a sand spit at the mouth of the marsh. This can trap up to 200 million gallons (MG) of urban runoff and seawater in the marsh and lower channel system. When large summer south swells from Mexican hurricanes and southern hemisphere storms overtop the sand spit, the mouth of the Talbert marsh opens and 80 to 100 MG of water may be released into the nearshore waters in a single tidal flush. Because the Talbert Marsh waters are close to seawater salinities in the dry season, the discharge does not float on the sea surface, and may quickly mix into the deeper waters where the power plant intake is located.

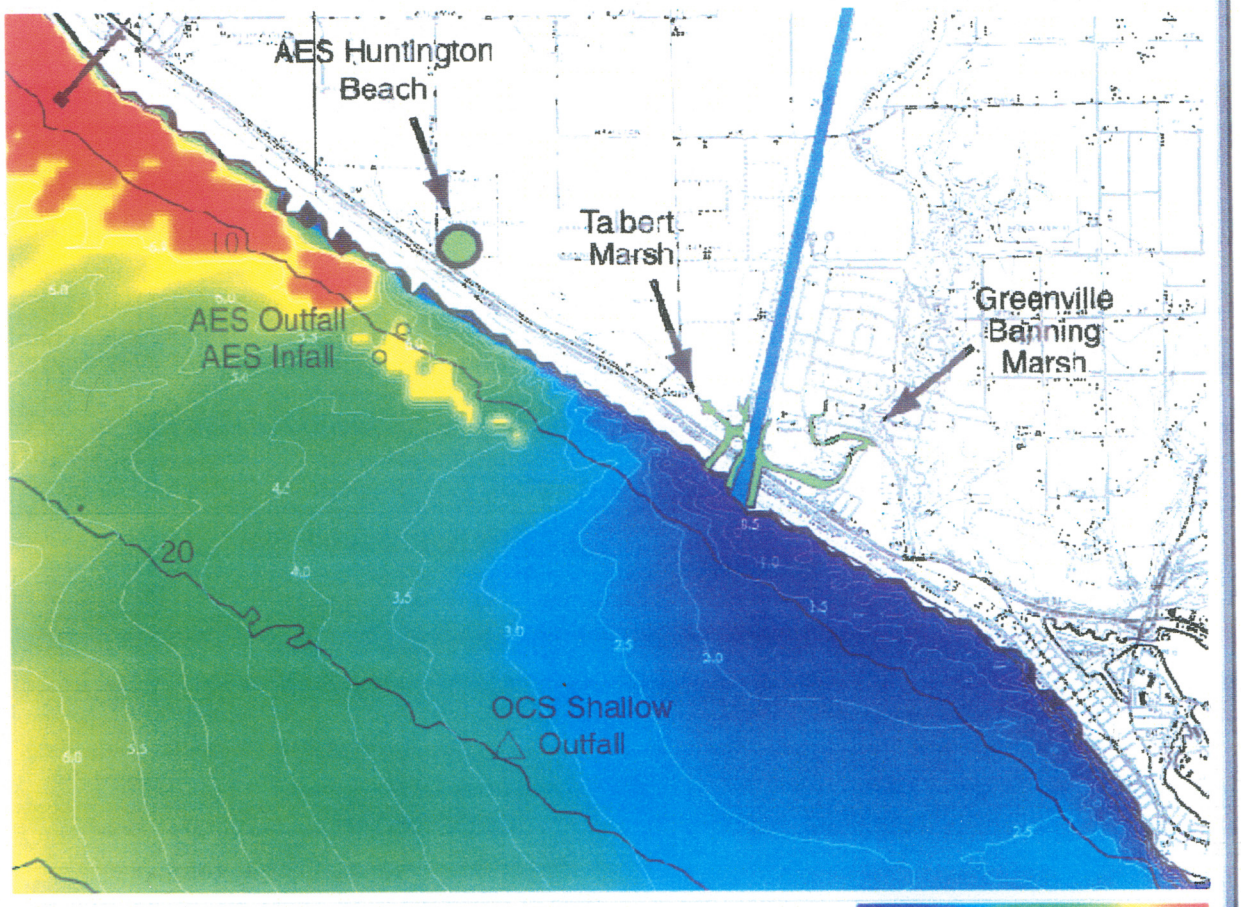


Figure 2.3. Dilution of Santa Ana River / Talbert Channel plume, at depth of velocity cap, (24 hour average), 24 Feb 1998, R.O. - 50 mgd, Plant cooling water-505.9 mgd. (Values default to bottom dilution for depths less than velocity cap.)

Tidal flushing of the Talbert Marsh would have the greatest potential to impact water quality at the power plant intake with summer El Niño conditions when net transport by waves and currents is upcoast toward the power plant intake. The model was run using waves, and current conditions from August 7-10, 1997, and the release of 100 MG from the marsh to represent worse case conditions.

As shown on Figure 2-4, the worse case conditions showed that at the intake, the marsh water was diluted 20,000 to 1. This is due to the fact that the marsh water is released into the surf zone and the onshore waves keep the marsh water in the shallow nearshore waters, whereas the intake is located 1,904 feet offshore in 34 feet of water. The Talbert Marsh is therefore, not a source of water at the intake to the power plant during summer dry weather conditions.

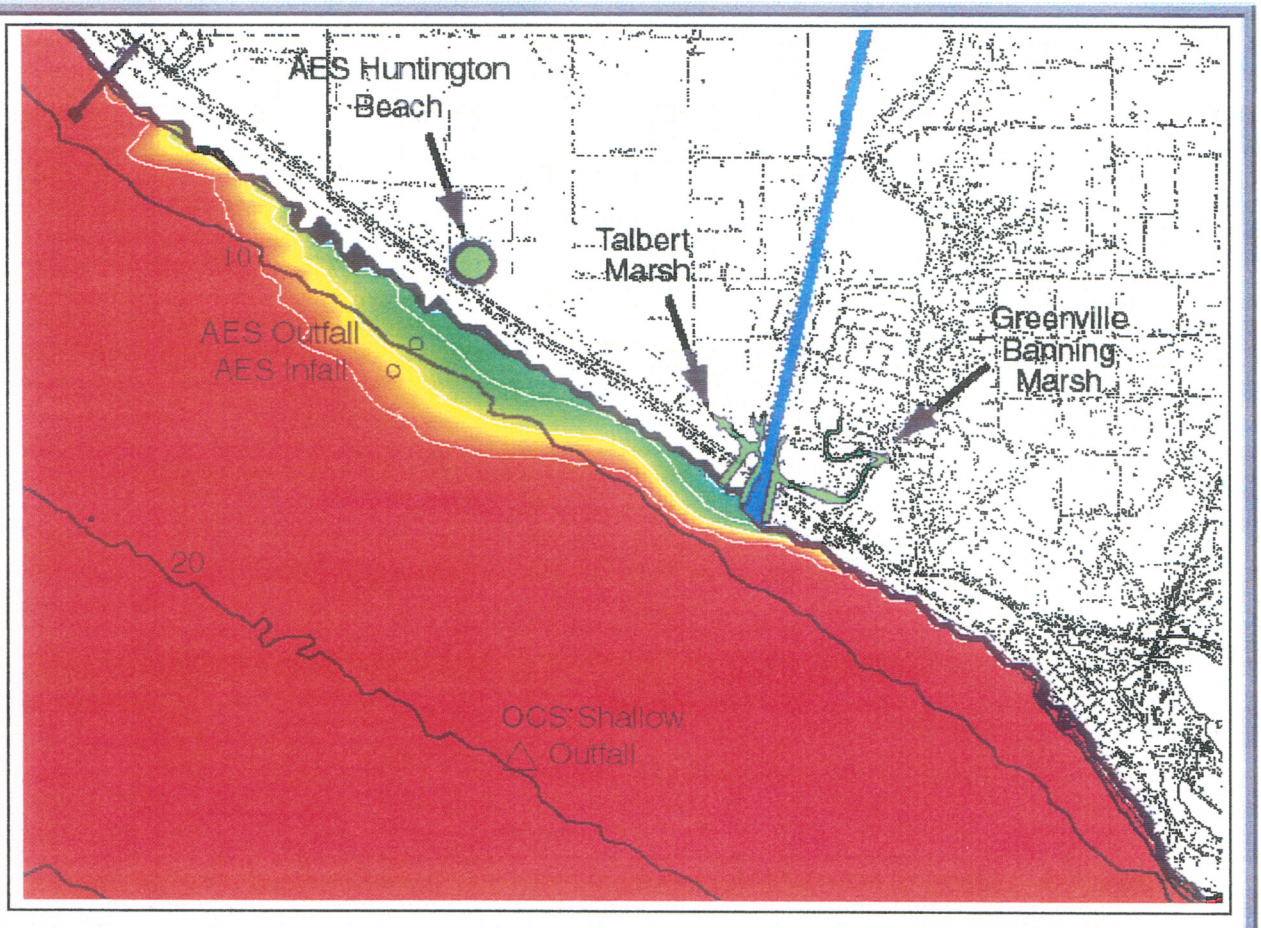
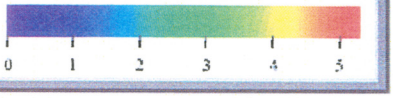


Figure 2.4. Total coliform dilution from Talbert Marsh tidal flush, 9 August 1997, 11:50 PDT.



RECIRCULATION OF POWER PLANT DISCHARGE

The power plant outfall is located 792 feet from the intake so the potential for recirculation of the discharge into the intake was examined. The National Pollutant Discharge Elimination System (NPDES) permit for the power plant allows the plant to discharge up to 516 MGD. The discharge consists largely of cooling water but up to 1.66 MGD of power plant process wastewater and storm water can be mixed with the cooling water and discharged at the outfall. In addition, when the RO plant is operating the concentrated seawater discharge from the plant will be mixed with the cooling water and discharged via the outfall.

Recirculation of the power plant discharge would have the greatest potential to impact water quality at the intake during wet weather conditions when the maximum amount of storm water is being discharged through the outfall. The model was run using the El Niño conditions of February 1998 and the maximum

allowable discharge of 1.66 MGD of power plant process wastewater and storm water. In addition, the RO plant was assumed to be running at full capacity so that 50 MGD of concentrated seawater discharge was mixed with the cooling water discharge. Furthermore, recirculation potential was examined under two generating scenarios: 1) one generating unit on-line with a total discharge of 78.4 MGD of cooling water, storm water and wastewater, and the concentrated seawater discharge and 2) four generating units on-line producing a total discharge of 458.6 MGD of cooling water, storm water and wastewater, and the concentrated seawater discharge.

The model results under worst case conditions are presented in Table 2-2 and on Figures 2-5 and 2-6. The dilution of the power plant discharge at the intake during a 7-day extreme runoff period is 6,300:1 when one generating unit is running. This shows that 0.016 percent of the plant discharge is recirculated to the intake. Under this generation scenario, the power plant storm water and wastewater discharge represents 2.1 percent of the total plant discharge. Therefore, only 0.0003 percent of the stormwater and wastewater is recirculated at the intake. Likewise, only 0.01 percent of the concentrated seawater discharge is recirculated at the intake. The results for four generating units show a much greater dilution factor at the intake (32,000:1) Based on these results, the recirculation of the power plant discharge during storm events has been shown to be an insignificant source of water at the intake.

Table 2-2 Model Results of Recirculation Study

Description	One Generating Unit	Four Generating Units
Dilution Factor	6,300:1	32,000:1
Recirculation of Cooling Water, %	0.005	0.0027
Recirculation of Storm Water and Wastewater, %	0.0003	0.00001
Recirculation of Concentrated Seawater, %	0.01	0.0003
Total Recirculation, %	0.016	0.003

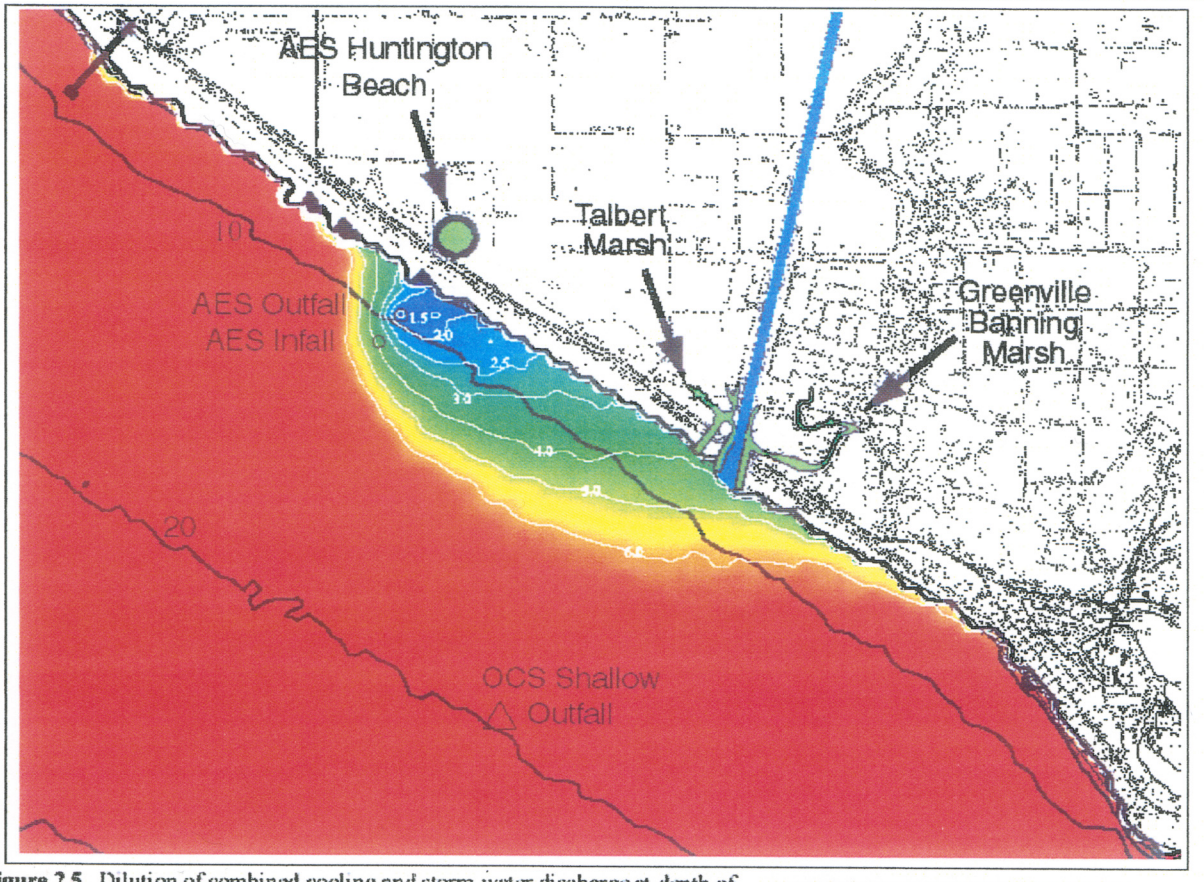


Figure 2.5. Dilution of combined cooling and storm water discharge at depth of velocity cap: R.O. = 50 mgd, cooling water= 126.7 mgd, storm water = 1.66 mgd (7 day ave). Values default to bottom dilution for depths greater than velocity cap.

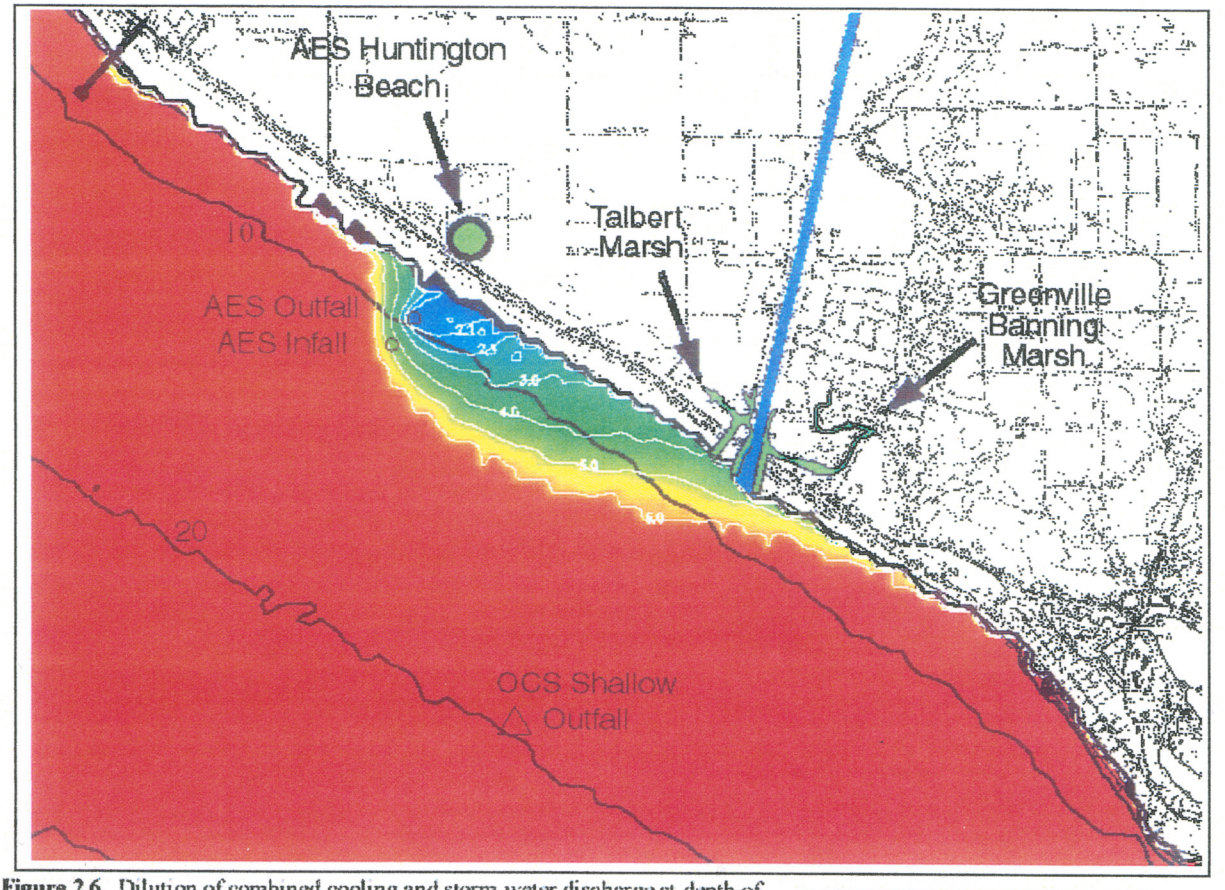


Figure 2.6. Dilution of combined cooling and storm water discharge at depth of velocity cap: R.O. = 50 mgd, cooling water = 506.9 mgd, storm water = 1.66 mgd (7 day ave). Values default to bottom dilution for depths greater than velocity cap.

ORANGE COUNTY SANITATION DISTRICT WASTEWATER DISCHARGE

The OCSD discharges 243 MGD of wastewater at an outfall that is located 5 miles offshore at a depth of 195 feet. All wastewater receives primary treatment and 50 percent of the wastewater also undergoes secondary treatment prior to discharge. OCSD also has an emergency outfall that is closer to shore but it has not been used since construction of the deep outfall. It has been hypothesized that the discharge from the outfall flows upcoast and toward the power plant intake and is responsible for the high bacterial densities at Huntington State Beach that have resulted in frequent beach closures during summer months. If this is the case, the wastewater discharge could potentially impact water quality at the power plant intake, which is located offshore from the beach area that has historically had the highest coliform densities.

Under normal oceanographic conditions, the power plant intake and OCSD discharge are segregated in two different water masses by ocean thermal stratification, with no appreciable exchange between those water masses. Furthermore, currents generally flow downcoast from the OCSD outfall. The OCSD wastewater discharge would have the greatest potential to impact water quality at the power plant intake with summer El Niño conditions when net transport by waves and currents is upcoast toward the power plant intake. In addition, to model worse case conditions, it was assumed that OCSD was discharging at its maximum allowable rate of 480 MGD and a shallow thermocline exists so that the power plant intake is below the thermocline and in the same water mass as the OCSD discharge. It should be noted that the simultaneous occurrence of these atypical conditions is extremely rare (once in every 9 to 49 years) because they tend to be mutually exclusive, i.e., the upcoast flow occurs during the summer months and the maximum discharge of wastewater occurs in the winter months. In addition, it was assumed that the power plant was operating at its maximum flow rate of 507 MGD.

The worse case model results show that the OCSD discharge is diluted 30 million to 1 at the power plant intake, as shown on Figure 2-7. Since the OCSD discharge contains exceedingly high coliform densities (1 million MPN/100 mL to 100 million MPN/100 mL), the dilution of coliform bacteria was examined under worse case model conditions. In addition to the worse case physical conditions described earlier, it was assumed that there would be no die-off of coliform bacteria in the ocean. Using the value of 100 million MPN/100 mL in the discharge, the total coliform bacteria from the wastewater discharge would be in the range of 1 to 3 MPN/100 mL at the power plant intake. These levels would be indistinguishable from the ambient background levels in the ocean and are therefore neither significant nor detectable. Furthermore, this condition would only persist for half of a tidal cycle (6 hours and 12.5 minutes) because with the ebb tide the flow would be reversed and away from the power plant intake. Based on these worse case conditions, it was determined that the OCSD discharge is not a source of water to the power plant intake.

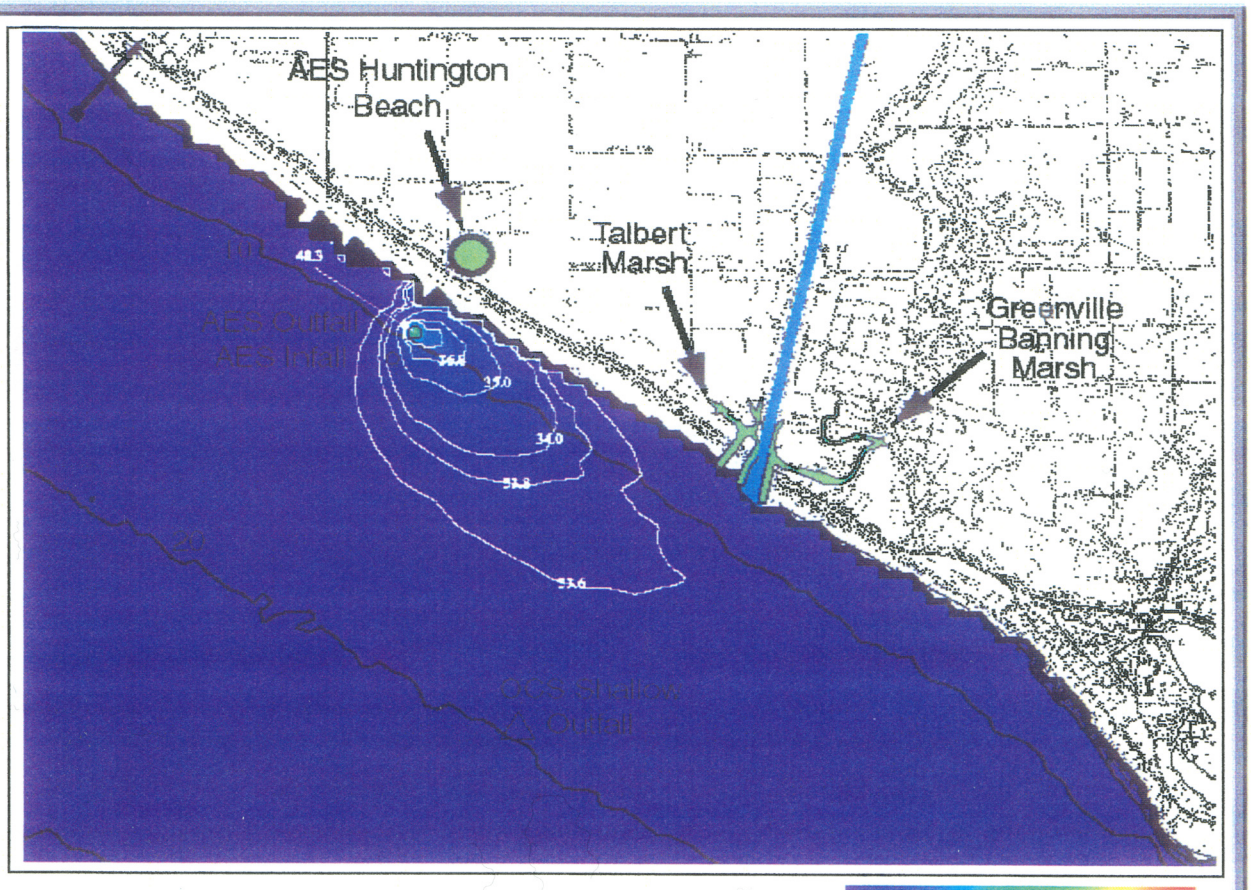


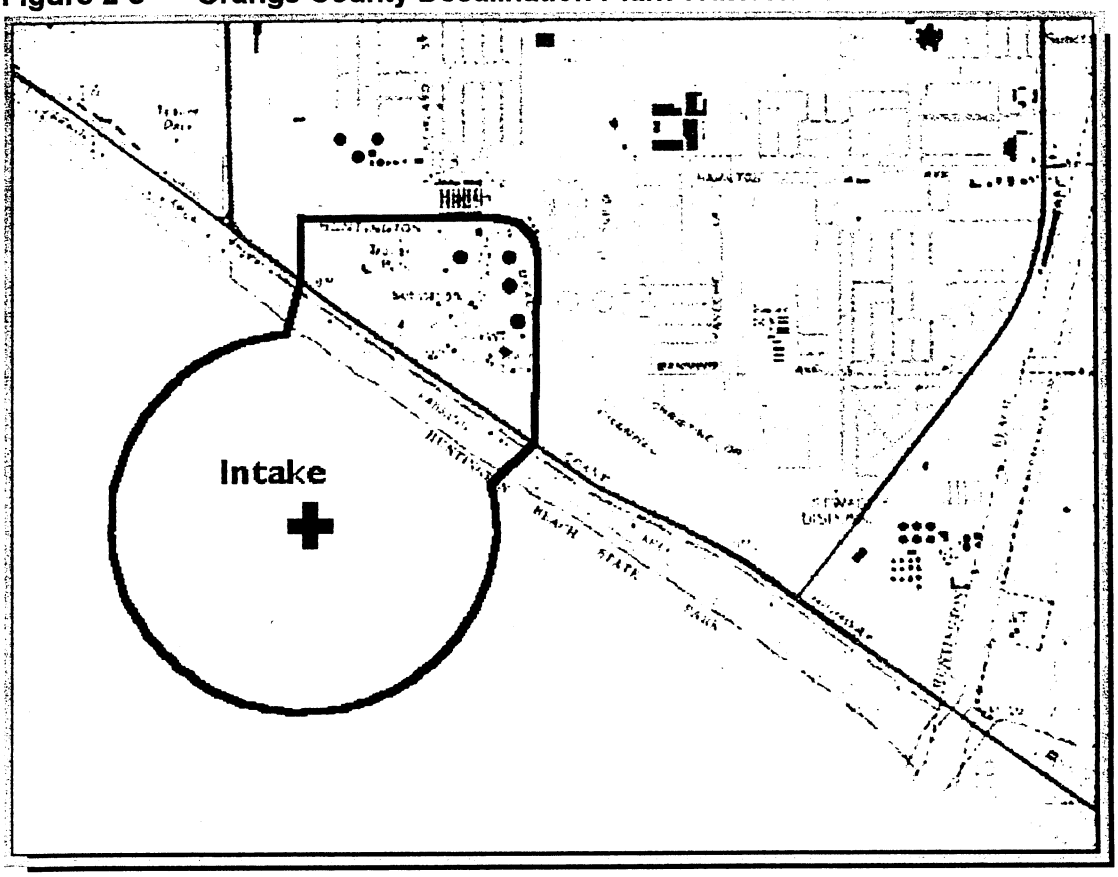
Figure 2.7. 30 day average of salinity on sea bottom for concentrated sea water from: R.O. = 50 mgd. Plant Flow Rate = 126.7 mgd, summer conditions.

WATERSHED BOUNDARIES

The model results have shown that even under a variety of worst-case conditions, the source of water at the power plant intake is seawater. The Santa Ana River, the Talbert Marsh, recirculation of the power plant discharge, and the OCSD wastewater discharge have all been shown to have no effect on the water quality of the power plant intake.

Based on the modeling results and the guidance provided by the California Department of Health Services (DHS) Guidance Document on the California Drinking Water Source Assessment and Protection Program (DWSAP), the watershed for the Orange County Desalination Plant has been defined as the Pacific Ocean within a circle with a radius of 2500 feet centered on the intake line for the power plant. The terrestrial portion of the watershed consists of the power plant site, the land that drains to the power plant site, and the land that is between the power plant and the ocean. The watershed is shown on Figure 2-8.

Figure 2-8 Orange County Desalination Plant Watershed



In addition to the modeling results, several factors were considered in determining the watershed boundaries for the desalination plant.

- *The power plant intake is located 1,904 feet off shore in water that is 34 feet deep. Due to tidal action there is significant flushing of the area near the intake twice a day.*
- *Storm drainage from the City is routed around the power plant site in the Huntington Beach flood control channel and is discharged approximately 1.75 miles down coast from the intake via the Talbert Marsh so there are no discharges of urban runoff to the ocean in the vicinity of the intake.*
- *Drainage from approximately 70 acres of land near the power plant site is piped into the site and is released to the power plant discharge vault.*
- *There are some discharges of process water to the cooling water at the power plant site so the site itself is an important part of the watershed and a potential source of contaminants.*

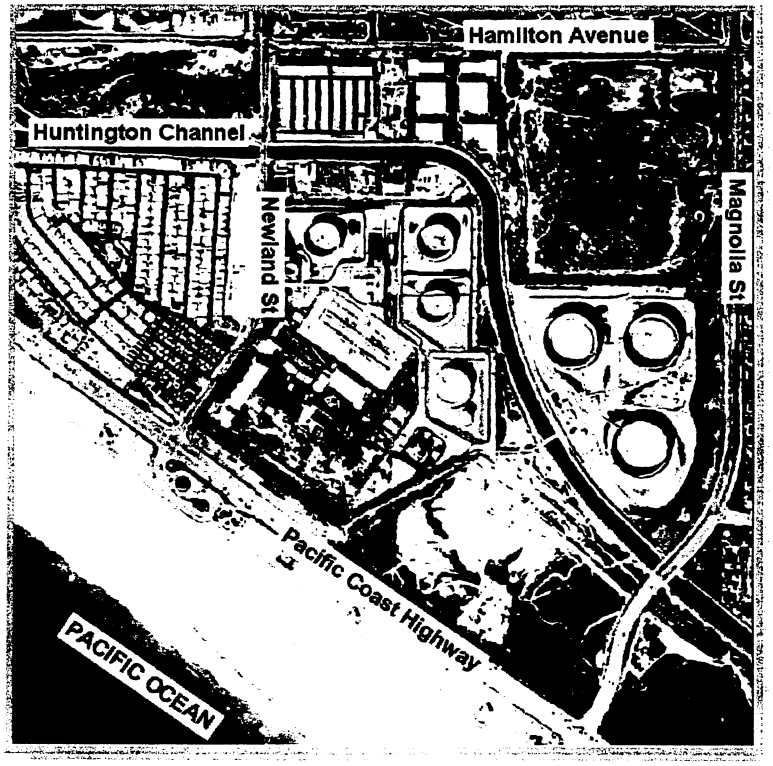
WATERSHED DESCRIPTION

The watershed for the Orange County Desalination Plant consists of 430 acres of the Pacific Ocean near the power plant intake and 150 acres of land that consists of the power plant site and the land that drains to the power plant. The primary uses of the land portion of the watershed are the power plant, a mobile home and recreational vehicle park to the west, a wildlife center to the south, and a small commercial area to the north that is bordered by the Huntington Beach flood control channel. Pacific Coast Highway traverses the watershed and separates Huntington State Beach from the remainder of the land portion of the watershed.

THE WATER SUPPLY SYSTEM AND TREATMENT PLANT

Poseidon plans to construct and operate a reverse osmosis (RO) desalination facility with the capacity to provide up to 50 MGD of drinking water to customers in Orange County. The desalted water will be blended with other drinking water sources prior to delivery to customers. The treatment plant will be located in the southeast portion of the City at the Huntington Beach Power Plant. The power plant is currently owned by AES and was formerly owned by Southern California Edison. Existing site facilities (a small storage tank and an industrial building will be removed to accommodate the desalination plant. The project site is shown on Figure 2-9.

Figure 2-9 Project Site



SOURCE WATER

The Pacific Ocean will be the source of water to the desalination plant. Water from the power plant intake line flows into an intake well at the power plant site. The water flows through trash racks to remove debris and then through removable mechanical screens to remove solids. Biological growth within the cooling system is controlled by intermittently injecting chlorine (in the form of sodium hypochlorite), for 30 minutes twice a day at each circulating water pump. The cooling water is pumped through the condensers serving each of the four generating units to cool and condense spent steam for recirculation as boiler feed water. The water then flows into the discharge vault and then to the outfall line that discharges to the Pacific Ocean. As proposed, approximately 100 MGD of the heated water leaving the condensers will be diverted to the desalination plant rather than the outfall structure. The intake to the desalination plant will be located near the beginning of the outfall line just downstream from the discharge vault. A new pipeline will be constructed to deliver water from the outfall line to the desalination plant.

TREATMENT PROCESS

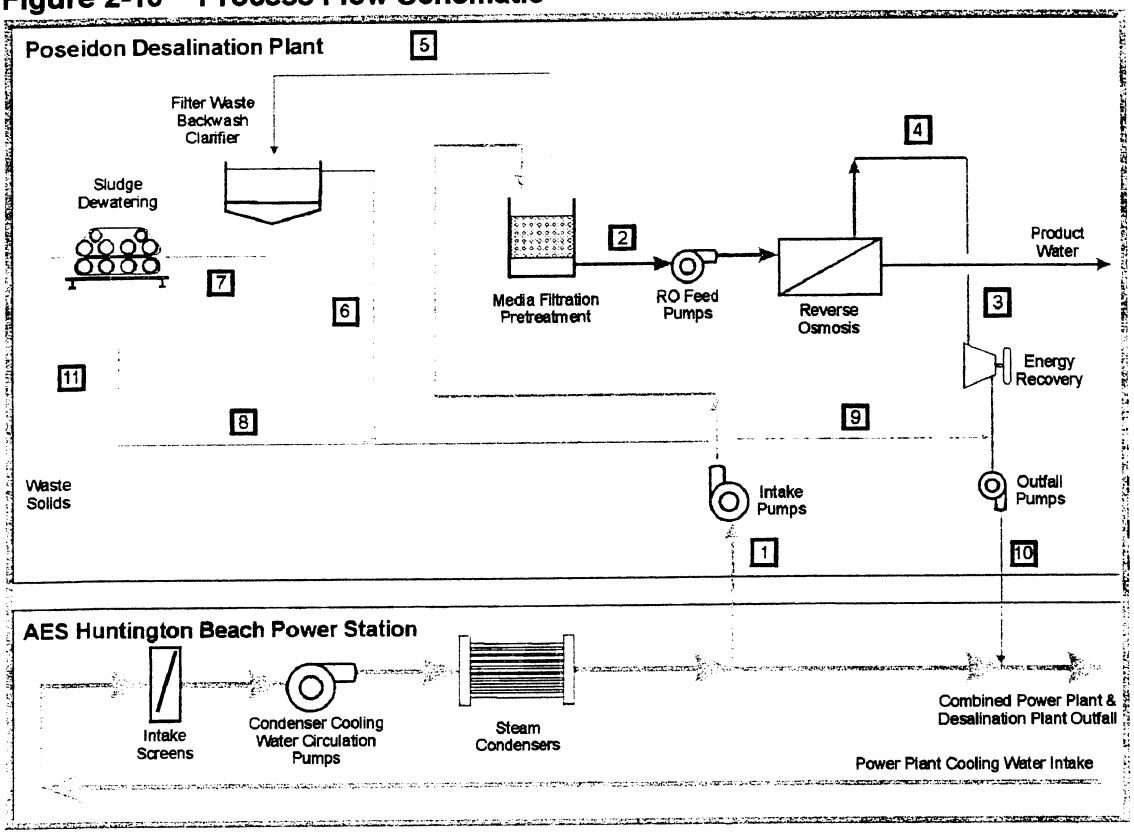
Approximately 100 MGD of seawater will be drawn from the cooling water discharge and conveyed to the desalination plant to produce 50 MGD of drinking water. The quantity will vary slightly throughout the year depending on the total dissolved solids concentrations in the cooling water. Figure 2-10 provides a schematic diagram of the proposed treatment process.

Pretreatment

The seawater will first be treated to remove solids and free chlorine, which could foul or physically damage the RO membranes. Pretreatment for removal of suspended solids and biological fouling debris will be accomplished with single-stage direct granular media filtration. Coagulants, such as ferric sulfate or ferric chloride and polymers, will be added as needed to enhance the operation of the filters and to provide the required quality of water to the RO process. The final phase of pretreatment will be cartridge filtration. The filter cartridges will be standard 5-micron polypropylene filters enclosed in a pressure vessel. The pressure vessels will be located in the RO feed water piping between the pretreatment and RO processes.

The pretreatment filters will be backwashed to remove the solids that accumulate in the media beds. The filter backwash water will be combined with the concentrated seawater byproduct of the RO process and discharged to the power plant outfall line. Backwash water may be treated prior to discharge if needed to comply with the desalination plant's NPDES permit.

Figure 2-10 Process Flow Schematic



Dechlorination

The power plant chlorinates the cooling water for a short period of time each day and the desalination plant intake water will be chlorinated on an as-needed-basis to minimize microbiological growth on the filter media. The filter effluent will be dechlorinated using sodium bisulfite to prevent damage to the RO membranes.

pH Adjustment

The RO feed water will be treated with sulfuric acid to reduce the potential for scale formation in the RO process. The amount of acid added to the water will be determined based on the bicarbonate concentration of the seawater and Stiff Davis Index in the RO concentrate. The acid addition also results in the generation of carbon dioxide in the RO permeate which is needed to react with the lime for product water stabilization in the post-treatment step.

RO Process

The RO process will be a single-pass design using high-rejection seawater membranes. The system will consist of 13 process trains, each train with a design capacity of about 4 MGD. This arrangement provides approximately 4 percent standby capacity, which is needed to ensure continuous water delivery with normal

membrane wear and maintenance requirements. Each process train will consist of 170 to 225 membrane pressure vessels which will each contain six to eight RO elements. A decision has not been made on the specific membranes that will be installed in the desalination plant. The membranes will be required to meet strict specifications regarding membrane materials, workmanship, design, and other properties affecting virus rejection. The membranes will be required to reject 99.6 percent of the salt in the feed water to produce finished water with a TDS concentration of 250 to 350 mg/L. Several manufacturers, including Hyrdraunautics, Filntech/Dow, Koch/Fluid Systems, and Toray, produce membranes that meet these specifications.

High pressure, electrically driven, feed pumps will pump water from the intake filters through the RO membranes. The pumps will provide feed pressures ranging from 800 to 1,200 pounds per square inch (psi). The actual feed water pressure depends upon several factors including temperature of the intake water, salinity of the intake water, and the age of the membranes. The pumps will be equipped with variable frequency drives to improve energy efficiency and to provide pressure control over a wide range of feed water quality and membrane conditions. To further improve energy efficiency, the high-pressure pumps will be equipped with energy recovery devices that will reduce the net energy demand for the system.

During the desalting operation, water molecules are forced through the RO membranes. Less than one percent of the TDS will pass through the membranes. The TDS objective for the product water is 250 to 350 mg/L. The water and TDS that do not pass through the RO membranes will be discharged to the power plant cooling water outfall, downstream of the intake to the desalination plant. For the proposed 50 MGD plant, approximately 50 MGD of concentrated seawater will be generated.

Chemical Conditioning

Product water from the RO process requires chemical conditioning prior to delivery to the distribution system to increase hardness and reduce corrosion potential. Lime will be used for post-treatment stabilization of the water.

Disinfection

The final product water will be disinfected prior to delivery to the distribution system. Chlorine, in the form of sodium hypochlorite, will be added as a disinfectant to meet the DHS requirements for potable water disinfection and to control biological growth in the transmission pipeline between the desalination plant and the receiving reservoirs in the distribution system.

Distribution

The desalted water will be blended with other supplies and distributed to customers in Orange County. The specific distribution system has not yet been identified. The plant is expected to operate more than 90 percent of the time.

CHAPTER 3
POTENTIAL CONTAMINANT SOURCES

Field and literature surveys were conducted to investigate potential sources of contamination to the Orange County Desalination Plant raw water supply. The survey examined both general land use and specific facilities in the watershed with the potential for adversely affecting surface water quality. A description of the survey methods and survey findings is presented in this chapter.

SURVEY METHODS

Information relating to potential and existing contaminant sources was obtained from a driving/walking survey of the watershed, a walking survey of the AES Huntington Beach L.L.C. Power Plant (Huntington Beach Power Plant) site, a review of literature, telephone interviews, and meetings with agency staff. Prior to conducting the field survey, U.S. Geological Survey (USGS) topographical maps and the storm drainage system diagram were obtained and the watershed boundary was delineated based on storm drainage patterns and discussions with power plant staff on the drainage entering the power plant site. The driving survey covered the entire terrestrial portion of the watershed. The power plant site was visited on several occasions. Approximately half a day was spent walking the power plant site and inspecting the area near the intake well. Numerous documents were reviewed and staff from many local and state agencies were contacted for information. The references at the end of this report provide a list of the documents that were used and agency staff who were contacted.

PROTECTION ZONES

The California Department of Health Services (DHS) Guidance Document on the California Drinking Water Source Assessment and Protection Program (DWSAP) allows for the delineation of protection zones close to an intake location within a watershed (DHS, 2000a). The purpose of identifying protection zones is to define areas within the watershed where activities have a higher risk of contaminating the water supply and, where watershed management activities should be concentrated. The DWSAP provides various methods for determining protection zones and allows water suppliers to suggest zones that are appropriate for their individual circumstances. Since this is not a typical surface water intake, the watershed boundaries are not clearly defined. Several factors were considered in determining the watershed boundaries and appropriate protection zones for the desalination plant.

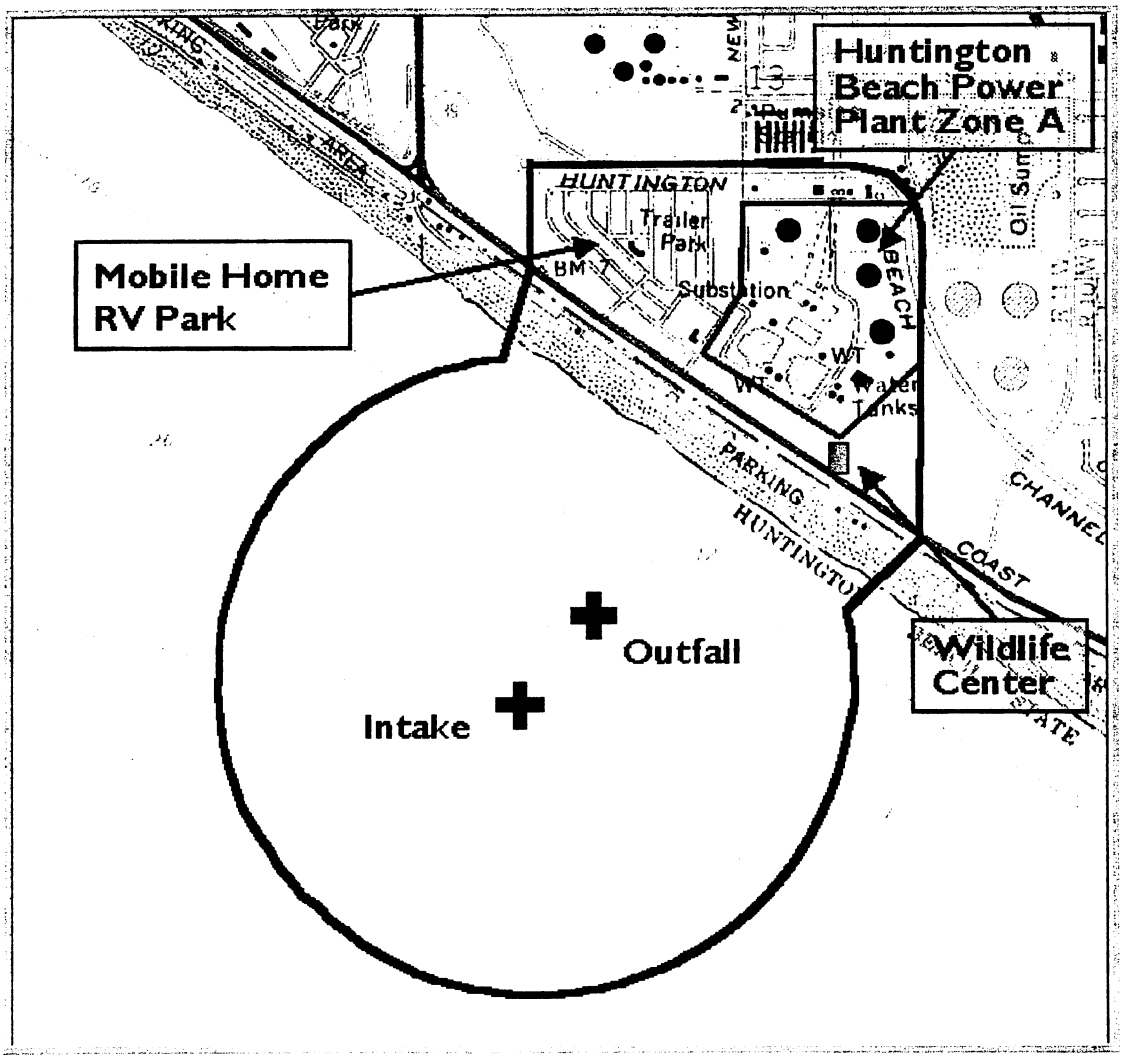
- *The source water for the Orange County Desalination Project proposed by Poseidon Resources Corporation (Poseidon) will be cooling water from the condensers of the*

Huntington Beach Power Plant. The intake for the power plant is located in the Pacific Ocean 2,292 feet from the shore in 34 feet of water.

- *Storm water and process wastewater from the power plant site are discharged to the cooling water system and then to the ocean via an outfall structure that is located 700 feet shoreward from the intake structure.*
- *Storm drainage from the City of Huntington Beach (City) is routed around the generating station site in the Huntington Beach Flood Control Channel and is discharged approximately 1.75 miles downcoast from the intake via the Talbert Marsh.*

The watershed and protection zones for the desalination plant are shown on Figure 3-1 and have been delineated as follows:

Figure 3-1 Orange County Desalination Plant Watershed and Protection Zone



Watershed *The watershed has been defined as the Pacific Ocean within a circle with a radius of 2,500 feet centered on the intake for the power plant. The rationale for this approach is taken from the DWSAP Guidance that suggests that a 2,500-foot zone around a lake intake is appropriate. The watershed also includes all land that drains to this portion of the Pacific Ocean. The land portion of the watershed consists of the power plant site and the land that is between the power plant site and the ocean. It also includes the area that drains to a storm drain that enters the power plant and is discharged to the power plant outfall. The storm drainage will be rerouted during construction of the desalination plant so that it is discharged downstream of the intake to the desalination plant. Land use in the watershed consists of the power plant, a trailer/recreational vehicle park, a Wildlife Care Center, and a small commercial area.*

Zone A *This is the zone that has the most potential to impact water quality at the intake of the desalination plant. It has been defined as the power plant site because activities at the power plant and discharges to the cooling water system upstream of the desalination plant intake have the most potential to impact water quality at the desalination plant. Spills in this area would have to be identified quickly and prompt action would be needed to prevent contamination of the water supply.*

POTENTIAL CONTAMINANT SOURCES

Information on potential contaminant sources in the watershed is presented in this section. A general description of the source, information on water quality contaminants that could potentially impact the water quality at the desalination plant intake, and an assessment of the significance of the contaminant source and the vulnerability of the water supply to each source is presented. Due to the nature of the watershed, there are no contaminant sources associated with agricultural activities, mines, logging, or geologic hazards. There are also no hazardous waste or solid waste disposal facilities in the watershed.

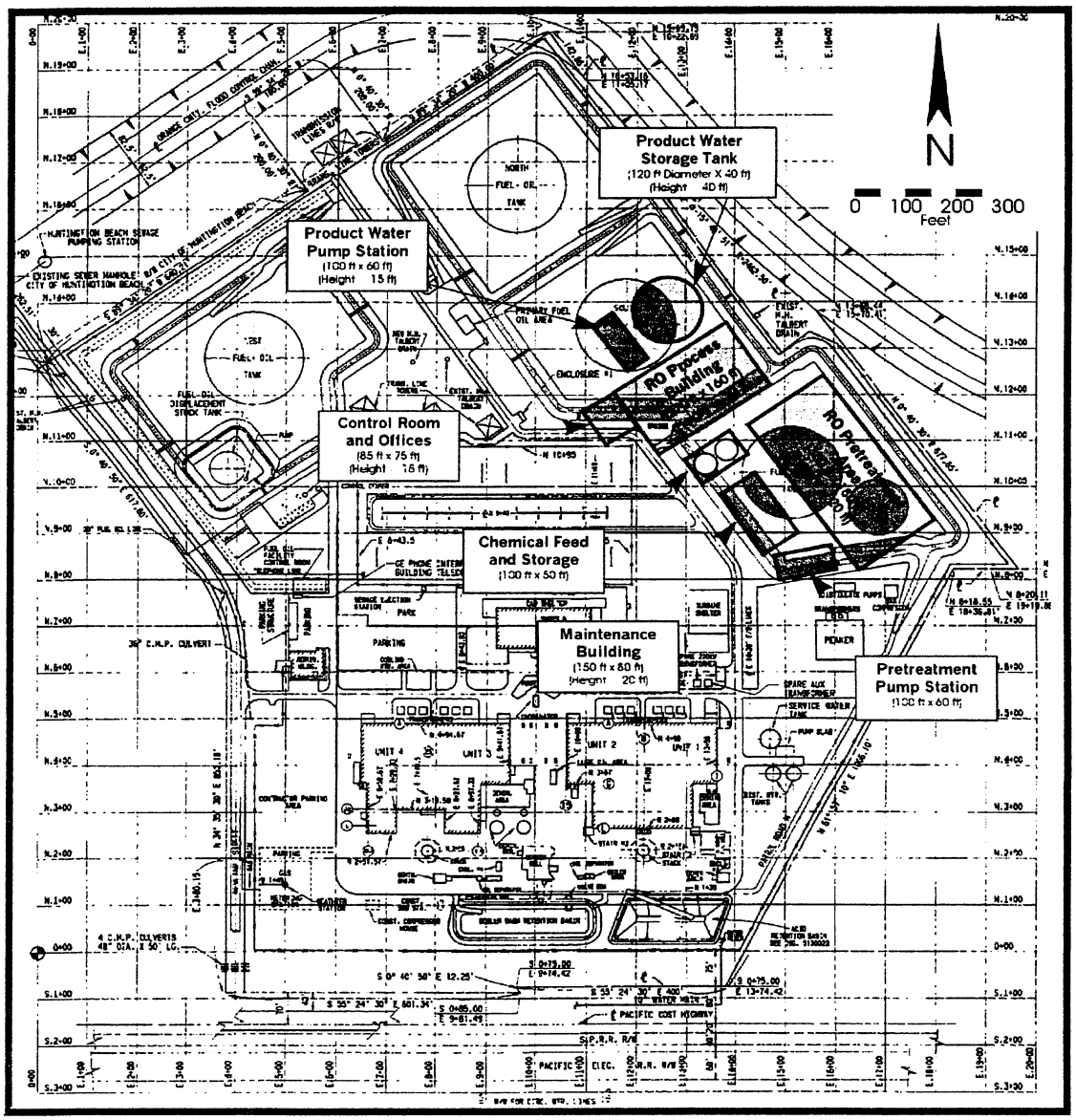
HUNTINGTON BEACH POWER PLANT ACTIVITIES

Description

The desalination plant will be located on the site of the Huntington Beach Power Plant and will derive its intake water from the plant's cooling water system. The power plant site is therefore a potential source of contaminants to the raw water that will be pumped into the desalination plant. The information in this section was obtained from several site visits to the power plant; conversations with plant staff; the Spill Prevention Control and Countermeasure (SPCC) Plan (SCE, 1998); the Hazardous Materials/Waste Management & Contingency Plan (AES, 1998); the National Pollutant Discharge Elimination System (NPDES) permit for the power plant, and a memorandum prepared by AES.

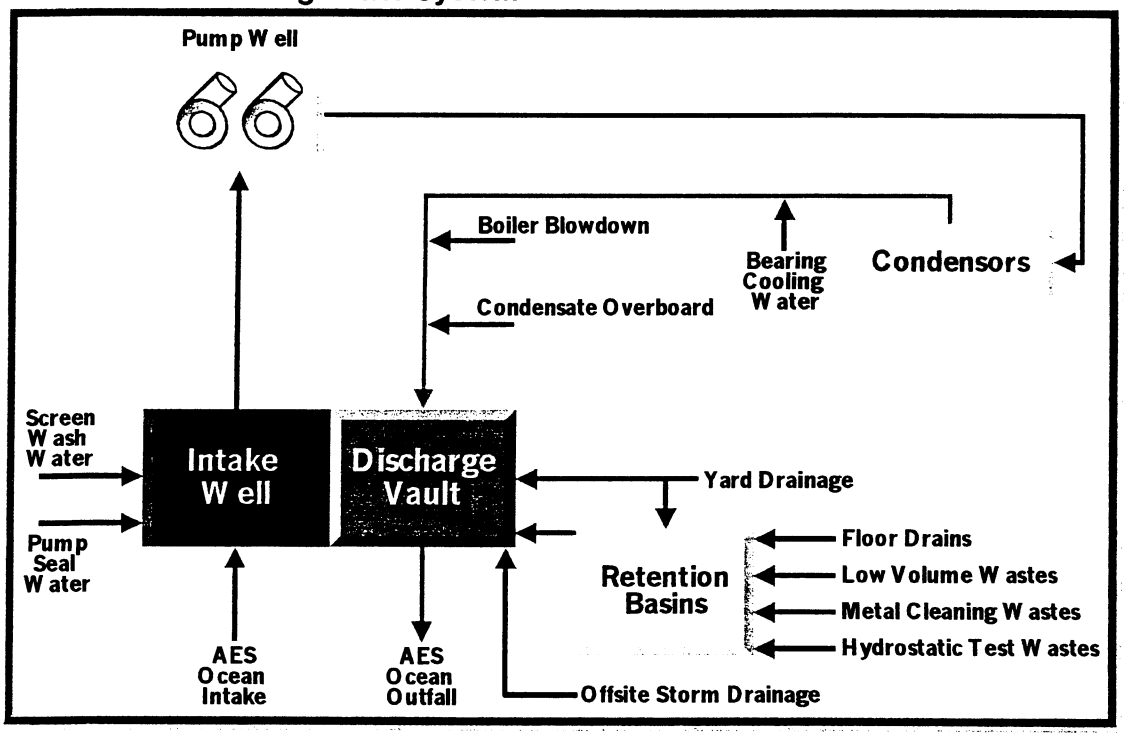
The power plant site is shown on Figure 3-2. AES owns and operates the generating units and all associated equipment. Southern California Edison (SCE) owns and operates the substation and the fuel oil tanks. Electric power is currently generated from natural gas at two steam generating units (Units 1 and 2) and one gas turbine peaking unit (Unit 5). Two additional steam generating units (Units 3 and 4) are currently being refurbished and will be brought back into service in the fall of 2001. Units 1 and 2 have a total generating capacity of 430 megawatts (MW) and Units 3 and 4 will have a capacity of 450 MW when they are brought back online. Unit 5 has a generating capacity of 133 MW.

Figure 3-2 Power Plant Site Layout and Conceptual Site Layout of Desalination Plant



The intake water to the desalination plant will be cooling water taken after the water has flowed through the condensers of the power plant. Potential sources of contaminants at the power plant site include cycle water, storm water, and wastewater that is mixed with the cooling water, and on-site spills of sufficient magnitude to enter the floor drainage system or yard storm drainage system. The power plant operates under a NPDES permit issued by the California Regional Water Quality Control Board, Santa Ana Region (Regional Board). Figure 3-3 is a schematic showing the locations where various waste streams enter the cooling water system.

Figure 3-3 Discharges to the Huntington Beach Power Plant Cooling Water System



Description of Cooling Water System

Pacific Ocean water is drawn into the power plant via an intake structure located 2,292 feet offshore where the water depth is 34.1 feet. Water is drawn through a velocity cap atop a rectangular intake tower that is 15.8 feet above the ocean floor. Water flows through a 14-foot diameter concrete pipeline to the power plant. The ocean intake pipeline enters a 13-foot by 50-foot open intake well. The water flows through trash racks to remove debris and then through removable mechanical screens to remove solids. When the water leaves the intake well it flows in a 14-foot by 11-foot box conduit to the underground pump well. There are eight pumps, four serving Units 1 & 2 and four that will serve Units 3 & 4 in the near future. Each pump supplies cooling water to one half of a divided water

box condenser via a 54-inch diameter pipeline. The return lines from each condenser half join to form a common underground line that ultimately connects with the combined return from the condenser halves of the sister unit. The water then flows into the discharge vault. From the discharge vault, the water is discharged to the ocean through a 14-foot diameter concrete pipe and outfall structure that is similar to the intake structure except that it does not have a velocity cap. The outfall is located 1500 feet offshore, where the water depth is 27.9 feet. The outfall is 792 feet from the intake structure. The volume of cooling water ranges from 127 to 507 million gallons per day (MGD), depending upon the number of units generating power. The total transit time from intake to discharge is 21.5 minutes.

Cycle Water Discharges

Cycle water is discharged to the cooling water system at various locations as the cooling water flows through the power plant. The cycle water is under vacuum so the cooling water leaks into the cycle water but the cycle water does not leak into the cooling water. There are several locations where cycle water is discharged into the cooling water system. Each of these is described in this section.

Screen Wash Water

Water entering the intake well flows through trash racks and traveling screens to remove debris. Once a week, approximately 4,000 gallons of boiler blowdown water is used to wash the screens and remove fouling organisms. This process lowers the total dissolved solids (TDS) concentration of the surface water in the intake well without introducing significant contaminants into the system.

Pump Seal Water

There are a few drains that discharge pump seal water into the intake well. The volume of water from the pump seals is a couple of gallons per minute and is insignificant compared to the volume of cooling water that flows through the intake well.

Boiler Blowdown Water

Intermittent blowdown of boiler water minimizes the concentration of dissolved solids in the boiler water and the steam. Blowdown is occasionally necessary during normal operation and when condenser tube leaks occur. Start-up and shutdown of the boilers also requires that they be blowndown. A typical boiler blowdown consists of 9,400 gallons of water. The NPDES permit allows an average daily discharge of 20,000 gallons of boiler blowdown water.

Bearing Cooling Water Heat Exchangers

Bearing cooling water for all five units is discharged into the cooling water system downstream of the condensers. The bearing cooling water exchangers are new and there are currently no leaks to the cooling water system. They have the potential for developing leaks of several thousand gallons per day into the cooling water system as they age.

Condensate Overboard *When a generating unit is started-up, cycle water is flushed through the condenser and "overboarded" to the cooling water system. This generally occurs about once per month and up to 25,000 gallons of water can be discharged to the cooling water system. Under normal operating conditions there is no condensate overboard discharge.*

Table 3-1 presents a summary of the discharges to the cooling water system that will be upstream of the intake to the desalination plant. The contaminants in the condenser overboard and the boiler blowdown discharges will be diluted by the cooling water and will be easily removed through the pretreatment process and the reverse osmosis (RO) membranes at the desalination plant. Although the bearing cooling water exchangers do not currently leak, there is the potential for leakage in the future as they age. The only contaminant of concern is nitrite. The other chemicals in the bearing cooling water are not toxic to humans. Because the volume of bearing cooling water represents a maximum of 0.002 percent of the cooling water flowing through one unit, the contaminants in the bearing cooling water will be greatly diluted in the unit's cooling water system. A nitrite concentration of 800 mg/L would be diluted to about 0.02 mg/L in the cooling water that would reach the desalination plant. This level of nitrite will easily be removed by the RO membranes.

Table 3-1 Cycle Water Discharges to the Huntington Beach Power Plant Cooling Water System

Discharge	Volume	Contaminants
Condensate Overboard	25,000 gallons per unit at start-up, generally once per month.	Chloride - 1-5 mg/L Ammonia - 0.15-0.5 mg/L Silica – 1 mg/L Iron – 1-5 mg/L Copper – 1 mg/L pH – 7.0-8.5
Boiler Blowdown	25,000 gallons per day from each unit.	Chloride – 1-9 mg/L Phosphate – 0.5-10 mg/L Silica – 0.135-0.25 mg/L Iron – 1 mg/L Copper – 1 mg/L pH – 9.15-11 EC – 10-300 umhos/cm Sodium hydroxide – 1-40 mg/L
Bearing Cooling Water Exchanges	Several 1,000 gallons per day from each unit.	Nitrite – 600-800 mg/L EC – 6,000 umhos/cm pH – 8.5 Hardness – 10 mg/L as CaCO3 Sodium fluorescein dye – 1-10 mg/L Polyoxyethylene-polyoxypropylene copolymer Ethoxylated nonylphenol Polydimethysiloxane Isothiazolin Uranine dye – 2-10 mg/L

Storm Water Discharges

The following discharges are currently upstream of the point where water will be diverted to the desalination plant. Poseidon will work with AES to reroute these discharges during construction of the desalination plant so that they will be downstream of the intake for the desalination plant.

Offsite Storm Drainage

Storm drainage from approximately 70 acres of land near the power plant site is piped into the site and is discharged into the power plant discharge vault. The drainage comes from a road and mobile home/recreational vehicle park located west of the power plant, a Wildlife Care Center parking lot located to the south, and; a small commercial area north of the site. The Wildlife Care Center rehabilitates injured animals, primarily birds such as pelicans, sea gulls, and migratory birds. Occasionally, they care for opossums, raccoons, and other small animals. The commercial area consists of an animal hospital, humane society facilities, and Beach Auto Wrecking.

Yard Storm Drainage

Drainage from the power plant yard normally flows to the retention basin for settling and removal of oil and grease prior to release to the discharge vault. The main retention basin has a capacity of 830,000 gallons. A second retention basin, which is used when needed, has a capacity of 738,000 gallons. During large storm events, when the capacity of the retention basins are exceeded, the storm drainage from the yard is diverted directly into the outfall line.

Floor Drains

The site's main drainage system collects runoff from floor drains located underneath and around the power block areas. This drainage is routed through an oil/water separator prior to discharge to the retention basin. The power plant has two oil/water separators, each of which has a capacity of 934 gallons. The retention basin discharges to the discharge vault.

Wastewater Discharges

The retention basin receives a variety of wastes from the power plant, in addition to the yard and floor drainage that was discussed previously. Currently the discharge from the retention basin is upstream of the proposed intake for the desalination plant. This discharge will be rerouted during construction of the desalination plant so that it is downstream of the desalination plant intake. The retention basin receives low volume wastes, metal cleaning wastes, and pipeline hydrostatic test water.

Low Volume Wastes

Low volume waste sources include water softener regeneration brines (20,000 gallons per day), filter backwash water (8,000 gallons twice each week), reverse osmosis/deionization unit brines from the power plant's RO plant (60,000 gallons per day), and laboratory and sampling streams. These discharges are not continuous and may occur simultaneously. The retention basin water is analyzed for total suspended solids and oil and grease prior to discharge to the outfall line.

Metal Cleaning Wastes

Metal cleaning wastes include wastewater from chemical cleaning of boiler tubes and other equipment (0.48 MGD permitted discharge) air pre-heater washwater (0.4 million gallons less than once per year), and boiler fireside washwater (0.15 million gallons less than once per year). These discharges are not frequent and do not occur simultaneously. Metal cleaning wastes are discharged to temporary storage tanks prior to receiving treatment in a mobile lime treatment system. Then they are discharged to the retention basin and subsequently the outfall line.

Hydrostatic Test Water

A hydrostatic test of the fuel delivery pipeline is conducted about once a year. During the test, approximately 1.25 MGD of water is discharged to the retention basin and, ultimately, the outfall line.

Heat Treatment Water

Periodically water from the discharge vault is diverted back into the plant and reheated. This reheated water is then used to clean the discharge line of biological growths. This recirculated water currently contains any wastes that have been discharged to the discharge vault prior to the flow being reversed in the plant.

Hazardous Materials Spills

A number of petroleum products and other hazardous materials are stored and used at the power plant. Although unlikely, there is the potential for a spill to reach the floor drain or the storm drainage system and enter the cooling water system. As stated previously, floor and yard drainage currently enters the outfall line upstream of the point where the desalination plant will be located. Poseidon will relocate this discharge so that it is downstream of the desalination plant intake.

Petroleum Products

The power plant has storage tanks, equipment, and structures that are designed to contain several petroleum products. Although fuel oil is not currently used to generate power at the Huntington Beach Power Plant, it can be stored in bulk in four large aboveground storage tanks owned by SCE. In the past, oil was delivered to the power plant via SCE's fuel pipeline system and transported from the storage tanks to the generating units through pipelines. There are no plans to use fuel oil for power generation in the future.

Distillate oil was previously used as back up fuel for the peaking Unit 5. It is currently stored in one 880,000-gallon aboveground tank. AES has plans to dispose of this oil and decommission and demolish the tank.

Lubricating oil is used for the turbines of the generating units. It is delivered to the facility by tanker trucks and is stored in two 9,000-gallon aboveground storage tanks; one for new oil and one for used oil. Each generating unit has a 5,000-gallon lubricating oil reservoir within the structure of the unit. Lubricating oil is transferred throughout the site via pipelines. The pipelines are not equipped with secondary containment. According to the SPCC Plan, in the event of a pipeline spill, a low fuel pressure alarm would alert operators to the spill and the spill would be isolated from the source within 15 minutes.

The aboveground tanks are located within secondary containment berms designed to contain 110 percent of the tanks' volume to prevent spills of petroleum products from reaching the Pacific Ocean or storm drainage channels. Storm water falling within the berms is usually allowed to evaporate. If needed, storm water can be pumped into the Huntington Beach flood control channel adjacent to the site. If oil is visible in the storm water, it is loaded onto vacuum tanker trucks and disposed of offsite. The 5,000-gallon lubricating oil reservoirs do not have secondary containment structures but spills would drain to the power plant's floor drain system and then the oil/water separator and retention basin. Any oil found in the retention basin would be skimmed from the surface before discharge to the outfall line.

Gear oil is used for lubricating pumps and other mechanical equipment. It is delivered to the facility and stored in 55-gallon drums at a couple of locations. Diesel fuel is used for small internal combustion engines. It is delivered to the site and stored in 55-gallon drums. Any spills from drums in these areas would flow into the building floor drains which are piped to the oil/water separator and then the retention basin.

Waste oil is primarily a product of equipment repairs. It is stored in 55-gallon drums in the Hazardous Waste Storage Area. The area is curbed to contain any spilled oil and there are no floor drains in this area. Waste oil is transported offsite by an authorized oil recycler.

Gasoline is stored in one 1,000-gallon underground storage tank near the maintenance shop. The tank is double walled fiberglass and is equipped with a liquid leak detection systems between the walls. There have been no leaks from the underground storage tank and there have not been any spills when the gasoline tank has been filled.

An SPCC Plan was prepared by SCE in 1998 for the Huntington Beach Power Plant to minimize the potential for oil spills. This plan establishes procedures, methods, and certain requirements to prevent the discharge of oil from the power plant site into or upon the navigable waters of the

United States in accordance with the provisions of the Environmental Protection Agency regulations found in 40 CFR, Part 112. According to the SPCC Plan there were no spills between 1995 and 1998. There have been no reportable spills in recent years (Personal Communication, Terry Kunz, AES).

Chemical Storage and Use

Although sodium hypochlorite is the only chemical added to the cooling water, many different chemicals are used in the boiler feed water system, and the boiler cleaning wastewater system. Chemicals stored in large quantities include sodium hypochlorite (2,500 gallons) and hydrazine (1,000 gallons). In addition the two, 33,000-gallon bearing cooling water tanks contain water that has sodium nitrite at 1000 mg/L. These chemicals are received in bulk from tank trucks and stored in tanks that have secondary containment berms. Chemicals received at the power plant in 55-gallon drums and smaller containers are stored in dedicated storage areas and used in a nearby mixing room. These storage and mixing areas are provided with paved secondary containment to capture leaks or spills. The plant operates under a Hazardous Materials Release Contingency Plan (AES, 2001).

Potential for Spills to Reach Cooling Water System

A large spill, that was not contained by secondary containment structures, could potentially reach the cooling water system if it flowed into the floor drains around the generating units or into the yard storm drains. Spills could not reach the intake well because the well is surrounded by a 3-foot high concrete wall. A spill reaching the floor drains of the generating units would be trapped in the oil/water separator or in the retention basin. Under normal operations, a spill in the yard would be prevented from entering the storm drainage system. In the event of a spill, power plant operators use commercial drain inlet blocking covers to prevent the spilled material from entering drain inlets. The covers are stored near drain inlets throughout the site. Under normal operations, the yard drainage is directed to the retention basin prior to release to the discharge vault so the spill would be trapped in the retention basin. An undetected spill that occurred in the yard during a significant storm event could be routed directly to the discharge vault if the retention basins were full and storm drainage was being directed to the discharge vault. Currently the storm drainage and retention basin discharges are upstream of the point where water will be diverted to the desalination plant. Poseidon intends to move the discharge from the retention basin and storm drainage downstream of the intake to the desalination plant so even if a spill reached the outfall line, it would be downstream from the intake.

Leakage From the Discharge Vault into the Intake Well

The discharge vault is adjacent to the intake well and the two are separated by several gates. Water can be released from the discharge vault into the intake well and recirculated through the plant. Water in the discharge vault contains all of the wastes that are discharged to the cooling water system. There is likely some amount of leakage through the gates between the discharge vault and the intake well.

Significance/Vulnerability Assessment.

Pump seal water, screen wash water and cycle water (bearing cooling water, boiler blowdown, and condensate overboard) will be discharged to the cooling water system upstream of the point where water will be diverted to the desalination plant. These discharges to the cooling water system do not pose a significant risk to the quality of water at the desalination plant, largely due to the relatively small volume of these discharges compared to the volume of cooling water that circulates through the power plant on a daily basis. With the exception of nitrite in bearing cooling water, the chemicals present in the discharges do not pose a health risk. The nitrite concentrations will be greatly diluted by the volume of cooling water.

Although the storm water and wastewater discharges are currently located upstream of the intake location for the desalination plant, they will not pose a threat to water quality because Poseidon will work with AES to reroute these discharges downstream of the intake during construction of the desalination plant.

The petroleum and chemical storage areas do not pose a significant risk to intake water quality. The storage tanks have secondary containment structures that will contain any spills unless a catastrophic event such as an earthquake or explosion occurs. Spills of oil and chemicals on-site will be trapped in the oil/water separators or the retention basin. AES has had no reportable spills in recent years. It is, therefore, not anticipated that spills will be a major source of contaminants to the desalination plant.

Periodic heat treatment currently poses a significant risk because all of the process wastewater, power plant floor and yard drainage, and offsite urban drainage are routed to the discharge vault. During heat treatment, water from the discharge vault is recirculated through the power plant. Since Poseidon will reroute the waste streams during construction of the desalination plant, the discharge vault water quality should improve. However, the heat treatment water will include the concentrated seawater discharge from the desalination plant and could possibly contain higher than normal quantities of cycle water. Poseidon will avoid taking water into the desalination plant during heat treatments.

WASTEWATER COLLECTION, TREATMENT, AND DISCHARGES

Description

The only wastewater that is discharged in the watershed is the process wastewater from the power plant that is mixed with the cooling water and discharged at the power plant outfall. This is discussed in detail in the previous section on the power plant. All municipal wastewater generated at the power plant and in the surrounding community is discharged to the Orange County Sanitation District (OCSD) system.

OCSD collects and treats wastewater generated by 2.2 million people living in a 470-square mile area of central and northwest Orange County. The OCSD's 84-inch diameter Coast Trunkline runs along Pacific Coast Highway in the watershed. An inverted siphon carries wastewater underneath the intake and outfall lines of the power plant. A 48-inch diameter line runs along Newland Avenue, west of the power plant, and connects with the trunkline on the south side of Pacific Coast Highway. There are three State Park restroom facilities in the watershed. Wastewater flows from the restrooms to a line that collects wastewater from other State Park restrooms and then ties into the OCSD trunkline. OCSD investigated the trunkline, siphon, and Newland line in 1999 and found no evidence of cracks in the pipelines. Groundwater monitoring indicated there was no leakage of wastewater from the pipelines. OCSD also investigated the sewer lines that carry wastewater from the State Park restrooms to the trunk line. One broken line was discovered and repaired in 1999. OCSD is currently conducting more extensive testing of sewer lines in the vicinity of Huntington State Beach.

Wastewater is treated at Reclamation Plant No. 1, located in Fountain Valley, and Treatment Plant No. 2, located near the mouth of the Santa Ana River in Huntington Beach. The two plants have a design capacity of 480 MGD and currently treat an average of 243 MGD. All of the wastewater receives advanced primary treatment and approximately half also receives secondary treatment. The wastewater is not disinfected. The treated wastewater is discharged to the Pacific Ocean via a 120-inch diameter outfall pipe that extends five miles from shore to a depth of 195 feet. The last mile of the outfall pipeline is a diffuser with hundreds of portholes through which effluent is released. In 1999, OCSD conducted a dye study that showed that the outfall line was not leaking (MEC, 1999). OCSD also has an emergency outfall that extends 1 mile offshore from the mouth of the Santa Ana River that has not been used since the deep ocean outfall was constructed in 1971. The locations of the OCSD outfalls in relation to the Huntington Beach Power Plant intake are shown on Figure 2-3 and other figures in Chapter 2.

OCSD operates under an NPDES permit issued by the Santa Ana Regional Board. The U.S. Environmental Protection Agency (EPA) granted OCSD a variance from secondary treatment requirements under Clean Water Act Section 301(h). The NPDES permit and the 301(h) waiver expire in June 2003. OCSD is currently under

pressure from coastal communities to provide full secondary treatment of the wastewater and not reapply for the 301(h) waiver.

The Orange County Health Care Agency closed a portion of Huntington State Beach on July 1, 1999 because elevated levels of total coliform, fecal coliform, and enterococci bacteria in shoreline samples appeared to indicate sewage contamination. Beaches were closed throughout the summer and the last section of beach was reopened on September 3, 1999. A three-month source investigation was conducted by OCSD and many other participating agencies but the source of the high bacteria levels was not identified (OCSD, 1999). Dr. Stanley Grant of the University of California, Irvine advanced the hypothesis that the discharge from OCSD flows upcoast and a combination of internal waves and the disruption of the thermocline by the discharge from the Huntington Beach Power Plant could bring the plume shoreward and could result in the high bacterial densities at the shore (OCSD, 2000). OCSD conducted a study in November 2000 that found evidence of a submerged wastewater field below 20 meters and reaching shoreward to the 20-meter depth contour, which is between 1.25 and 1.5 miles offshore. OCSD conducted a $5 million investigation in the summer of 2001 to further investigate this hypothesis. Preliminary results indicate that under certain conditions the wastewater plume moves upcoast and within one mile of the shore. The OCSD report on the 2001 study is expected to be released in May 2002.

Significance/Vulnerability Assessment

The only wastewater that is discharged in the vicinity of the power plant intake is the process wastewater from the power plant that has been mixed into the cooling water discharge. As discussed in Chapter 2, modeling conducted by oceanographers at Scripps Institution of Oceanography demonstrated that the wastewater from the power plant is not entrained in the intake water (Jenkins & Wasyl, 2002). Modeling conducted on the OCSD discharge demonstrated that the discharge is diluted 30 million to 1 at the power plant intake. This level of dilution was found under model conditions that were designed to simulate oceanographic conditions most likely to cause the discharge plume to move upcoast and toward the shore. OCSD is currently analyzing the data from an intensive study conducted in the summer of 2001 to determine if their waste field travels upcoast and toward the shore. Preliminary results indicate that their findings are consistent with the model results, indicating that the OCSD discharge is not a significant source of contaminants to the desalination plant. Leaks from pipelines along the shore are also not a significant source of contaminants at the power plant intake due to the low volume of leakage that has been found and the fact that the groundwater gradient is away from the beach rather than toward it.

URBAN RUNOFF

Description

With the exception of the minor amount of runoff from the watershed that is piped into the power plant site, urban runoff in the vicinity of the power plant is pumped into large flood control channels that discharge to the Pacific Ocean via the Talbert Marsh. There are no direct discharges of urban runoff to the ocean within the watershed of the desalination plant.

Urban runoff from Huntington Beach and surrounding communities is collected in forebays of pump stations operated by the City and Orange County. During the 1999 OCSD investigation of the potential causes of the beach closures, the dry weather runoff from the pump station forebays was sampled and found to contain total coliform densities that, at times, exceeded 160,000 MPN/100 mL. Fecal coliform densities were in the 1000s. As a result, the dry weather nuisance runoff is being pumped from the forebays to the OCSD Wastewater Treatment Plant No. 2 where it is treated with the wastewater and discharged to the Pacific Ocean via a deep ocean outfall. The Orange County Board of Supervisors recently voted to spend $2 million to install permanent pumps and inflatable dams in the Talbert Channel and the Santa Ana River to continue diversion of the dry weather runoff to the OCSD facilities.

Due to the large volume of water, storm water flows are not treated. When the water reaches a programmed level in the forebays, the storm water is pumped into large flood control channels that discharge to the Talbert Marsh and subsequently to the Pacific Ocean near the mouth of the Santa Ana River. The Fountain Valley, Talbert, and Huntington Beach flood control channels drain a 13 square mile watershed and converge in the Talbert Marsh. The Huntington Beach flood control channel flows along the northern and eastern boundaries of the power plant site. Talbert Marsh discharges to the ocean about 7000 feet down coast from the power plant. Talbert Marsh and the lower reaches of the flood control channels are tidally influenced so that they are flooded with ocean water during flooding tides and a mixture of ocean water and runoff drains from the marsh during ebb tides. The Santa Ana River drains a 1700 square mile watershed and discharges to the ocean 8300 feet down coast from the power plant.

As discussed in Chapter 2, a modeling study was conducted to determine if the urban runoff discharged to the ocean from the Talbert Marsh and the Santa Ana River watersheds could adversely affect water quality at the power plant intake. This study showed that urban runoff can travel up coast along the shore but it does not reach the intake to the Huntington Beach Power Plant (Jenkins and Wasyl, 2002). The model results are consistent with the results of a dye study and a citrus fruit study on transport of urban runoff from the Talbert Marsh (OCSD, 1999). As a result of the modeling study, the Talbert Marsh and Santa Ana River watersheds were not included in the watershed of the desalination plant.

Significance/Vulnerability Assessment

There are no discharges of urban runoff within the watershed of the desalination plant. A modeling study showed that urban runoff from the Talbert Marsh and Santa Ana River watersheds does not reach the intake to the Huntington Beach Power Plant. The storm drainage that is discharged to the power plant cooling water system was discussed previously.

RECREATION

Description

Huntington State Beach is a heavily used recreation area. Recreational usage figures for the state beach are not available from the California Department of Parks and Recreation but it is estimated that over 5 million people visit Southern California beaches each year. The recreational facilities at Huntington State Beach consist of the beach, a multi-use trail between the beach and Pacific Coast Highway, snack bars, rental shops, and restroom facilities. Water recreation consists of swimming, surfing, and sailing. In addition, there are a number of land activities, including sunbathing, biking, rollerblading, and picnicking.

Significance/Vulnerability Assessment

Recreational usage of Huntington State Beach is not likely a significant source of contaminants to the desalination plant. The intake to the power plant is located 1,904 feet offshore in water that is 34 feet deep, well beyond the area that is used for body contact recreation. Any contaminants entering the water in the surfzone would be greatly diluted due to tidal action.

OIL AND GAS ACTIVITIES

Description

Oil and gas wells are common in the area around the watershed but there are no drilling activities in the watershed of the desalination plant. There are two offshore oil platforms to the west of the watershed, approximately 1.5 miles from the shore and there are four platforms about 10 miles west of the watershed. Oil and gas pipelines connect the platforms to facilities on the shore upcoast from the watershed. There are no oil tanker shipping lanes in the vicinity of the watershed. The closest shipping lanes are six to seven miles offshore. There was historically a marine oil tanker terminal upcoast from the watershed in Huntington Beach. It was decommissioned some years ago (Personal Communication, John Coleman, State Lands Commission). There have not been any reportable spills or leaks from the offshore oil platforms or the pipelines (Personal Communication, Dave Sanchez, Division of Oil & Gas).

Significance/Vulnerability Assessment

Oil and gas drilling and transport activities do not routinely pose a risk to water quality at the intake to the power plant. A catastrophic event at one of the offshore platforms that is close to the coast could affect water quality at the power plant intake but this poses a relatively small risk due to the low probability of such an occurrence based on past operational history.

RED TIDES

Description

Red tides occur along the California coast during the summer months. Red tides are caused by the rapid reproduction of dinoflagellates which results in discoloration of the ocean water ranging from yellow to deep red. Some of the dinoflagellates that cause red tides along the California coast contain a powerful biotoxin, saxitoxin. Filter feeding shellfish consume vast quantities of these organisms and concentrate the biotoxin in their tissues. If humans consume shellfish containing this toxin, they can suffer from paralytic shellfish poisoning (PSP), which can result in death. Red tides also often result in fish kills with massive amounts of dead fish washing up on beaches.

In the spring of 1998, over 400 California sea lions died along the central coast. Their death was attributed to a marine biotoxin, domoic acid, which is produced by Pseudo-nitzschia australis, a diatom (Scholin, et.al, 2000). Domoic acid is a potent neurotoxin that has resulted in death and permanent brain damage in humans when shellfish containing concentrated levels have been consumed (NOAA, West Coast Marine Biotoxins & Harmful Algal Blooms Newsletter, 1998), although there have been no cases of human poisonings along the California coast (DHS, 2000).

The DHS Phytoplankton Monitoring Program measures the populations of the algae known to produce saxitoxin and domoic acid on a regular basis. These organisms are often found along the southern California coast but are usually at low levels. DHS also conducts an extensive shellfish monitoring program to determine when the concentrations of biotoxins are approaching dangerous levels.

Significance/Vulnerability Assessment

Although these biotoxins are a grave public health concern when they are biomagnified by shellfish and the shellfish are ingested by humans, they do not represent a threat to the safety of the drinking water that will be produced by the desalination plant. They are a threat to human health only after they have been concentrated in the tissues of animals that are consumed by humans. In addition, the organisms responsible for producing marine biotoxins are killed through disinfection. The water soluble cell degradation products, such as the biotoxins, and the organisms themselves are removed through filtration. There is no risk of

biotoxin-producing algae or the toxins being present in the finished water of a desalting plant (Ibrahim, 1999).

ANTICIPATED GROWTH AND PROJECTED CHANGES IN SOURCES OF CONTAMINANTS

The land portion of the watershed is fully developed so it is unlikely that there will be any changes in the activities or the contaminants in the next five years. As discussed previously, the power plant is currently in the process of rebuilding two generating units. These units will be operational before the desalination plant is constructed so they have been included in the analysis of potential contaminant sources.

SIGNIFICANCE OF POTENTIAL CONTAMINANT SOURCES

There are few contaminant sources with the potential to impact the water quality at the intake to the desalination plant. Contaminant sources in the watershed which have been judged to be insignificant are wastewater, urban runoff, oil and gas extraction activities, recreation, and red tides. Activities at the Huntington Beach Power Plant have the most potential to impact raw water quality due to the proximity to the desalination plant intake and the nature and volume of materials stored and used on the site.

Process Wastewater and Drainage

Currently, the power plant process wastewater, and drainage from the power plant yard, generating unit floors, and the adjoining watershed are discharged upstream of the desalination plant intake. The quality of these discharges is poor with respect to microbial contaminants. Poseidon will reroute these discharges so they enter the power plant outfall line downstream of the discharge vault and the intake to the desalination plant so they will not pose a risk to water quality at the intake.

Leakage From Discharge Vault

There is a source of bacteria and ammonia to the intake well that has not been completely identified. The increase in bacteria and ammonia concentrations between the ocean intake and the intake well may be due to leakage from the adjoining discharge vault. The discharge vault occasionally has concentrations of bacteria that exceed the detection level of 24,000 MPN/100 mL and ammonia concentrations as high as 0.9 mg/L due to the waste streams that enter it. It is anticipated that when the waste streams are rerouted during construction of the desalination plant, the quality of water in the discharge vault will improve since it will no longer be receiving the process wastewater and urban drainage that currently lead to the high levels of bacteria and ammonia. If leakage from the discharge vault has caused the bacteria and ammonia concentrations to increase over the levels found in the ocean, the quality of the intake well water should improve when the current discharges to the vault are rerouted.

Cycle Water Discharges

The power plant cycle water discharges do not pose a significant risk due to the nature of the chemicals present in the discharges and the small volumes compared to the cooling water volume.

Heat Treatment

Periodic heat treatment may pose a significant risk to water quality at the desalination plant intake. Currently all of the process wastewater, power plant floor and yard drainage, and offsite urban drainage are routed to the discharge vault. During heat treatment, water from the discharge vault is recirculated through the power plant. Since Poseidon will reroute the waste streams during construction of the desalination plant, the discharge vault water quality should improve. However, the heat treatment water will include the concentrated seawater discharge from the desalination plant and could possibly contain higher than normal quantities of cycle water. Poseidon will avoid taking water into the desalination plant during heat treatments.

Catastrophic Spills

Although AES has had no reportable spills in recent years, there is always the potential for a spill of oil or a hazardous chemical. Due to the configuration of the cooling water system and safeguards that route most of the plant drainage to oil/water separators and the retention basins, small spills at the power plant will not reach the cooling water system. Although highly unlikely, there is the potential for a large spill due to a natural disaster such as an earthquake or explosion. Under this scenario, the operation of the desalination plant will be curtailed and possibly discontinued until the spill's effect on water quality is mitigated.

CHAPTER 4
WATER QUALITY

This chapter contains a discussion of the drinking water regulations pertinent to the sanitary survey, a description of the existing water quality monitoring programs, an evaluation of the water quality data, and a recommendation on the appropriate level of *Giardia* and virus reduction at the desalination plant. Additional monitoring is also recommended.

DRINKING WATER REGULATIONS

The Safe Drinking Water Act (SDWA) authorizes the U.S. Environmental Protection Agency (EPA) to set standards for contaminants in drinking water supplies in the United States. The EPA was required to establish primary regulations for the control of contaminants that affect public health and secondary regulations for compounds that affect the taste or aesthetics of drinking water. Under the provisions of the SDWA, the California Department of Health Services (DHS) has the primary enforcement responsibility (referred to as "primacy"). Water quality data from various locations in the power plant and the Pacific Ocean near the power plant intake are compared to drinking water standards, or maximum contaminant levels (MCLs) in this chapter.

SURFACE WATER TREATMENT REGULATION

Under the Surface Water Treatment Regulation (SWTR), the general requirements are to provide treatment to ensure at least 3-log reduction of *Giardia lamblia* cysts and at least 4-log reduction of viruses. The California SWTR Staff Guidance Manual provides a description of source waters that require additional treatment above the minimum 3-log *Giardia* and 4-log virus reduction (DHS, 1991). The Guidance Manual states "...in a few situations, source waters are subjected to significant sewage and recreational hazards, where it may be necessary to require higher levels of virus and cyst removals..."

Due to the expense and uncertainties associated with pathogen monitoring, the State Guidance Manual uses total coliform levels as a guide for increased treatment. Table 4-1 presents treatment requirements for *Giardia* cyst and virus removal/inactivation based on median monthly densities of total coliform bacteria. Evaluation of pathogen reduction levels based on total coliform bacterial density is not as scientifically valid as basing them on actual pathogen concentrations. The relationship between total coliforms and pathogenic cysts is tenuous, but in the absence of other information, DHS uses total coliform density to determine required pathogen reduction levels for individual water treatment plants.

Table 4-1. Treatment Requirements for *Giardia* Cyst and Virus Reduction Based on Total Coliform Levels

Level of Microbiological Contamination Total Coliform Density, Monthly Median,Total Coliforms/100 mL	*Giardia* Cyst Treatment Requirements, Log Reduction	Virus Treatment Requirements, Log Reduction
<1,000	3	4
>1000 – 10,000	4	5
>10,000 – 100,000	5	6

The Interim Enhanced Surface Water Treatment Rule (IESWTR) was published in the Federal Register on December 16, 1998. DHS is currently developing a final regulation to implement the IESWTR. Water utilities will be required to comply with the regulation by January 1, 2002. The purpose of the rule is to improve control of microbial pathogens, specifically *Cryptosporidium* and ensure that the microbial quality of drinking water is not compromised by the need to control disinfection by-products. This rule has set a maximum contaminant level goal (MCLG) for *Cryptosporidium* of zero. In lieu of setting an MCL, a treatment technique requirement of 2-log removal has been established.

DRINKING WATER SOURCE ASSESSMENT AND PROTECTION PROGRAM

The 1996 SDWA Amendments included a requirement for states to develop a program to assess sources of drinking water and encouraged states to establish protection programs. California has developed the Drinking Water Source Assessment and Protection (DWSAP) Program in response to this requirement. There are eight components which are required as part of the DWSAP including: source identification; delineation of the watershed or recharge area and zones; evaluation of the physical barrier effectiveness; identification of potential contaminating activities, vulnerability assessment, development of an assessment map, preparation of a drinking water source assessment report, and inclusion of a summary of the report in the Annual Consumer Confidence Report. The drinking water source assessment conducted for the Orange County Desalination Plant watershed in conjunction with the sanitary survey is included in Appendix A. This sanitary survey satisfies the requirements of the DWSAP for the desalination plant.

CONTAMINANTS OF CONCERN

Contaminants of concern in a domestic water supply are those that either pose a health risk or in some way alter the aesthetic acceptability of the water. Contaminants that pose a health risk can be further classified as those that pose an immediate risk, such as pathogenic organisms, and those that pose a long-term health risk, such as carcinogens. Based on the evaluation of potential contaminant sources presented in Chapter 3, the key contaminants that may adversely affect the quality of the water pumped into the desalination plant are microbiological contaminants. These contaminants are discussed, along with other water quality contaminants in this chapter.

EXISTING WATER QUALITY

The water quality monitoring that has been conducted at the Huntington Beach Power Plant and in the nearshore ocean waters is discussed in this section. The water quality data are compared to drinking water standards.

MONITORING PROGRAMS

The water quality data described in this chapter are derived from a monitoring program conducted by Poseidon Resources Corporation (Poseidon), MBC, and Orange County Sanitation District (OCSD).

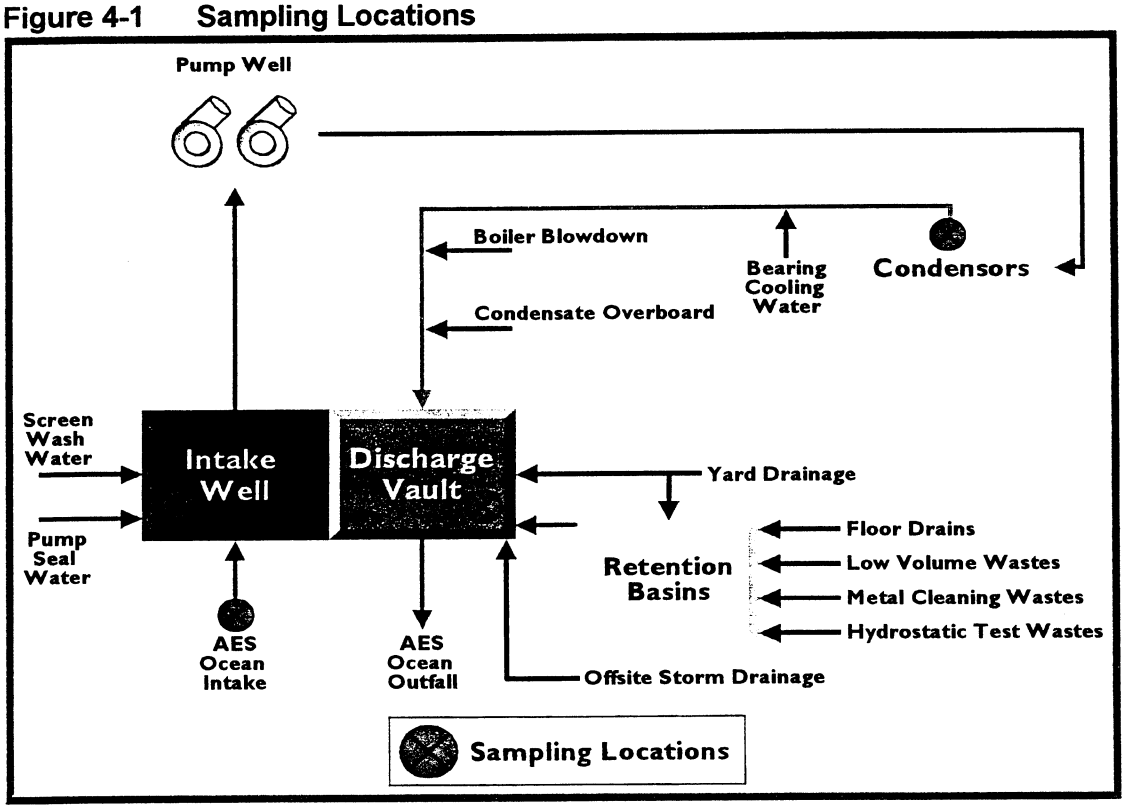
Power Plant Intake Monitoring

Data have been collected at the power plant intake by Poseidon and MBC, under contract to AES.

Poseidon Monitoring

Poseidon collected water quality data from the power plant intake well where the cooling water enters the plant several times between January and April 2001 to determine the quality of water at the desalination plant intake. Figure 4-1 is a schematic of the power plant showing the locations where various waste streams enter the cooling water system. The sampling locations are also shown on this figure.

Figure 4-1 Sampling Locations



January 10-11, 2001 Storm Event	*Samples were collected every four hours from the intake well of the power plant during the storm event for a limited number of physical/chemical constituents, total and fecal coliform bacteria, and radiological constituents. Ocean water is drawn directly into the intake well so the total dissolved solids (TDS) should be near 34,000 mg/L. Based on the TDS data, it was apparent that there was a freshwater lens on the surface of the intake well when some of the samples were collected.*
March 5-6, 2001 Light Rain Event	*Samples were collected from the intake well over a 30-hour period and analyzed for a variety of physical and chemical constituents, metals, total and fecal coliform bacteria and Enterococcus. In addition, one sample was analyzed for volatile organics. The data indicate that there was a freshwater lens in the intake well when some of the samples were collected.*
March 16, 2001 Tital Cycle	*Samples were collected every two hours from in intake well over a partial tidal cycle for physical/chemical constituents, total and fecal coliforms, and Entercoccus*
April 3, 2001	*A sample was collected from the intake well and analyzed for radiological constituents.*
April 17, 2001	*A sample was collected from the intake well and analyzed for a variety of physical/chemical constituents, metals, organics, total and fecal coliforms and Enterococcus.*
August 7, 2001	*A sample was collected from the condenser outlet and analyzed for a variety of physical/chemical constituents, total and fecal coliforms and Enterococcus.*

MBC Monitoring

MBC conducted extensive monitoring for total coliforms, *Escherichia coli (E. coli), Enterococcus* and general water quality characteristics in the intake well to the power plant during the summer of 2001. In addition, hourly samples were collected for 24 to 36 hours during the six intensive surveys conducted by OCSD in the spring and summer of 2001

Power Plant Outfall Monitoring

Data on the quality of water discharged from the power plant and on various waste streams in the power plant have been collected.

Poseidon Monitoring

Poseidon collected one sample from the discharge vault of the power plant to determine the quality of water that would enter the desalination plant if the power plant waste streams and urban drainage were not rerouted during

construction of the desalination plant. Samples were collected on August 20, 2001 and analyzed for physical/chemical characteristics, total and fecal coliforms, *Enterococcus*, and radiological constituents.

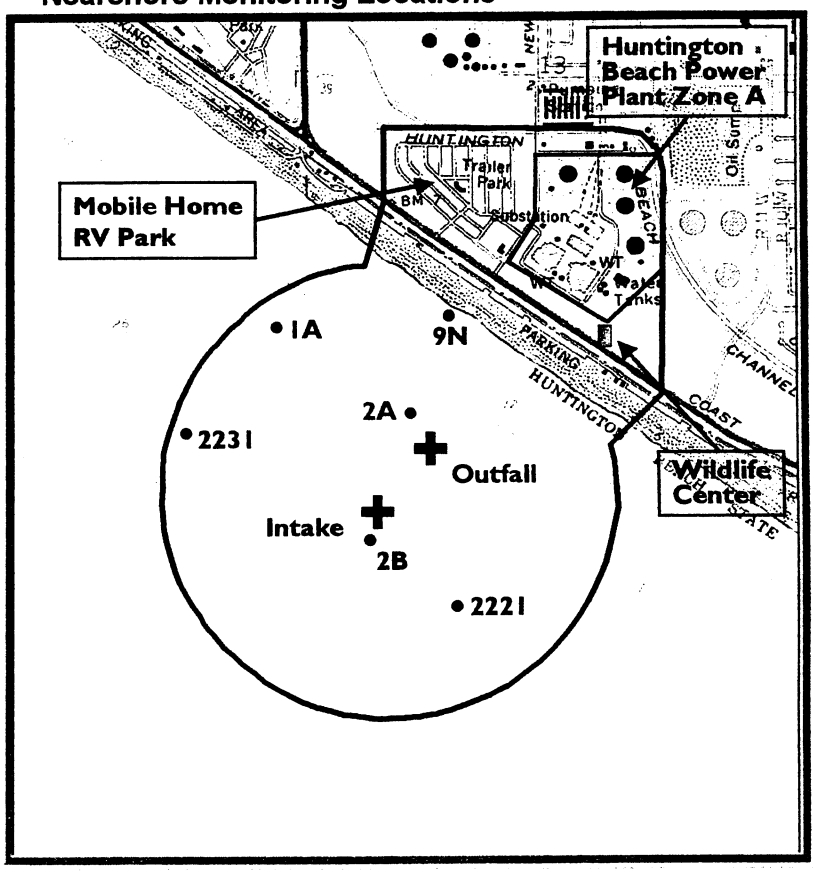
MBC Monitoring

MBC conducted extensive monitoring for total coliforms, *E. coli*, *Enterococcus*, and general water quality characteristics in the discharge vault, the retention basins, and the urban runoff entering the power plant in the summer of 2001. In addition, hourly samples were collected from the discharge vault during the OCSD intensive surveys.

Nearshore Ocean Data

OCSD collected samples at six locations within the ocean portion of the watershed during the intensive surveys of the summer of 2001. The data from one of these locations, Station 2B which is located near the power plant intake, is included in this analysis. Data from the other locations were reviewed but are not included in this chapter. Figure 4-2 shows the locations of the OCSD monitoring stations.

Figure 4-2 Nearshore Monitoring Locations



EVALUATION OF MONITORING DATA

The data from the monitoring programs are evaluated in this section. The data from the intake well and the outlet from the condenser are grouped together to represent the raw water quality that will be pumped into the desalination plant. As discussed in Chapter 3, the power plant waste streams and storm drainage will be rerouted during construction of the desalination plant so that they are discharged to the outfall line downstream of the intake to the desalination plant.

Table 4-2 compares the data from the Poseidon monitoring program to the DHS primary MCLs. Table 4-3 compares the data from this monitoring program to the secondary MCLs. All values shown in bold exceed the MCLs. Although MCLs apply to finished drinking water, raw water concentrations that exceed MCLs provide an indication of potential contaminants of concern.

Electrical Conductivity and Total Dissolved Solids

The electrical conductivity (EC) and TDS data are used primarily to determine the mix of seawater and fresh water at the intake of the desalination plant. The TDS concentration of seawater along the southern California coast is generally between 33,000 and 34,000 mg/L, which corresponds to a conductivity of about 48,000 to 50,000 umhos/cm. TDS is not considered to be a parameter of concern, as it would be in a conventional water treatment plant, because the desalination plant will be designed to remove the TDS from the water.

Figure 4-3 Presents the TDS data from the power plant intake well and the discharge vault from the MBC monitoring program conducted during the summer of 2001. These data show that the intake TDS concentrations are generally around 33,000 mg/L. The discharge vault concentrations were more variable during the first part of the summer and then consistently near 33,000 mg/L during the last two months of monitoring. During June and the first part of July the power plant was not generating power; however, water was still circulated through the system with one pump. Power generation started mid July and continued throughout the remainder of the monitoring period. The TDS data indicate that the discharge water quality can be affected by discharges of power plant wastes and urban drainage, which are much lower in TDS than seawater. When the plant is generating power, the TDS concentrations in the intake and discharge vault were consistently near 33,000 mg/L.

Figure 4-4 presents the TDS and conductivity data obtained from the intake well by Poseidon during the January 10-11, 2001 storm event. The intake well does not receive any storm water discharges so the TDS concentrations should be the same as seawater. These data show that the concentrations during the storm were similar to the concentrations found during the summer monitoring program. One sample had a TDS concentration of 28,100 mg/L, indicating a potential source of freshwater but there was not a corresponding drop in EC.

Figure 4- 3 TDS in Intake Well and Discharge Vault

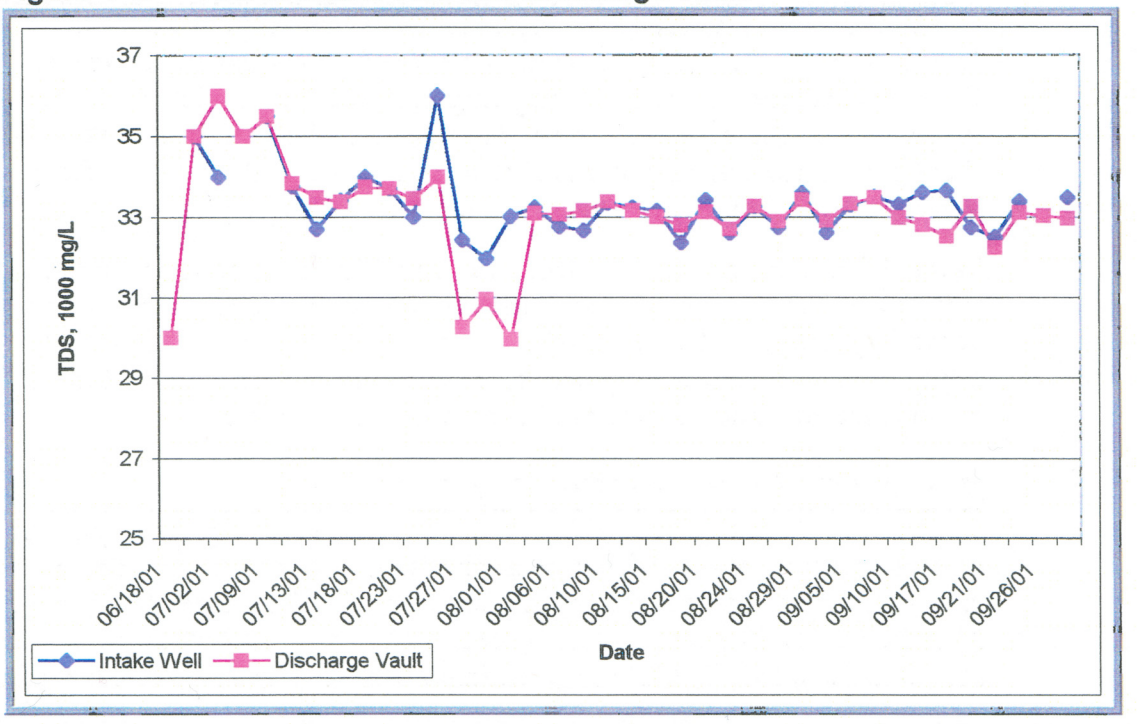
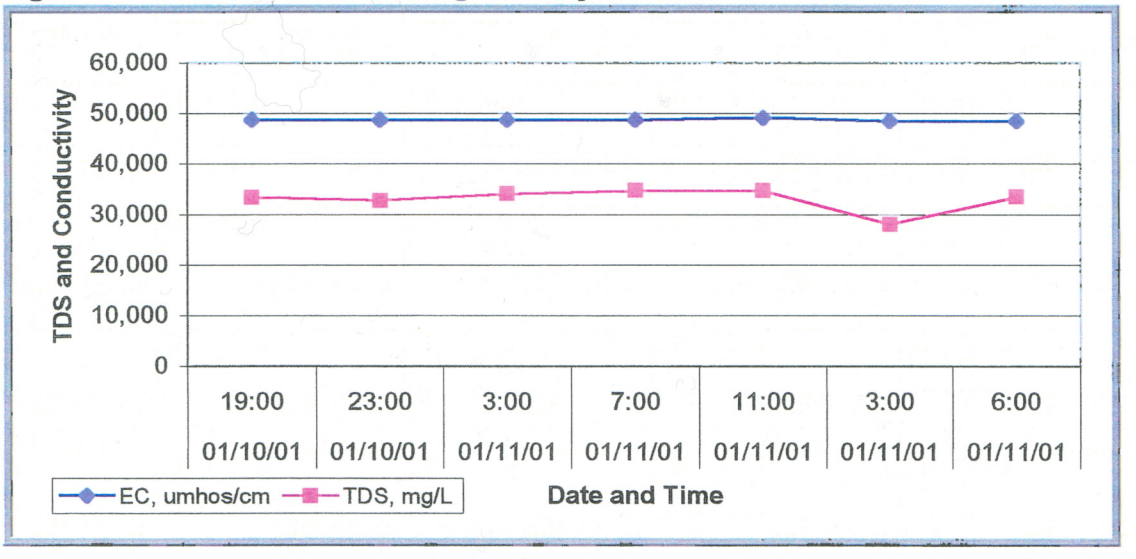


Figure 4-4 TDS and EC During January 2001 Storm Event



As shown in Table 4-3, the concentrations of TDS, chloride, and sulfate are substantially higher than the secondary MCLs. In conventional water treatment plants, the TDS of the finished water is higher than the TDS of the raw water due to chemicals added in treatment. Reverse osmosis (RO) membranes are designed to remove these salts from seawater so they are not considered to be contaminants of concern in the finished drinking water.

Table 4-2 Comparison of Intake Well Monitoring Data to Primary Maximum Contaminant Levels

Constituent	Primary Maximum Contaminant Level	Poseidon Monitoring Data		
		Number of Samples	Mean Concentration	Maximum Concentration
Inorganic Chemicals				
Aluminum, mg/L	1	3	0.063	0.073
Antimony, mg/L	0.006	3	0.00009	0.00013
Arsenic, mg/L	0.05	3	0.002	0.003
Asbestos, MFL	7			
Barium, mg/L	1	14	<0.000001	<0.000001
Beryllium, mg/L	0.004	3	<0.000005	<0.000005
Cadmium, mg/L	0.005	4	0.00003	0.0001
Chromium, mg/L	0.05	4	0.002	0.003
Copper, mg/L	1.3	4	0.0005	0.0008
Cyanide, mg/L	0.2	2	<0.001	<0.001
Fluoride, mg/L	2	14	0.724	0.9
Lead, mg/L	0.015	4	0.0001	0.0002
Mercury, mg/L	0.002	4	<0.0001	<0.0001
Nickel, mg/L	0.1	5	0.001	0.002
Nitrate, mg/L as N	10	14	<0.1	<0.1
Nitrate + Nitrite, mg/L as N	10			
Nitrite, mg/L as N	1			
Selenium, mg/L	0.05	3	0.005	0.008
Thallium, mg/L	0.002	3	0.00004	0.00006
Radioactivity				
Gross alpha particle, pCi/L	15	3	3.62	6.62
Gross beta particle, pCi/L	50	2	14.15	23.4
Radium 226 & 228, pCi/L	5	1	0.226	
Radium 226, pCi/L				
Radium 228, pCi/L				
Strontium-90, pCi/L	8			
Tritium, pCi/L	20,000			
Uranium, pCi/L	20			
Organic Chemicals				
Atrazine, mg/L	0.003	1		<0.010
Benzo(a)pyrene, mg/L	0.0002	1		<0.001
Carbofuran, mg/L	0.018	1		<0.050
Di(2-ethylhexyl)pthlate, mg/L	0.004	1		<0.030
Endothall, mg/L	0.100	1		<0.400
Simazine,mg/L	0.004	1		<0.010
2,3,7,8 – TCDD, pg/L	0.003	1		<1.69

Table 4-3 Comparison of Monitoring Data to Secondary Maximum Contaminant Levels

Constituent	Secondary Maximum Contaminant Level	Poseidon Monitoring Data		
		Number of Samples	Mean Concentration	Maximum Concentration
Aluminum, mg/L	0.2	3	0.063	0.073
Color, units	15			
Copper, mg/L	1.0	4	0.0005	0.0008
Corrosivity	Non corrosive			
MBAS, mg/L	0.5			
Iron, mg/L	0.3	3	0.051	0.081
Manganese, mg/L	0.05	3	0.006	0.009
MTBE, mg/L	0.005	2	<0.002	<0.003
Threshold Odor Number, units	3			
Silver, mg/L	0.1	4	0.0003	0.0006
Thiobencarb, mg/L	0.001	1		<0.010
Turbidity, units	5	27	3.9	16
Zinc, mg/L	5.0	3	0.006	0.008
Total dissolved solids, mg/L	500	26	33,100	39,100
Conductance, umhos/cm	900	24	48,400	49,200
Chloride, mg/L	250	14	19,600	20,200
Sulfate, mg/L	250	14	2,300	2,700

Turbidity

The major concern with turbidity in the raw water supply to the desalination plant is that it can result in shortened filter run times for the pretreatment filters and excess membrane fouling. Turbidity also shields microorganisms from disinfection in conventional treatment plants but that should not be an issue with the desalination plant. The turbidity data collected by Poseidon from the intake well indicate that turbidity is generally low (mean concentration of 3.9 NTU). The maximum turbidity measured was 16 NTU during the January 10-11 storm event. Turbidity spikes are not expected because the seawater is drawn into the power plant from a depth of 18 feet and there are no storm water discharges to the intake well.

Metals

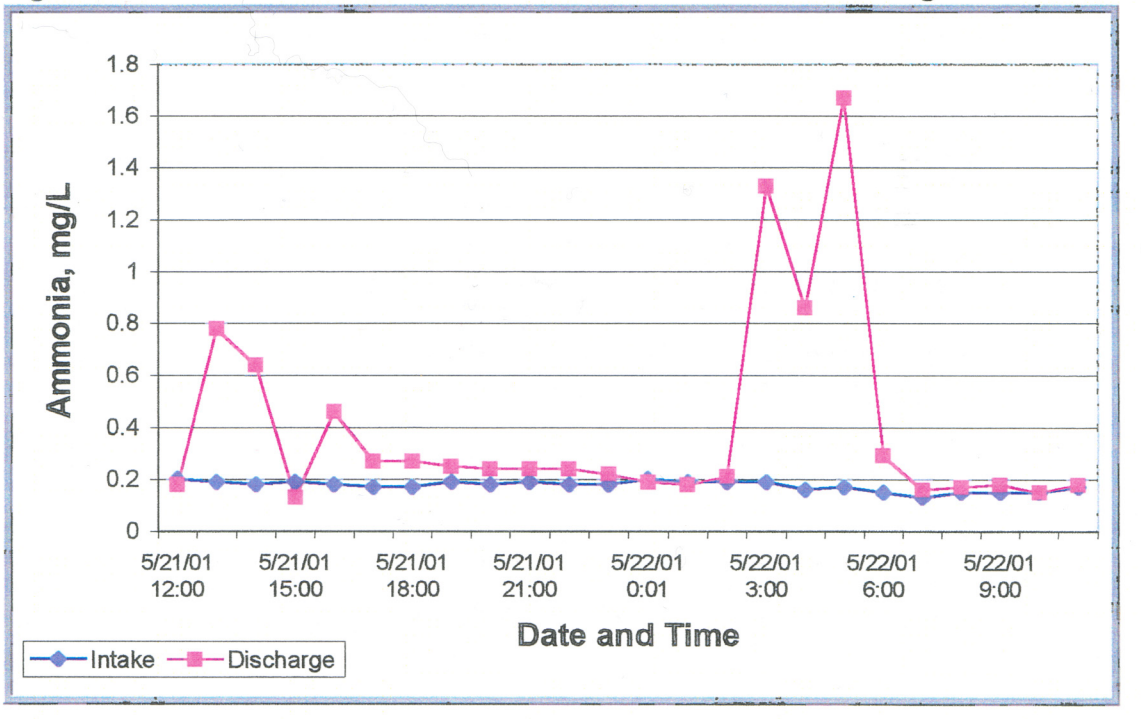
The intake well metals concentrations were below the primary and secondary MCLs in the three to four samples analyzed. Hexavalent chromium was measured in one sample collected from the condenser outlet and one from the discharge vault and it was not detected at 0.001 mg/L.

Inorganic Chemicals

The inorganic chemicals include nutrients, asbestos, and fluoride. The concentrations of nitrate and fluoride were below the primary MCLs at the intake well. Asbestos was not monitored by Poseidon and is not likely found in the seawater that is drawn into the power plant. There are no known sources of asbestos in the power plant. Although ammonia is not regulated as a drinking water contaminant, ammonia data are presented on Figure 4-5 because ammonia is one of

the contaminants added to the cooling water system in condensate overboard and it can also indicate the presence of other contaminant sources. Although not shown on the figure, the concentration of ammonia at Station 2B, near the power plant intake in the ocean, is generally less than 0.01 mg/L. The intake well ammonia concentrations during the May intensive study ranged from 0.01 to 0.2 mg/L. The concentrations in the discharge vault were generally around 0.2 mg/L but there were several peaks with the highest concentration reaching 1.67 mg/L. Ammonia concentrations were also measured during the June intensive survey. Intake concentrations generally ranged from 0.01 to 0.07 mg/L with one peak of 0.73 mg/L. Discharge vault concentrations ranged from 0.03 to 0.89 mg/L. These data indicate that there is a low level source of ammonia to the intake well because the concentrations in the intake well exceed the 0.01 mg/L found in seawater. There are other sources of ammonia between the intake well and the discharge vault. Condensate overboard is one potential source but it appears that other sources are present because the condensate overboard is discharged sporadically to the system and the ammonia concentrations are persistent.

Figure 4-5 Ammonia Concentrations in the Intake and Discharge Vault



Aesthetic Characteristics

Poseidon did not monitor for color or threshold odor number in the intake well samples. Neither of these constituents is of concern because chemicals that contribute to the color and odor of the water will be removed by the RO membranes and pretreatment processes.

Radiological Contaminants

Gross alpha particle radioactivity was measured in three samples from the intake well, beta particle radioactivity was measured in two samples, and combined radium 226 and 228 was measured in one sample. The levels of radioactivity detected were all below the primary MCLs and are likely due to natural sources.

Organic Chemicals

The full suite of Title 22 organic chemicals was analyzed in a sample collected during dry weather conditions on April 17, 2001. Volatile organics were also measured during a light rain event on March 6, 2001. None of the organic chemicals was detected in either sample. The detection limits for several organics (atrazine, benzo(a)pyrene, carbofuran, di(2-ethylhexyl)pthalate, endothall, simazine, and 2,3,7,8-TCDD) exceeded the primary MCLs so it was not possible to determine compliance. The April 17 sample was also analyzed for some of the unregulated organic contaminants and most of the contaminants for which DHS has developed action levels. None of the organic contaminants was detected in the sample.

Poseidon collected oil and grease samples during several monitoring events. Most of the samples contained <1 mg/L of oil and grease. One sample from the discharge vault was analyzed at a lower detection limit and 0.06 mg/L was detected.

Disinfection Byproduct Precursors

Poseidon collected samples for total organic carbon (TOC) during the January storm event and the March dry weather event. TOC was detected in two samples at concentrations of 0.5 and 0.6 mg/L during the dry weather event. The storm event samples were analyzed with a detection limit of 5 mg/L so all samples were less than 5 mg/L. RO membranes will remove 80 to 90 percent of the TOC present in the raw water so the TOC concentration in the finished water is expected to be less than 0.1 mg/L. Bromide was measured at 62 mg/L in one sample that was collected in April. Based on an average concentration of bromide in seawater of 68 mg/L and 99.6 percent (usually) removal of bromide by RO membranes, the bromide concentration is expected to be about 270 *ug*/L in the finished water. When bromide is present in water there is the potential for formation of brominated trihalomethanes (THMs) and haloacetic acids (HAAs) upon chlorination. The formation of brominated THMs and HAAs depends upon TOC concentration, pH, chlorine dose, temperature, and contact time, in addition to bromide concentration. With the low TOC concentrations found in the intake water, there will likely be little formation of disinfection byproducts (DBPs). If the water is blended with other supplies the potential for formation of brominated DBPs increases. Poseidon will conduct an analysis of DBP formation when the alternative distribution system and blending options are identified. Desalination plant disinfection practices will be coordinated with these of existing water sources to minimize DBP formation in the distribution system.

Microbiological Contaminants

There is an extensive database on dry weather densities of total coliforms, fecal coliforms, *E. coli*, and *Enterococcus* in the intake well and the discharge vault of the Huntington Beach Power Plant as a result of the intensive monitoring conducted for OCSD during the summer of 2001. There are limited data during storm events so Poseidon will collect additional data during the winter of 2001/2002. The coliform densities at the intake well represent the levels prior to chlorination at the power plant. These levels will be used to determine raw water quality for the purposes of assessing treatment removal requirements for the desalination plant in the following section. As discussed previously in Chapter 3, several waste streams currently enter the cooling water system upstream of the point where water will be drawn off for the desalination plant. The discharge vault water quality that is presented in this section is characteristic of the mixture of cooling water, urban drainage, and wastewater from the power plant that is discharged to the ocean. Poseidon will reroute the wastewater and urban drainage that currently enter the discharge vault so that these discharges will enter the cooling water system downstream of the intake to the desalination plant.

Bacteria in the Intake Well

Figure 4-6 presents data on total coliforms, *E. coli*, and *Enterococcus* in the intake well. Samples were collected by MBC every few days between June and September 2001. Total coliform densities were generally below 1000 MPN/100 mL but there were several peaks above this level, with two samples being reported as >24,192. One of these peaks occurred on August 13 when the cooling water flow in the plant had been reversed to heat treat the piping to kill barnacles, mussels, and other attached organisms. Water from the discharge vault was recirculated through the plant during this process. As discussed previously, a number of waste streams enter the discharge vault and coliform densities in this water are often quite high. There is no operational explanation for the peak in early July.

MBC collected hourly samples from the intake well during six intensive surveys conducted for OCSD between May and September 2001. Data from five of the intensive surveys were released to the public by OCSD at the end of August. The September data are not yet available. The data from the June and August surveys are presented on Figures 4-7 and 4-8. These figures show there is considerable variability in total coliform levels in the intake well during a 48 hour period. During June, the density ranged from <10 to >24,192 MPN/100 mL and during August the range was 233 to 5,794 MPN/100 mL. The major difference between the two months was the high levels of *Enterococcus* that were present during August. *Enterococcus* were not present in the samples collected in May, June, and early July. They were present in the mid July intensive survey and in the August survey at levels exceeding 1,000 MPN/100 mL in some samples.

Figure 4- 6 Bacteria Densities in the Intake Well

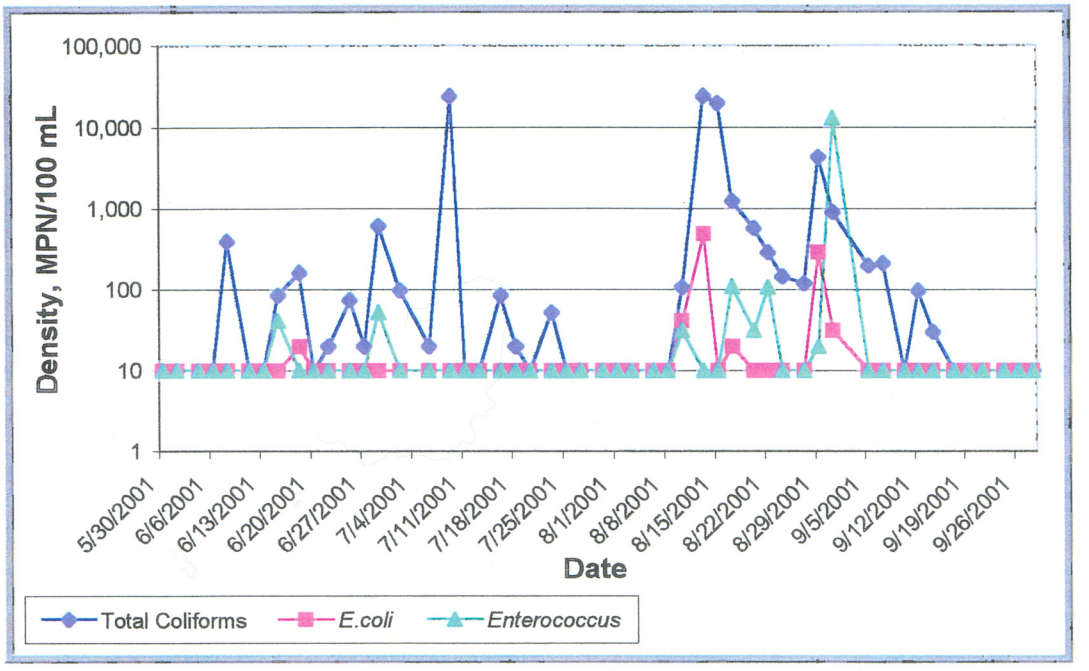


Figure 4- 7 Bacteria Densities in the Intake Well, June 2001

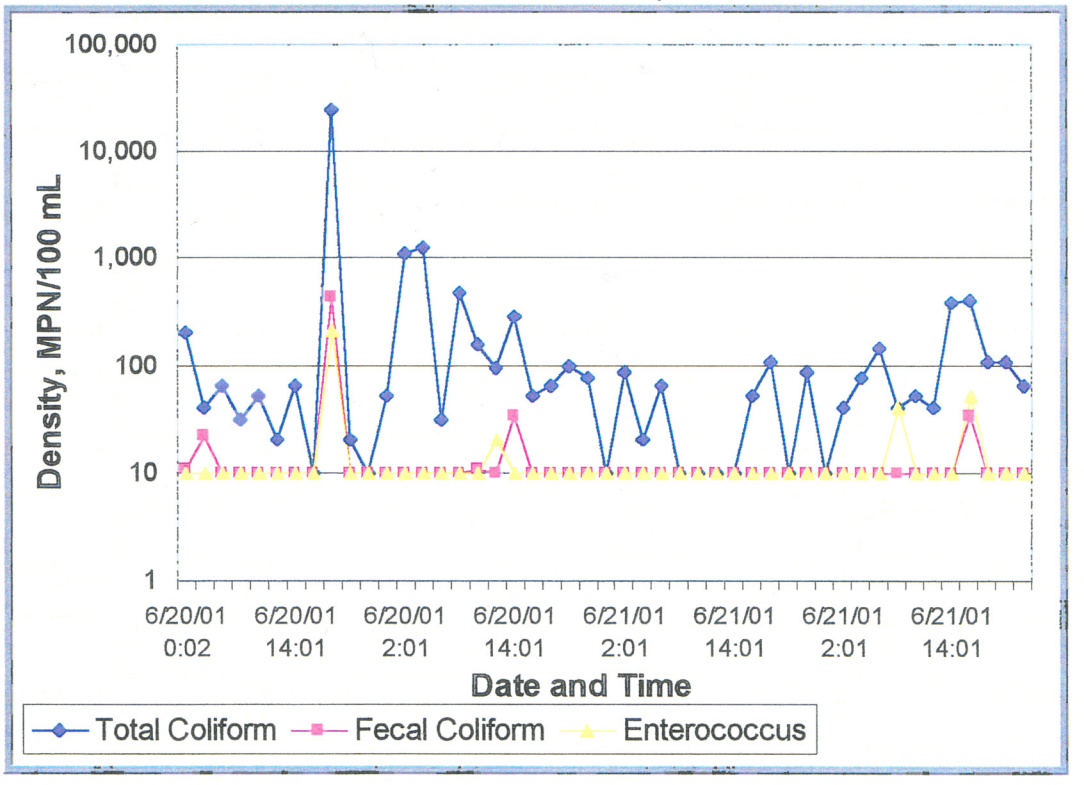
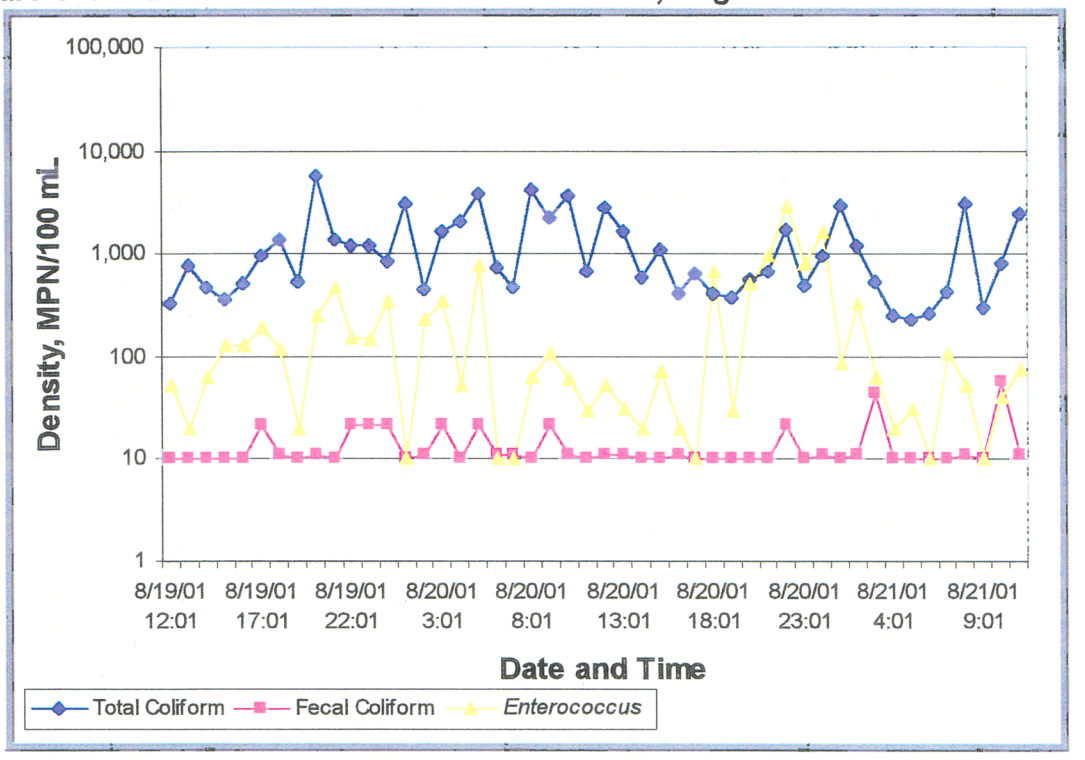


Figure 4- 8 Bacteria Densities in the Intake Well, August 2001



The data from the intake well were compared to data collected at OCSD's montitoring station 2B, which is near the power plant intake in the ocean and should be representative of the quality of water drawn into the intake line and the intake well at the power plant. Samples were collected at various depths at Station 2B. The 5-meter depth is closest to the depth of the intake; however the data from all depths are shown on Figures 4-9 and 4-10. In June the total coliform levels in the intake well were similar to those found in the ocean with the exception of a couple of samples from the intake well that were about one order of magnitude higher than the levels found in the ocean. During August, the levels of total coliforms in the ocean at Station 2B were consistently about an order of magnitude lower than the levels in the intake well. Although not shown on the graph, the fecal coliform, *E. coli*, and *Enterococcus* levels were generally <10 MPN/100 mL at all depths in the ocean at Station 2B, whereas *Enterococcus* densities in the intake well approached and exceeded 1000 MPN/100 mL in many of the samples collected in August.

Poseidon collected data from the intake well on several occasions between January and April 2001. Most of the monitoring was conducted during dry weather events and total and fecal coliforms were below the detection limit of 2 MPN/100 mL. Samples were collected every four hours for 24 hours during the January 10 and 11, 2001 storm event to characterize water quality conditions over the course of the event. Unfortunately, the samples were not diluted by the laboratory so many of the total coliform results were reported as >23 MPN/100 mL. Fecal coliform densities during this event ranged from 9 to 23 MPN/100

mL. Poseidon intends to conduct hourly monitoring during a storm event this winter to better characterize intake water quality during storm events.

Figure 4- 9 Comparison of Total Coliform Densities at AES Intake Well and Ocean Near Intake Structure, June 2001

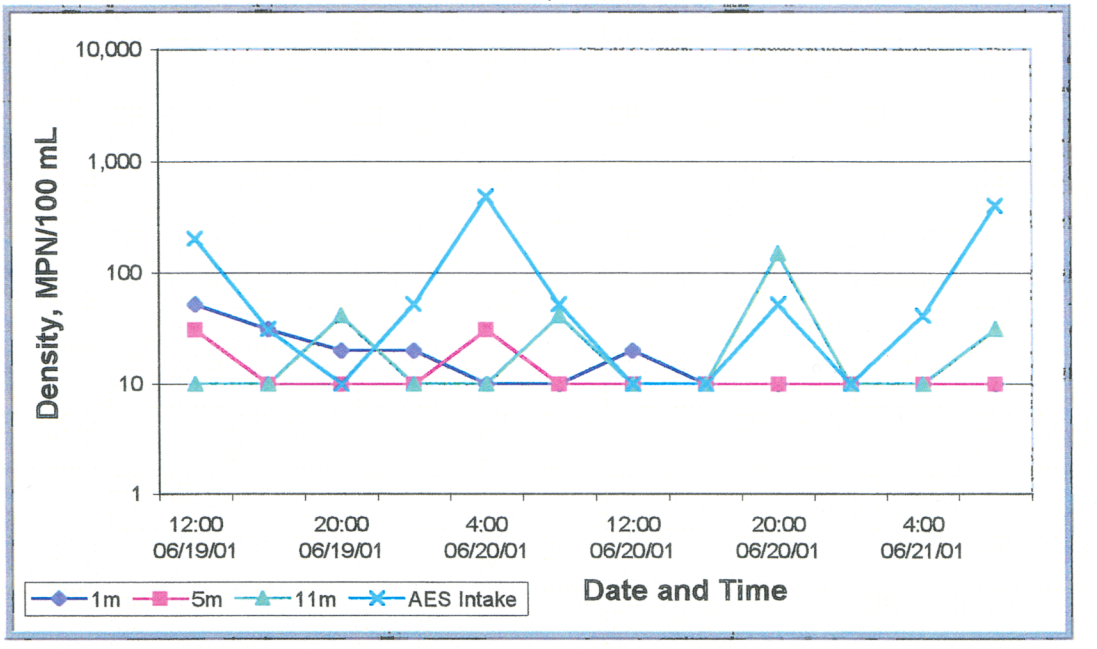
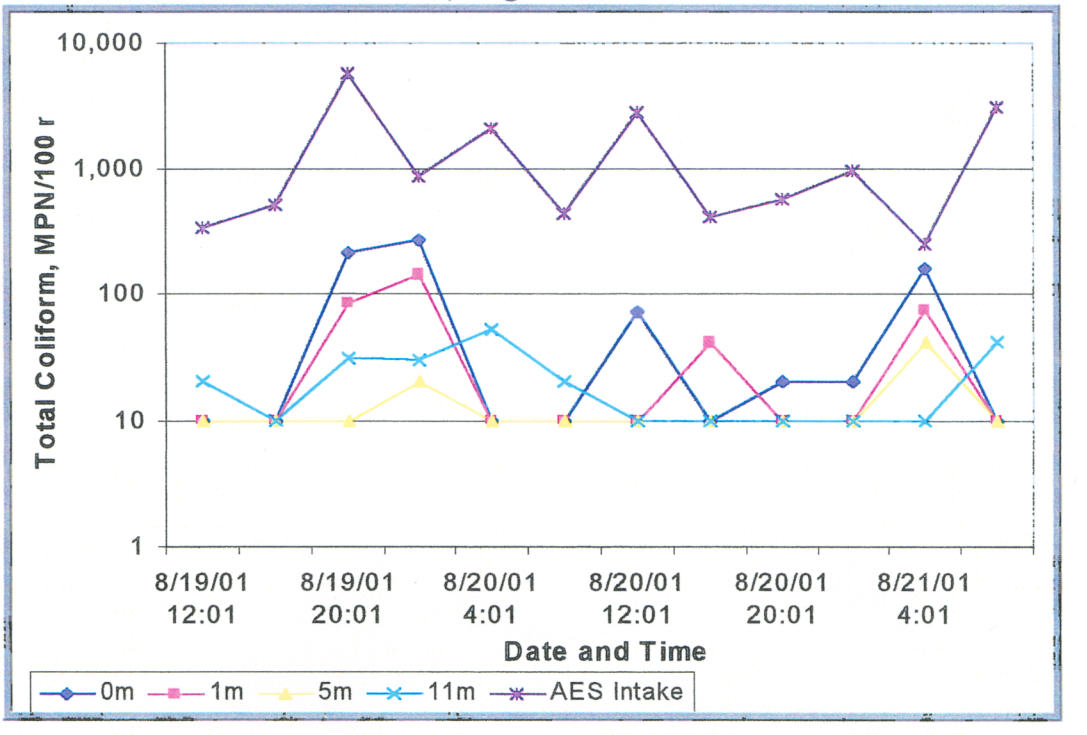


Figure 4- 10 Comparison of Total Coliform Densities at AES Intake and Ocean Near Intake Structure, August 2001



Bacteria in the Discharge Vault and Waste Streams

MBC conducted monitoring on the discharge vault and waste streams during the summer of 2001. Figure 4-11 presents the total coliform, *E. coli*, and *Enterococcus* data for the discharge vault. The total coliform levels often exceeded 24,000 MPN/100 mL during the summer. Although *Enterococcus* and *E. coli* densities were often less than 10 MPN/100 mL, there were a few peaks of *Enterococcus* that exceeded 1000 MPN/100 mL and *E. coli* peaks that exceeded 100 MPN/100 mL.

Figure 4- 11 Bacterial Densities in the Discharge Well

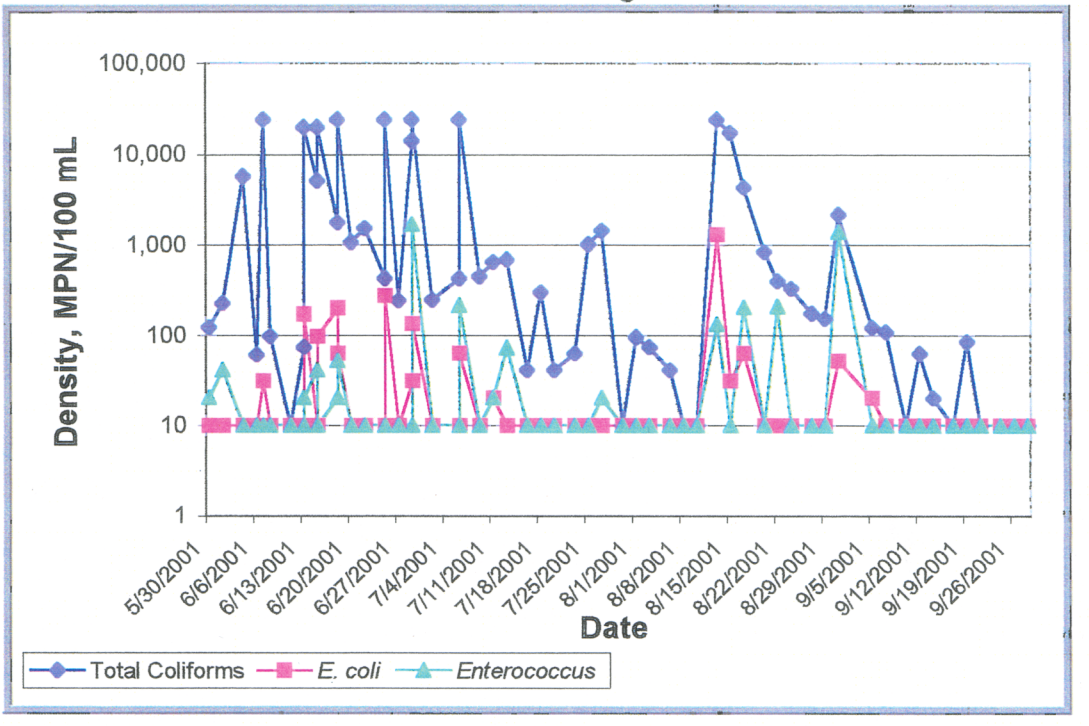


Table 4-4 presents summary data on the bacteriological quality of the discharge vault and waste streams. These data show that the total coliform densities in the retention basins and in the urban drainage that is pumped into the power plant are quite high. When the retention basin water is pumped into the discharge vault, it floats on the surface because it is essentially fresh water with a much lower salinity and density than the seawater that is used for cooling the power plant. The samples collected from the surface of the discharge vault are heavily influenced by the retention basin discharge. The samples from the middle of the discharge vault are more representative of the cooling water densities. The sources of high coliforms in the storm drainage are potentially the Wildlife Care Center, and animal droppings around the humane society facility and in the mobile home park. The source of the high coliforms in the retention basin is currently being investigated by MBC. These data indicate the importance of rerouting these waste streams during construction of the desalination plant so that they are located downstream of the intake to the desalination plant.

Table 4-4 Bacterial Quality of Power Plant Waste Streams

Discharge	Total Coliform, MPN/100 mL			*E. coli*, MPN/100 mL		
	Maximum	Minimum	Median	Maximum	Minimum	Median
West Retention Basin	>24,192	10	12,098	9,804	<10	542
East Retention Basin	>24,192	<10	>22,028	464	<10	63
Urban Runoff	>24,192	17,329	>24,192	1793	86	305
Discharge Vault-surface	>24,192	<10	19,863	275	<10	31
Discharge Vault-middle	24,192	<10	209	1296	<10	<10

Figure 4-12 presents a comparison of the total coliform densities in the intake well and the discharge vault for the summer of 2001. Until mid August, the discharge vault total coliform densities were generally higher than the intake levels. In mid August, the plant flow was reversed for heat treatment of the pipelines. Water from the discharge vault flowed back through the intake well causing the intake well levels to exceed 24,192 MPN/100 mL. After the heat treatment, the intake and discharge vault levels dropped steadily and were essentially equal. Data for the June and August intensive surveys are shown on Figures 4-13 and 4-14, respectively. During the June intensive monitoring period, the total coliform densities in the discharge vault were frequently >24,192 MPN/100 mL, whereas the intake coliform levels were consistently below 1,000 and often less than 100 MPN/100 mL. During the August intensive monitoring, the intake total coliform levels hovered around 1000 MPN/100 mL and the discharge levels were generally between 1000 and 10,000 MPN/100 mL.

Figure 4- 12 Intake Well and Discharge Vault Total Coliform Densities

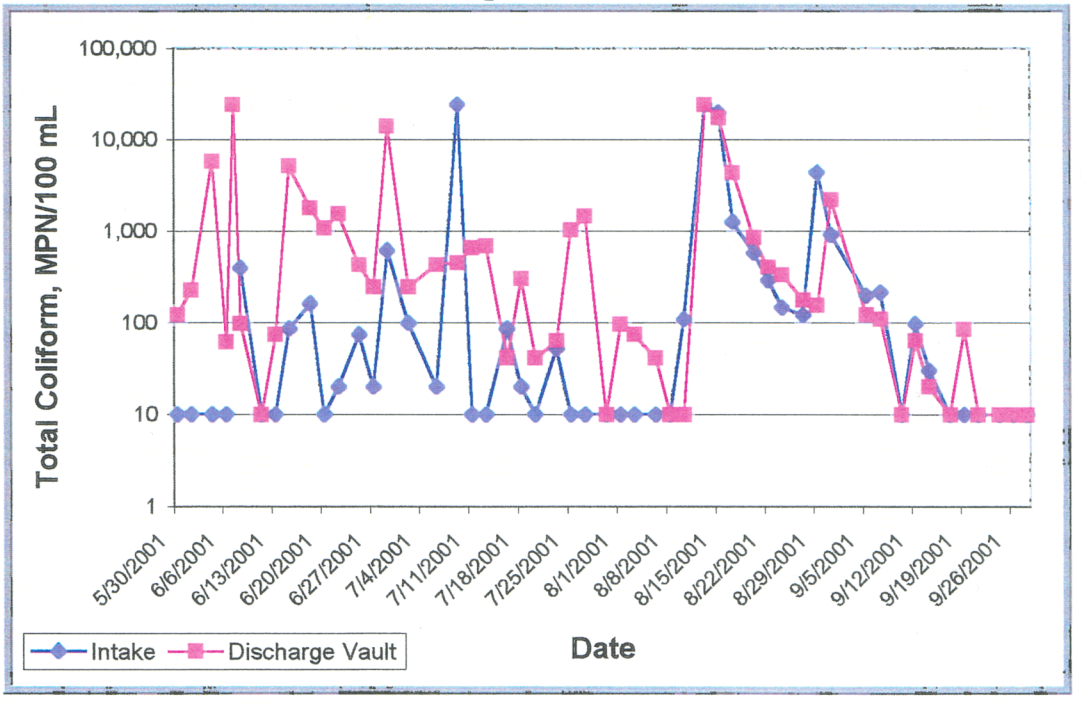


Figure 4- 13 Intake Well and Discharge Vault Total Coliform Densities, June 2001

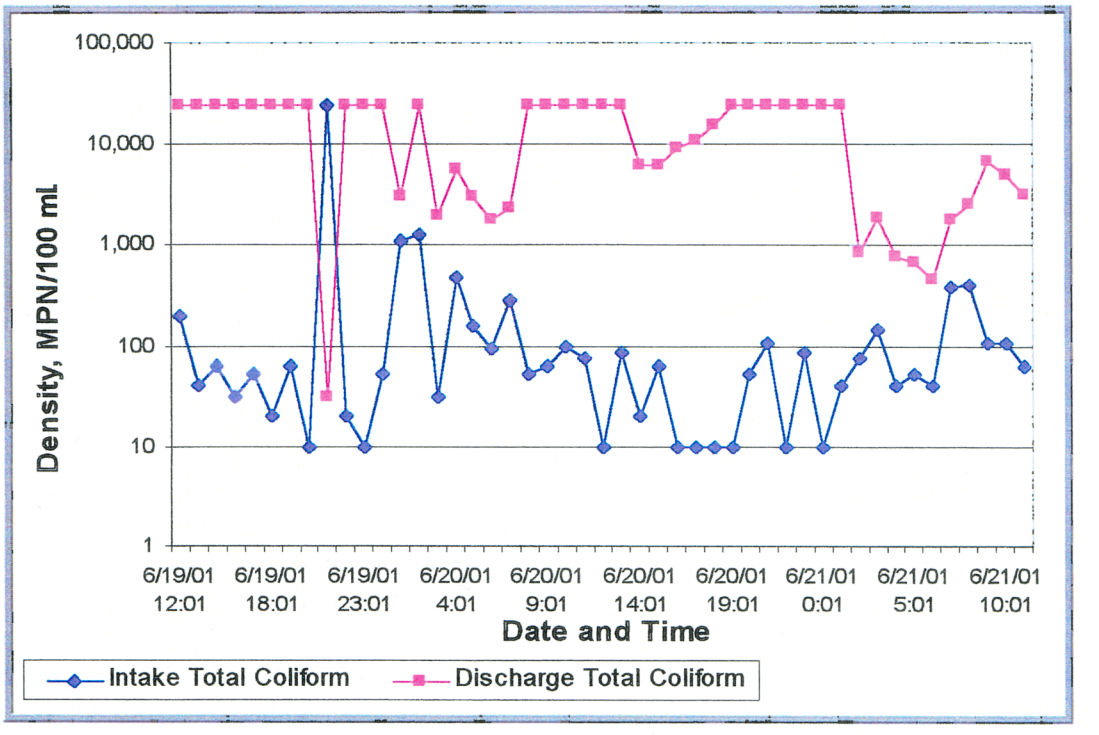
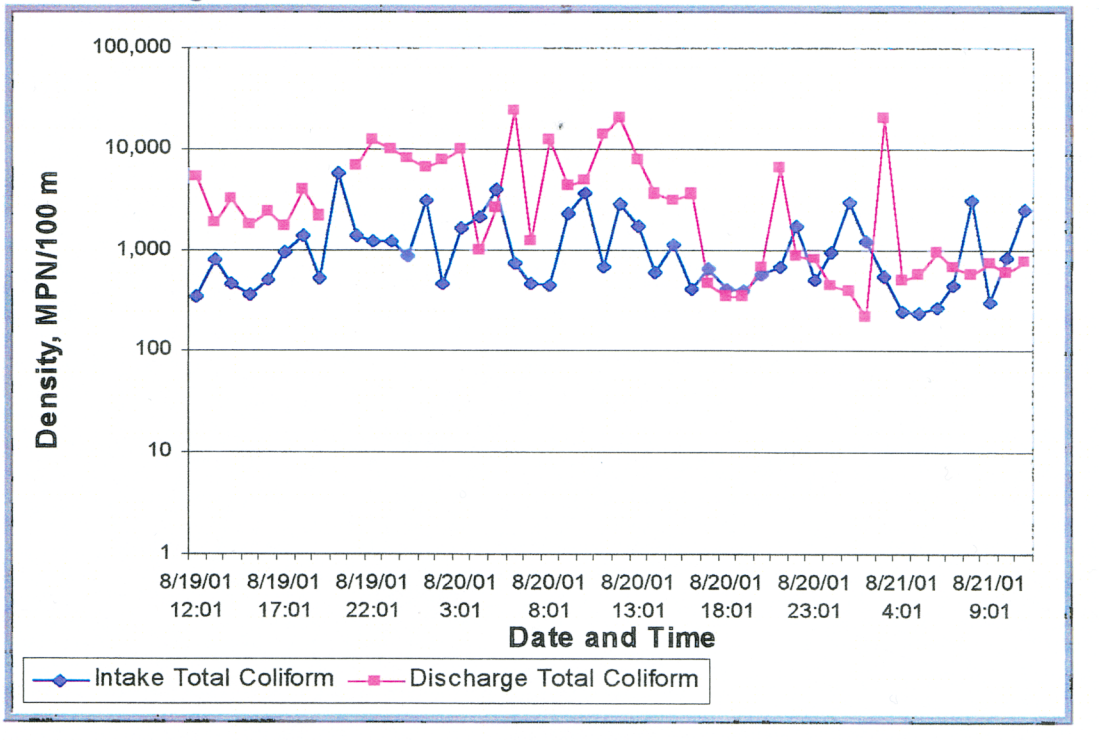


Figure 4- 14 Intake Well and Discharge Vault Total Coliform Densities, August 2001



The potential threats to the microbiological quality of water at the desalination plant intake are sources within the power plant. The modeling conducted for this study and a review of water quality data for various monitoring locations within the vicinity of the power plant intake show that ocean water quality near the intake is not influenced by wastewater or storm water discharges. The ammonia data presented previously and the bacteriological data presented in this section suggest that there is a waste stream entering the intake well that has not been identified. Power plant staff have confirmed that the only discharge to the intake well is the screen wash water and a small amount of pump seal water. Neither of these sources would explain the coliform and *Enterococcus* levels that were found in the intake well. Birds do not roost near the intake well so they are not a likely source. Leakage from the discharge vault into the intake well through the gate structures may be the source of the bacteria since the levels found in the discharge vault were generally higher than the levels found in the intake well. There is also an unidentified source of ammonia and coliforms to the retention basins. MBC is currently analyzing the data that were collected during the summer of 2001 to determine the sources of bacteria at the power plant. Poseidon will reroute the retention basin discharge to be downstream of the intake to the desalination plant so it will not impact intake water quality.

EVALUATION OF ABILITY TO MEET SURFACE WATER TREATMENT REGULATION REQUIREMENTS

The modeling studies conducted for Poseidon showed that storm water and wastewater discharges to the ocean do not affect the water quality at the intake to the power plant. Although recreational use of the beach is high, there is little use of the ocean in the vicinity of the intake due to the distance from shore. The power plant waste streams and the storm drainage from the watershed that is piped into the power plant are the principle sources of microbiological contaminants to the desalination plant. Poseidon will reroute the power plant discharges so that the intake to the desalination plant is upstream of the discharges. The intake well water quality will then be representative of the quality of water that will enter the desalination plant.

As allowed by the SWTR, the monthly median total coliform data were used to determine recommended treatment requirements for the desalination plant. Table 4-5 presents the monthly median total coliform densities at the intake well of the power plant. The total coliform monthly medians at the intake locations range from <2 MPN/100mL in March to 705 MPN/100 mL in August. The dry season is adequately characterized with up to 102 samples per month. The wet season is not fully characterized. Poseidon will collect additional data on coliform densities during a storm event this winter.

Table 4-5 Median Monthly Coliform Densities

Month	Total Coliform, MPN/100 mL			
	Number of Samples	Min	Max	Median
January	7	23	>23	-
February	0			
March	17	<2	<2	<2
April	1	<2		
May	25	<10	>24,192	199
June	60	<10	>24,192	52
July	102	<10	>24,192	20
August	62	<10	>24,192	705
September	11	<10	213	10

These data show that the monthly median total coliform densities during dry weather are below the threshold of 1000 MPN/100 mL used by DHS to trigger higher levels of treatment. Based on the coliform data and the watershed sanitary survey, 3-log removal/inactivation of *Giardia* and 4-log removal/inactivation of viruses appears appropriate during dry weather conditions. Additional data are needed on wet weather conditions to confirm that this level of removal is appropriate year round. In addition, the plant will also have to provide 2-log removal of *Cryptosporidium* to meet the requirements of the IESWTR.

PATHOGEN REMOVAL AND INACTIVATION

The required reductions in *Giardia, Cryptosporidium,* and viruses will be obtained through a combination of removal using DHS certified removal processes and inactivation using a DHS certified disinfection process. The following is a discussion of the capabilities of the desalination treatment processes (pretreatment, RO, and disinfection) to remove/inactivate *Giardia, Cryptosporidium,* and viruses.

TREATMENT PLANT PERFORMANCE

The desalination plant will be operated to remove microbial, chemical, and physical contaminants in the raw water so that drinking water standards are met in the finished water.

Pathogen Removal

Multiple treatment barriers are essential to prevent microbial contaminants from entering the distribution system. A series of barriers will be employed at the Orange County Desalination Plant to decrease variability, increase reliability, and ensure that consistently safe finished water is produced. The treatment barriers will consist of media filtration/cartridge filtration, RO, and disinfection.

Pretreatment

The single-stage granular media direct filtration process that will be used is an established process with a long operational history. DHS allows 2-log removal

credit for *Giardia* and 1-log removal credit for viruses for filters that are operated properly.

Reverse Osmosis

There is not an established operational history for membrane treatment plants with a capacity of 50 MGD. In addition, pilot tests have shown that the degree of removal of pathogens varies greatly depending upon the membrane that is tested. Poseidon is requesting that DHS grant 2-log removal credit for *Giardia, Cryptosporidium,* and viruses for the RO membrane process so that monitoring of EC can be used to assess RO performance. The Orange County Desalination Plant will likely achieve even higher levels of removal.

Disinfection

Chlorine disinfection is a well-established process for inactivating any pathogens that are not removed through the filtration and RO processes. Poseidon will ensure that CT is sufficient to achieve at least 1-log inactivation of Giardia and 4-log inactivation of viruses.

The reliability of each treatment process will be verified upon start-up of the desalination plant. Although, a failure in one unit process puts a greater load on the other processes, the desalination plant will be designed so that failures in a single process will not adversely affect the quality of product water. For example, if the filtration process was not able to remove 1-log viruses due to an upset in one of the filters, the combination of RO and disinfection would provide two barriers and sufficient removal of viruses. Likewise, if a membrane system experiences a minor break in integrity, the combination of filtration and disinfection will provide multiple barriers.

Dissolved Solids, Metals and Organics

The RO process is capable of achieving all primary and secondary MCLs for TDS, metals and organics. RO has excellent performance in the removal of TDS, including monovalent ions such as sodium and chloride. The TDS of the finished water will range from 250 to 350 mg/L.

RO also provides an excellent barrier to trace metals, pesticides and PCB's, volatile organic compounds (VOC), and semi-volatile organic compounds. RO removes almost all organic compounds having a molecular weight greater than 200 to 400. As a result, RO is an extremely efficient process for organics reduction. TOC removal is on the order of 95 percent. Relative to pesticides, RO has demonstrated removal efficiencies of up to 80 percent (McCarty, 1979).

SYSTEM RELIABILITY AND MONITORING

The desalination plant will incorporate redundant treatment capabilities, standby unit processes and real-time monitoring equipment to ensure that a high quality drinking water supply is achieved at all times. Real-time monitoring involves the

continuous analysis of control parameters that give assurance that each unit process is performing in the designed manner. Start-up monitoring is a short-term program conducted to better understand the process train performance and the effectiveness of real-time monitoring.

REAL-TIME MONITORING

Continuous real-time monitoring represents a "first line of defense" to insure proper operation of the desalination plant. Continuous monitoring of key water quality and operational parameters will assist in process control and assure product water quality. Based on past pilot and full-scale experience, it has been found that when parameters monitored on a real-time basis remain within specified boundaries, the performance of the process is also adequate in removing constituents not monitored on a real-time basis.

Reverse Osmosis Pretreatment

Real-time monitoring of the RO pretreatment process will be directed toward identifying problems that could impact the operation of the RO system.

Reverse Osmosis

Due to the importance of the RO unit performance, several parameters covering the system's feed, product, and reject streams will be monitored real-time. Software will be used to normalize the data for each parameter and identify deviations from predetermined operational criteria. These parameters are presented in Table 4-6.

Table 4-6 Real-Time Monitoring Parameters

Feed	Permeate	Reject	Other
Temperature Pressure Conductivity PH Flow Turbidity	Conductivity Flow	Flow	Feed/Reject Channel Differential Pressure

START-UP MONITORING

Extensive monitoring will be conducted during the start-up phase of operation to ensure that the treatment plant is performing adequately. During the start-up phase, monitoring will be conducted to further evaluate some of the potential contaminants that are discussed in this chapter and in Chapter 3.

Microbiological Monitoring

Based on the monitoring completed to date, the bacteriological densities at the intake to the desalination plant have been adequately quantified for dry weather conditions. Additional data are needed during at least one storm event to characterize the intake quality under storm conditions. Poseidon will conduct

hourly monitoring during a significant storm event prior to or during start-up operations to better characterize the quality of water at the intake during storms.

Inorganic Contaminants

Poseidon will collect a sample of the treated water and analyze it for the inorganic chemicals listed in Table 4-2 (Title 22 Table 64431-A) during or soon after start up of the desalination plant. The sample will be analyzed using the detection limits for purposes of reporting (DLRs) listed in Title 22 Table 64432-A. If none of the chemicals exceeds the MCLs in the finished water, annual sampling for inorganic chemicals will satisfy the DHS regulations and will adequately protect public health. Nitrate and nitrite will be monitored quarterly in the finished water per DHS regulations.

Asbestos

Asbestos was not monitored in the samples collected by Poseidon from the intake well. It is unlikely that asbestos fibers would be present in the treated water, however, Poseidon will collect one sample from the treated water during plant start-up operations and have it analyzed for asbestos to ensure that the asbestos MCL is being met.

Organic Contaminants

Poseidon will collect a sample of the treated water and analyze it for the organic chemicals listed in Title 22 Table 64444-A during start-up operations or shortly thereafter. The sample will be collected during a significant storm event to test the performance of the plant under worst case raw water quality conditions. Quarterly samples will be collected for one year. The samples will be analyzed using the DLRs listed in Title 22 Table 64445.1-A. If none of the chemicals exceeds the MCLs in the finished water, annual sampling for inorganic chemicals will satisfy the DHS regulations and will adequately protect public health.

Aesthetic Monitoring

Several of the secondary MCLs were exceeded in the raw water samples collected by Poseidon. It is expected that these contaminants will be removed by the desalination plant but this will be confirmed by analyzing a sample of the finished water upon start-up of the plant for the contaminants for which secondary MCLs have been established.

Unregulated Contaminants Monitoring

Poseidon will collect quarterly samples of the finished water for the first year of operation of the desalination plant for the unregulated chemicals listed in Title 22 Tables 64450 to comply with DHS regulations.

CHAPTER 5
WATERSHED MANAGEMENT STRATEGIES

Most sanitary surveys identify best management practices and watershed management activities that the water supplier can implement or track to ensure that degradation of intake water quality does not occur. The watershed for the Orange County Desalination Plant is a small, relatively simple watershed. There are few potential sources of contaminants because the water is drawn from the ocean at a distance of 2,292 feet from the shore in 34 feet of water. Activities at the AES Huntington Beach L.L.C. Power Plant (Huntington Beach Power Plant) have the greatest potential to impact intake water quality. Poseidon Resources Corporation (Poseidon) will work with AES to be alerted to any potential water quality problems.

NOTIFICATION OF SPILLS AT POWER PLANT SITE

Prior to plant start-up, Poseidon will meet with AES environmental staff to discuss the need to protect the desalination plant from petroleum products or chemicals used at the power plant site. Although there are many precautions taken to avoid spills of hazardous materials at the power plant, Poseidon will request that AES notify them of any spills that reach the cooling water system so that the desalination plant intake water quality can be more closely monitored.

NOTIFICATION OF HEAT TREATMENT AND NON-ROUTINE OPERATIONS OR DISCHARGES TO THE COOLING WATER SYSTEM

During the periodic heat treatments at the power plant, water from the discharge vault is recirculated through the power plant. Although Poseidon will reroute the process wastewater and urban drainage downstream of the discharge vault during construction of the desalination plant, the heat treatment water will contain the concentrated seawater discharge from the desalination plant and could contain additional cycle water discharges. Poseidon will meet with AES to gain a better understanding of the frequency and duration of heat treatments. Poseidon will request that AES notify them of any planned heat treatments so that precautions can be taken to avoid taking this recirculated water into the desalination plant. Poseidon will also request that AES notify them of any non-routine operations or discharges to the cooling water system.

MONITORING SYSTEM

Poseidon will install equipment capable of sensing contaminants that could damage treatment processes in the intake line of the desalination plant as another line of defense in case there are spills at the power plant site that are not detected at the source. When contaminants are detected by the monitoring system, the treatment plant will automatically adjust operations or shutdown.

CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

A watershed sanitary survey was conducted to identify the potential sources of contaminants to the desalination plant proposed by Poseidon Resources Corporation (Poseidon) at the AES Huntington Beach L.L.C. Power Plant (Huntington Beach Power Plant). This chapter presents the key conclusions and recommendations from this survey.

CONCLUSIONS

The key conclusions from the sanitary survey are presented in this section.

SOURCES OF WATER

The modeling studies conducted as part of this sanitary survey showed that seawater is the source of water to the desalination plant. Water quality at the intake to the Huntington Beach Power Plant is not influenced by storm water discharges from the Santa Ana River and Talbert Marsh. Similarly, flushing of Talbert Marsh during summer El Niño conditions has no impact on water quality at the intake. The modeling studies also showed that wastewater from the Orange County Sanitation District does not reach the intake to the power plant and the discharge from the power plant is not recirculated into the intake.

CONTAMINANT SOURCES

There are few contaminant sources with the potential to impact the water quality at the intake to the desalination plant. Contaminant sources in the watershed which have been judged to be insignificant are wastewater, urban runoff, oil and gas extraction activities, recreation, and red tides. Activities at the Huntington Beach Power Plant have the most potential to impact raw water quality due to the proximity to the desalination plant intake and the nature and volume of materials stored and used on the site.

Process Wastewater and Drainage

Currently, the power plant process wastewater, and drainage from the power plant yard, generating unit floors, and the adjoining watershed are discharged upstream of the desalination plant intake. The quality of these discharges is poor with respect to microbial contaminants. Poseidon will reroute these discharges so they enter the power plant outfall line downstream of the discharge vault and the intake to the desalination plant so they will not pose a risk to water quality at the intake.

Leakage From Discharge Vault

There is a source of bacteria and ammonia to the intake well that has not been completely identified. The increase in bacteria and ammonia concentrations between the ocean intake and the intake well may be due to leakage from the adjoining discharge vault. The discharge vault occasionally has concentrations of bacteria that exceed the detection level of 24,000 MPN/100 mL and ammonia concentrations as high as 1.7 mg/L due to the waste streams that enter it. It is anticipated that when the waste streams are rerouted during construction of the desalination plant, the quality of water in the discharge vault will improve since it will no longer be receiving the process wastewater and urban drainage that currently lead to the high levels of bacteria and ammonia. If leakage from the discharge vault has caused the bacteria and ammonia concentrations to increase over the levels found in the ocean, the quality of the intake well water should improve when the current discharges to the vault are rerouted.

Cycle Water Discharges

The power plant cycle water discharges do not pose a significant risk due to the nature of the chemicals present in the discharges and the small volumes compared to the cooling water volume.

Heat Treatment

Periodic heat treatment may pose a significant risk to water quality at the desalination plant intake. Currently all of the process wastewater, power plant floor and yard drainage, and offsite urban drainage are routed to the discharge vault. During heat treatment, water from the discharge vault is recirculated through the power plant. Since Poseidon will reroute the waste streams during construction of the desalination plant, the discharge vault water quality should improve. However, the heat treatment water will include the concentrated seawater discharge from the desalination plant and could possibly contain higher than normal quantities of cycle water. Poseidon will not take water into the desalination plant during heat treatments.

Catastrophic Spills

Although AES has had no reportable spills in recent years, there is always the potential for a spill of oil or a hazardous chemical. Due to the configuration of the cooling water system and safeguards that route most of the plant drainage to oil/water separators and the retention basins, small spills at the power plant will not reach the cooling water system. Although highly unlikely, there is the potential for a large spill due to a natural disaster such as an earthquake or explosion. Under this scenario, the operation of the desalination plant will be curtailed and possibly discontinued until the spill's effect on water quality is mitigated.

WATER QUALITY

Water quality data were obtained from several sources and analyzed for this sanitary survey. The desalination plant will be able to treat the water from the Pacific Ocean to meet all drinking water standards and provide the customers in Orange County with a healthful, safe drinking water.

Compliance with Maximum Contaminant Levels

The water in the power plant intake well is generally of high quality. All contaminants were below the primary maximum contaminant levels (MCLs) established by the Department of Health Services (DHS) in several samples collected from the intake well. As expected in seawater, the concentrations of total dissolved solids (TDS), chloride, and sulfate are substantially higher than the secondary MCLs. The desalination plant will treat the water to remove metals, organics, and salts to levels below drinking water standards. Testing will be conducted upon plant start-up to confirm that drinking water standards are met in the treated water.

Although the total organic carbon concentration in the treated water is predicted to be less than 0.1 mg/L, the predicted bromide concentration of 270 mg/L may create the potential for the formation of brominated disinfection byproducts (DBPs) in the distribution system if the water is blended with other supplies of incompatible water quality and disinfection practices. The desalination plant disinfection strategy will be adjusted to that of existing water sources to minimize DBP formation in the distribution system. Poseidon will conduct an analysis of DBP formation when the distribution system and blending options are identified to conform with DBP regulations.

Pathogen Removal Requirements

Based on the coliform data and the watershed sanitary survey, 3-log removal/inactivation of Giardia and 4-log removal/ inactivation of viruses appears appropriate during dry weather conditions. This level of removal will likely be appropriate during wet weather conditions, particularly since the waste streams that have high levels of bacteria will be rerouted so that they will have no impact on intake water quality. In addition, the plant will also have to provide 2-log removal of Cryptosporidium to meet the requirements of the Interim Enhanced Surface Water Treatment Rule. The desalination plant will be able to comply with these removal requirements.

RECOMMENDATIONS

The following recommendations for collecting water quality data and for tracking activities in the watershed were made by the consultant conducting the sanitary survey. Poseidon has committed to conducting the water quality monitoring to ensure that the water delivered to consumers meets all drinking water standards.

The results of the monitoring will be promptly shared with DHS. Poseidon has also committed to the recommended watershed management practices.

REAL-TIME MONITORING

Continuous monitoring of key water quality parameters, such as electrical conductivity (EC), pH, and turbidity of the product water at the desalination plant will be conducted to assist in process control and assure product water quality. Both the pretreatment and the reverse osmosis (RO) unit performance will be monitored.

Reverse Osmosis Pretreatment	*Real-time monitoring of the RO pretreatment process will be directed toward identifying problems that could impact the operation of the RO system.*
Reverse Osmosis	*Due to the importance of the RO unit performance, several parameters covering the system's feed, product, and reject streams will be monitored real-time. Software will be used to normalize the data for each parameter and identify deviations from predetermined operational criteria.*

RAW AND FINISHED WATER QUALITY MONITORING

Extensive monitoring will be conducted during the start-up phase of operation to ensure that the treatment plant is performing adequately and to further evaluate some of the potential contaminants that are found in the source water.

Microbiological Monitoring	*Poseidon will conduct hourly monitoring during a significant storm event during the fall and winter of 2001/2002 to better characterize the quality of water at the intake during storms.*
Drinking Water Contaminant Monitoring	*Poseidon will collect a sample of the treated water and analyze it for the inorganic and organic chemicals and physical parameters that are regulated by DHS through primary and secondary MCLs. Poseidon will then conduct the routine monitoring for these chemicals required by Title 22 Drinking Water Regulations.*
Unregulated Contaminants Monitoring	*Poseidon will collect quarterly samples of the finished water for the first year of operation of the desalination plant for unregulated chemicals listed in Title 22 Table 64450 to comply with DHS regulations.*

WATERSHED MANAGEMENT STRATEGIES

Activities at the Huntington Beach Power Plant have the greatest potential to impact intake water quality. Poseidon will work with AES to ensure early detection and mitigation of any potential water quality problems.

Notification of Spills at Power Plant Site

Prior to plant start-up, Poseidon will meet with AES environmental staff to discuss the need to protect the desalination plant intake from petroleum products or chemicals used at the power plant site. Although there are many precautions taken to avoid spills of hazardous materials at the power plant, Poseidon will request that AES notify them of any spills that reach the cooling water system so that the desalination plant intake water quality is closely monitored.

Notification of Heat Treatment and Non-routine Operations or Discharges to the Cooling Water System

During the periodic heat treatments at the power plant, water from the discharge vault is recirculated through the power plant. Although Poseidon will reroute the process wastewater and urban drainage downstream of the discharge vault during construction of the desalination plant, the heat treatment water will contain concentrated seawater discharge from the desalination plant and could contain additional cycle water discharges. Poseidon will not take water into the desalination plant during heat treatment. Poseidon will meet with AES to gain a better understanding of the frequency and duration of heat treatments. Poseidon will request that AES notify them of any planned heat treatments so that precautions can be taken to avoid taking this recirculated water into the desalination plant. Poseidon will also request that AES notify them of any non-routine operations or discharges to the cooling water system.

Monitoring System

Poseidon will install equipment capable of detecting contaminants that could damage treatment processes in the intake line of the desalination plant as another line of defense in case there are spills at the power plant site that are not detected at the source. When contaminants are detected by the monitoring system, the treatment plant will automatically adjust operations or shut down.

REFERENCES

AES Huntington Beach, L.L.C. 1998. "Hazardous Materials/Waste Management & Contingency Plan."

American Water Works Association. 1990. Water Quality and Treatment, A Handbook of Community Water Supplies. Fourth Edition, McGraw Hill, Inc. New York.

California Department of Conservation. 2000. Map 134 Huntington Beach. Division of Oil, Gas, and Geothermal Resources.

California Department of Health Services. 1991. "Surface Water Treatment Staff Guidance Manual." Office of Drinking Water.

California Department of Health Services. 2000a. "Guidance Drinking Water Source Assessments For Surface Water Sources."

California Department of Health Services. 2000. Shellfish Information Line. (800) 553-4133.

Grant, S.B, C. Webb, B.F. Sanders, A.B. Boehm, J.H. Kim, J.A. Redman, A.K. Chu, R.D. Mrse, S. Jiang, N.A. Gardiner, A. Brown. 2000. "Huntington Beach Water Quality Investigation Phase II: An Analysis of Ocean Surf Zone, Watershed, Sediment and Groundwater Data Collected from June 1998 through September 2000." Prepared for National Water Research Institute, County of Orange, Cities of Huntington Beach, Fountain Valley, Costa Mesa, Santa Ana, Newport Beach, Orange County Sanitation District.

Grant, S.B., B.F. Sanders, A.B. Boehm, J.A. Redman, J.H. Kim, R.D. Mrse, A.K. Chu, M. Gouldin, C.D. McGee, N.A. Gardiner, B.H. Jones, J. Svejkovsky, G.V. Leipzig, A. Brown. 2001. "Generation of Enterococci Bacteria in a Coastal Saltwater Marsh and Its Impact on Surf Zone Water Quality."

Ibrahim, A.M.M. 1999. "Review of the Effects of Red Tides on Desalination Plants." Proceedings of the International Desalination Association.

Jenkins, S.A. & J. Wasyl. 2002. "Hydrodynamic Modeling of Source Water Make-up and Concentrated Seawater Dilution for the Ocean Desalination Project at the AES Huntington Beach Power Station Part II: Analysis of Issues to Source Water."

MEC Analytical Systems, Inc. 1999. Dye Study Report. Prepared for Orange County Sanitation District.

National Oceanographic and Atmospheric Administration. 1998. West Coast Marine Biotoxins & Harmful Algal Blooms Newsletter. Northwest Fisheries Science Center.

National Water Research Institute. 2000. "Report of the Blue Ribbon Panel Review of the Draft Report of the Huntington Beach Water Quality Investigations Phase II: An Analysis of Ocean, Surf Zone, Watershed, Sediment and Groundwater Data Collected from June 1998 through September 2000."

National Water Research Institute. 2000. "Report of the Blue Ribbon Panel Review of the Draft Report of the Huntington Beach Water Quality Investigations Phase II: An Analysis of Ocean, Surf Zone, Watershed, Sediment and Groundwater Data Collected from June 1998 through September 2000."

Noble, R.T., M.K. Leecaster, C.D. McGee, D.F. Moore, V. Orozco-Borbon, K. Schiff, P. Vainik, and S.B. Weisberg. 2000. "Southern California Bight 1998 Regional Monitoring Program Volume 3: Storm Event Shoreline Microbiology."

Orange County Sanitation District. 1999. "Huntington Beach Closure Investigation, Phase I Final Report."

Orange County Sanitation District. 2001. "Investigation of Shoreward Transport of the Orange County Sanitation District's Submerged Wastewater Field, Survey Report October 23, 2000 and November 27 and 30, 2000 Field Sampling."

Personal Communication, Karen Ashby, Orange County Public Facilities and Resources Department, May 2001.

Personal Communication, Shane Beck, MBC, October 2001.

Personal Communication, Mary Beth Broeren, City of Huntington Beach, May 2001.

Personal Communication, John Coleman, State Lands Commission, October 2001.

Personal Communication, Nancy Gardiner, URS Corporation, March 2001.

Personal Communication, Stanley Grant, University of California, Irvine, March 2001

Personal Communication, Larry Honeybourne, Orange County Health Care Agency, April 2001.

Personal Communication, John Izbicki, United States Geological Survey, March 2001.

Personal Communication, Chris Kabozik, Orange County Public Works Department, May 2001.

Personal Communication, Terry Kuntz, AES, January, February 2001

Personal Communication, Geraldine Lucas, City of Huntington Beach, April 2001

Personal Communication, Chuck Mitchell, MBC, September, 2001

Personal Communication, Bruce Moore, Orange County Public Facilities and Resources Department, March, May 2001

Personal Communication, Lisa Murphy, Orange County Sanitation District, February 2001

Personal Communication, Dave Sanchez, Department of Conservation, Division of Oil, Gas, and Geothermal Resources, October 2001.

Personal Communication, Mary Anne Skorpanich, Orange County Public Facilities and Resources Department, March 2001.

Personal Communcation, Dave Vilas, MBC, September 2001.

Riley, J.P. and R. Chester. 1971. Introduction to Marine Chemistry. Academic Press London and New York.

Scholin, C.A., et.al. 2000. "Mortality of Sea Lions Along the Central California Coast Linked to a Toxic Diatom Bloom." Nature 403(6765):80-4.

Southern California Edison. 1998. Spill Prevention Control and Countermeasure Plan, AES Huntington Beach L.L.C.

Williamson & Schmid. 1993. City of Huntington Beach Master Plan of Drainage.

ftp.ocsd.com - Orange County Sanitation District data

www.oc.ca.gov/hcal - Orange County Health Care Agency data on underground tanks and hazardous waste.

www.ocsd.com/Environment/MonitoringTheEnvironment - Orange County Sanitation District data

www.waterdata.usgs.gov/nwis - United States Geological Survey data.

APPENDIX A
DRINKING WATER SOURCE ASSESSMENT SUMMARY

DRINKING WATER SOURCE ASSESSMENT

ORANGE COUNTY DESALINATION PROJECT

POSEIDON RESOURCES CORPORATION

Prepared by
Archibald & Wallberg Consultants

November 2001

Assessment Summary

INTRODUCTION

This drinking water source assessment was conducted for the Orange County Desalination Plant in conjunction with the sanitary survey of the watershed. The desalination plant will obtain its source water from the cooling water of the AES Huntington Beach L.L.C. Power Plant (Huntington Beach Power Plant). The intake for the power plant is in the Pacific Ocean, 2,292 feet from shore in water with a depth of 34 feet.

The watershed for the Orange County Desalination Plant consists of 430 acres of the Pacific Ocean near the power plant intake and 150 acres of land that consists of the power plant site and the land that drains to the power plant. The primary uses of the land portion of the watershed are the power plant, a mobile home and recreational vehicle park to the west, a wildlife care center to the south, and a small commercial area to the north that is bordered by the Huntington Beach flood control channel. Pacific Coast Highway traverses the watershed and separates Huntington State Beach from the remainder of the land portion of the watershed.

ASSESSMENT PROCEDURES

The source water assessment for the Orange County Desalination Plant was conducted by Elaine Archibald of Archibald & Wallberg Consultants under contract to Poseidon Resources Corporation (Poseidon). The following sources of information were used:

- Driving/walking field survey of the watershed
- Interviews with Huntington Beach Power Plant staff
- Interviews with individuals who work for agencies with jurisdiction in the watershed
- Review of numerous documents (listed in the reference list for the sanitary survey).

DISCUSSION OF VULNERABILITY

There are few contaminant sources with the potential to impact the water quality at the intake to the desalination plant. Activities at the Huntington Beach Power Plant have the most potential to impact raw water quality due to the proximity to the desalination plant intake and the nature and volume of materials stored and used on the site.

Table 1 is the potentially contaminating activities (PCA) checklist for the Orange County Desalination Plant watershed. Table 2 is the vulnerability analysis. The risk ranking for a number of PCAs was reduced from high to moderate using the procedure outlined in Appendix E of the Guidance Manual. The basis for the reduction in risk ranking is the small volume of contaminants in relation to the amount of cooling water pumped through the power plant and the relative isolation of the cooling water system from some of these PCAs.

Table 1
PCA Checklist

PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B	PCA in Watershed	Unknown
Commercial/Industrial					
Automobile Related Activities					
Body shops (H)	X				
Car washes (M)	X				
Gas stations (VH)	X				
Repair shops (H)	X				
Boat services/repair/ refinishing (H)	X				
Chemical/petroleum processing/storage (VH)	X				
Chemical/petroleum pipelines (H)		X			
Dry cleaners (VH)	X				
Electrical/electronic manufacturing (H)	X				
Fleet/truck/bus terminals (H)	X				
Furniture repair/ manufacturing (H)	X				
Home manufacturing (H)	X				
Junk/scrap/salvage yards (H)				X	
Machine shops (H)		X			
Metal plating/finishing/ fabricating (VH)	X				
Photo processing/ printing (H)	X				
Plastics/synthetics producers (VH)	X				
Research laboratories (H)	X				
Wood preserving/ treating (H)	X				
Wood/pulp/paper processing and mills (H)	X				
Lumber processing and manufacturing (H)	X				
Sewer collection systems (H if in zones, otherwise L)	X				
Parking lots/malls (>50 spaces) (M)		X		X	
Cement/concrete plants (M)	X				
Food processing (M)	X				
Funeral services/ graveyards (M)	X				
Hardware/lumber/parts stores (M)	X				
Appliance/Electronic Repair (L)	X				
Office buildings/ complexes (L)		X			
Rental Yards (L)	X				
RV/mini storage (L)	X				
Residential/Muncipal					
Airports – Maintenance/ fueling areas (VH)	X				
Landfills/dumps (VH)	X				
Railroad yards/ maintenance/fueling areas (H)	X				
Septic systems – high density (>1/acre) (VH if in Zones, otherwise M)	X				

Table 1
PCA Checklist

PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B	PCA in Watershed	Unknown
Sewer collection systems (H, if in Zones, otherwise L)		X		X	
Utility stations – maintenance areas (H)		X			
Wastewater treatment plants (VH in Zones, otherwise H)	X				
Drinking water treatment plants (M)	X				
Golf courses (M)	X				
Housing – high density (>1 house/0.5 acres) (M)	X				
Motor pools (M)	X				
Parks (M)				X	
Waste transfer/recycling stations (M)	X				
Apartments and condominiums (L)	X				
Campgrounds/Recreational areas (L)	X				
Fire stations (L)	X				
RV Parks (L)				X	
Schools (L)	X				
Hotels, Motels (L)	X				
Agricultural/Rural					
Grazing (>5 large animals or equivalent per acre) (H in Zones, otherwise M)	X				
Concentrated Animal Feeding Operations (CAFOs) as defined in federal regulation1 (VH in Zones, otherwise H)	X				
Animal Feeding Operations as defined in federal regulation2 (VH in Zones, otherwise H)	X				
Other Animal operations (H in Zones, otherwise M)				X	
Concentrated Aquatic Animal Production Facilities, as defined in federal regulation (VH in Zones, otherwise H)	X				
Other Aquatic Animal production operations (H in Zones, otherwise M)	X				
Managed Forests (VH in Zones, otherwise H) (unless additional detail provided*)	X				
Farm chemical distributor/application service (H)	X				
Farm machinery repair (H)	X				
Septic systems – Low density (<1/acre) (H in Zones, otherwise L)	X				
Lagoons/liquid wastes (H)	X				
Machine shops (H)	X				

Table 1
PCA Checklist

PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B	PCA in Watershed	Unknown
Pesticide/fertilizer/petroleum storage & transfer areas (H)	X				
Agricultural Drainage (H in zones, otherwise M)	X				
Wells – Agricultural/Irrigation (H)	X				
Crops, irrigated (berries, hops, mint, orchards, sod, greenhouses, vineyards, nurseries, vegetable) (M)	X				
Sewage sludge/biosolids application (M)	X				
Fertilizer, Pesticide/Herbicide Application (M)	X				
Crops, nonirrigated (e.g., Christmas trees, grains, grass seeds, hay, pasture (L) (includes drip-irrigated crops)	X				
Managed Forests - Broadcast fertilized areas (M in Zones, otherwise L)	X				
Managed Forests - Clear-cut harvested <30 years (VH in Zones, otherwise H)	X				
Managed Forests - Partial harvested <10 years (H in Zones, otherwise M)	X				
Managed Forests - Road density >2 mi/sq. mi) (H in Zones,	X				
Other Activities					
NPDES/WDR permitted discharges (H)		X		X	
Underground Injection of Commercial/Industrial Discharges (VH)	X				
Historic gas stations (VH)	X				
Historic waste dumps/landfills (VH)	X				
Illegal activities/unauthorized dumping (H)	X				
Injection wells/dry wells/sumps (VH)	X				
Known contaminant plumes (VH)	X				
Military installations (VH)	X				
Mining Operations Historic (VH)	X				
Mining Operations – Active (VH)	X				
Mining – Sand/Gravel (H)	X				
Wells – Oil, Gas, Geothermal (H)	X				
Salt Water Intrusion (H)	Not applicable				
Recreational area – surface water source (H)				X	
Snow Ski Areas (H in Zones, otherwise M)	X				
Recent (<10 years) Burn Areas (H in Zones, otherwise M)	X				
Dredging (H in Zones, otherwise M)	X				

Table 1
PCA Checklist

PCA (Risk Ranking)	No PCA in zones	PCA in Zone A	PCA in Zone B	PCA in Watershed	Unknown
Confirmed leaking tanks (VH)	X				
Decommissioned – inactive tanks (L)	X				
Non-regulated tanks (tanks smaller than regulatory limit) (H)	X				
Not yet upgraded or registered tanks (H)	X				
Upgraded and/or registered – active tanks (L)		X			
Above ground storage tanks (M)		X			
Wells – Water supply (M)	X				
Construction/demolition staging areas (M)	X				
Contractor or government agency equipment storage yards (M)	X				
Freeways/state highways (M)				X	
Railroads (M)	X				
Historic railroad right-of-ways (M)	X				
Road Right-of-Ways (herbicide use areas) (M)				X	
Roads/Streets (L)				X	
Hospitals (M)	X				
Storm Drain Discharge Points (M)		X			
Storm Water Detention Facilities (M)	X				
Injection wells (potable water) (L)	X				
Injection wells (non-potable water) (M)	X				
Spreading Basins (potable water) (L)	X				
Spreading Basins (non-potable water) (M)	X				
Medical/dental offices/clinics (L)	X				
Veterinary Offices/clinics (L)	X			X	
Surface water – streams/lakes/rivers (L)	Not applicable				
Other (list)					

Table 2
Vulnerability Analysis

Zone	Type of PCA	PCA Points	Zone Points	PBE Points	Vulnerability Score	Basis for Modification to PCA Points
A	NPDES permitted discharges	5	5	5	15	
A	Chemical/petroleum pipelines	3	5	5	13	Small volume/area
A	Machine shop	3	5	5	13	Small volume/area
A	Sewer collection system (R/M)	3	5	5	13	Small volume/area
A	Utility stations	3	5	5	13	Small volume/area
A	Above ground tank	3	5	5	13	
A	Parking lots	3	5	5	13	
A	Storm drain discharges	3	5	5	13	
A	Office buildings	1	5	5	11	
A	Upgraded tank	1	5	5	11	
Watershed	NPDES permitted discharge	5	1	5	11	
Watershed	Salvage yard	5	1	5	11	
Watershed	Surface water recreation	5	1	5	11	
Watershed	Herbicide use, road right of ways	3	1	5	9	
Watershed	Other animal operations	3	1	5	9	
Watershed	Parking lots	3	1	5	9	
Watershed	Parks	3	1	5	9	
Watershed	State highways	3	1	5	9	
Watershed	Roads/streets	1	1	5	7	
Watershed	RV parks	1	1	5	7	
Watershed	Sewer collection system	1	1	5	7	
Watershed	Veterinary office/clinic	1	1	5	7	

VULNERABILITY SUMMARY

An assessment was completed for the Orange County Desalination Plant water source in November 2001. A copy of the complete assessment is available at Poseidon Resources Corporation, 3760 Kilroy Airport Way, Suite 260, Long Beach. You may request a summary of the assessment be sent to you by contacting Ms. Josie McKinley at (562) 490-2003.

The source is considered to be most vulnerable to the following activities associated with contaminants detected in the water supply:

- Discharges of process water and waste streams to the cooling water system during heat treatment or through leakage of discharge water into the intake well (coliform bacteria and *Enterococcus*).

Drinking Water Source Location

Public Water System Name: Orange County Desalination Plant
System No:
Name of Source: Pacific Ocean
Source No.:
Date: 11/1/01
Name of person completing form: Elaine Archibald, Archibald & Wallberg Consultants

LOCATION OF INTAKE: (decimal degrees)

Latitude, degrees N: 33.63666667

Longitude, degrees W: 117.9841667

Horizontal Datum: (X) NAD27 (preferred)

DESCRIPTION:
Intake structure is intake to Huntington Beach Power Plant located in the Pacific Ocean.

METHOD OF DETERMINING LOCATION:

USGS quad map (1:200 scale)
Computer calculated
Year of map publication: 1964
Year of map photorevision: 1981

Delineation of Surface Water Protection Zones

Public Water System Name: Orange County Desalination Plant
System No:
Name of Source: Pacific Ocean
Source No.:

Delineation date: 11/1/01

Delineation conducted by: Elaine Archibald

Protection zones established for this source are:

Zone A - Huntington Beach Power Plant site

Remainder of Watershed

Physical Barrier Effectiveness Checklist - Surface Water Sources

Public Water System Name: Orange County Desalination Plant
System No:
Name of Source: Pacific Ocean
Source No.:
Assessment Date: 11/1/01
Assessment Conducted By: Elaine Archibald, Archibald & Wallberg Consultants

Drinking Water Source/Watershed Information

1. Is the source an impounded reservoir or a direct stream intake?
   c. Other - Cooling water drawn in from Pacific Ocean

2. Source Characteristics
   a. Area of tributary watershed: 580 acres (150 acres of land and 430 acres of ocean)
   b. Area of water body within watershed: Not applicable
   c. Volume of water body: Not applicable
   d. Maximum rate of withdrawal through intake: 120 MGD
   e. Are the primary tributaries seasonal, perennial, or both? Not applicable

3. What is the approximate travel time to the intake for water at farthest reaches of the water body?
   a. Source is direct intake, no impounded water body - Although the Pacific Ocean is the source of water to the desalination plant, there are waste streams that enter the cooling water in the power plant. The actual source of water to the desalination plant is considered to be a direct intake with no impounded water body.

4. What is the general topography of the watershed?
   a. Flat terrain (<10% slopes)

5. What is the general geology of the watershed?
   b. Materials not prone to landslides

6. What general soil types are on the watershed?
   b. Loams, sands

7. What type of vegetation covers most of the watershed?
   d. Not sure - impervious surfaces and water

8. What is the mean seasonal precipitation on the watershed?
   b. 10 to 40 inches/year

9. Is there a significant ground water recharge to the water body?

b. No

Determination for this source: Low (LE)

Possible Contaminating Activities (PCA) Inventory

Public Water System Name: Orange County Desalination Plant
System No:
Name of Source: Pacific Ocean
Source No.:
Inventory Date: 9/26/01
Inventory Conducted By: Elaine Archibald, Archibald & Wallberg Consultants
Name of Surface Water Body: Pacific Ocean

The watershed contains PCAs associated with the following general categories:

Commercial/Industrial
Residential/Municipal
Other

Are zones established? Yes

Map of drinking water source with watershed boundaries and zones – See Figure 3-1 in Sanitary Survey.